



City of
Wagga Wagga

**ENGINEERING GUIDELINES
FOR SUBDIVISIONS AND
DEVELOPMENT STANDARDS**

Adopted April 2017

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part 1
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1. introduction

1.1 Background

The Engineering Guidelines for Subdivisions and Development Standards 2017 ('the Guidelines') outline the engineering standards to be used for infrastructure provided within the Wagga Wagga Local Government Area.

The Engineering Guidelines comprise:

Part 1 General Requirements

Part 2 Guidelines for Design of Roads

Part 3 Guidelines for Design of Drainage

Part 4 Guidelines for Design of Water Reticulation

Part 5 Guidelines for Design of Sewer Reticulation

Part 6 Guidelines for Landscaping and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Guidelines for Testing

Part 8 Standard Drawings

This document is derived from Wagga Wagga City Council Engineering Guidelines for Subdivisions and Developments (1996). It was redrafted by GHD Pty Ltd in 2006 and has been subsequently reviewed and updated by Council in 2017. This version evolved from the project coordinated by GHD involving Wagga Wagga, Albury, Wodonga and Griffith councils, and North East Water. It has also drawn on what is occurring more broadly in development control and planning

legislation in NSW. It recognises that each council has its own requirements in local practice but has drawn some commonality as provided in the GHD/joint Councils project.

On this basis, the Wagga Wagga City Council ('Council') has determined that where a developer is required to carry out civil engineering works in connection with a subdivision or development and that upon completion by the developer the works become the responsibility of Council, then the works are to be constructed in accordance with these Guidelines.

Precursors to this document have tended to be part guide and part design manual. Council is moving towards a set of recognised standards with references to appropriate design manuals. This is to reduce the need to revise the Guidelines each time a source document is changed. On this basis, it will be the responsibility of the developer and designer to keep abreast of changes in recommended current practise. Where a reference has been made to a particular document which has been superseded by a more recent document, the more recent document should be used.

This revision addresses a number of issues that have faced Council in recent years. Specifically these include: premature failure of pavements, maintenance issues with relatively new pipelines and subsidence of trenches leading to damage to nearby fences and buildings. Hence the standards introduce more rigorous

procedures to address these particular issues compared to the previous requirements.

In the Wagga Wagga local government area, the responsibility for water reticulation rests with the Riverina Water County Council (RWCC). Developers are to liaise with RWCC regarding water reticulation to the proposed development. Council will not issue a Certificate of Practical Completion without RWCC concurrence and RWCC's issue of a 'Certificate of Compliance – Water Supply' – see Part 4 of this document.

1.2 Consultation with Council

Council encourages prospective applicants and their design consultant to meet with engineering staff prior to commencing the design process. This is to allow Council to discuss with the designers what is proposed and seek common ground before a significant start is made by consultants in commencing detailed plans. Applicants will be required to prepare a Traffic Engineering Report to assist in assessing the impact of the development on surrounding areas. The results of the report are to be incorporated into the detailed design.

Applicants are advised to ensure that all conditions of the Development Consent are addressed within the detailed engineering plans, as a Subdivision Certificate or Completion of Works Certificate cannot be issued until the conditions of consent have been met in full.

For similar reasons, developers are encouraged to consult early with RWCC regarding reticulated water supply to the proposed development. Consultation with RWCC at an early stage, with concept plans (complete with ground contours) will allow water supply related issues and developer contributions to be identified at an early stage in the development process.

2. prior to plan preparation

2.1 General

Standards for subdivision and land development are rapidly changing in response to changing community expectations that have an increased emphasis on:

- community facilities, public open space areas, landscaping and urban design outcomes that is associated with new urbanism concepts
- water-sensitive urban design, water conservation and stormwater quality
- energy efficiency and sustainability
- community safety, particularly in public open space areas.

To assist in achieving these outcomes, approval will be merits-based and consider the overall impact of the development on the community and not solely on compliance with minimum engineering standards.

To encourage the submission of innovative design solutions and connectivity of services, Council staff are available for initial consultation to discuss and facilitate outcomes. In this context, development standards may be subject to variation with approval from Council where outcomes are linked to environmental and community benefits. There are benefits in following traditional methods of design and standardisation, but users should question the standards and be ready to adopt new and improved procedures. Council strongly supports this approach, based on a hierarchical consideration of planning strategies.

An important part of the planning approval process will be the preparation of an overall master plan that provides for the integrated provision of urban landscaping, roads, drainage, water, sewer, gas, lighting, telecommunications and electrical services. The objectives of this are to ensure:

- compliance with planning requirements
- that adequate information is provided at initial planning stages to allow orderly review and assessment of land development
- that developments provide effective and economical infrastructure that services the area.
- that staged or multi-developer projects are able to be delivered in a coordinated, safe, and efficient manner.
- that infrastructure is planned for the full potential of development and that unnecessary duplication or oversizing /undersizing of infrastructure is avoided.

To facilitate the expeditious approval of engineering plans, construction and Approved Plan of Subdivision release for subdivisions and developments the following approach is encouraged:

- Prior to commencement of design, meet with Council to discuss engineering development issues.
- Integrate subdivision work with infrastructure, urban design and community master planning. Submit a master plan of the overall subdivision development for inclusion in Council's mapping system.
- Demonstrate the application of quality assurance procedures when submitting designs and documents

to Council for review with independent documented review by experienced staff prior to submission.

- Council review will then focus on general compliance with strategy and these guidelines.

Legislation on workplace and public safety during construction is now quite specific. Thus the importance of safety of the general public, contractor's employees, subcontractors and road users on adjacent streets or accesses utilised during the project is critical. Details of how this is to be achieved are to be included in the project drawings and in the project specifications.

3. engineering drawings and specifications

3.1 Definitions, qualifications and experience

'Council means the Wagga Wagga City Council. Representation of the Council will be by a designated officer of Council with delegated authority.

All reference to an 'Accredited Certifier' means the Principal Certifying Authority as determined by the Environmental Planning and Assessment Amendment Act 1997.

All references to an Engineer shall be interpreted as a person acceptable for Corporate Membership of Engineers Australia or a person with equivalent qualifications and/or experience.

All references to a Registered Surveyor shall be interpreted as a person registered under the Surveyors Act, 1929 as amended.

'Engineering Guidelines' and 'Guidelines' refers to The City of Wagga Wagga Engineering Guidelines for Subdivisions and Development Standards 2017.

Council requires that design plans be prepared to Council standards by a person, either holding qualifications acceptable for Corporate Membership of Engineers Australia, accreditation by the Institution of Surveyors under the Survey Practice Accreditation Scheme for Subdivisional Civil Works 1996 (SPAS 1996), or approved by Council or Accredited Certifier and/or who has demonstrated experience in the preparation of plans and specifications for land development.

3.2 Submission of Engineering Drawings

3.2.1 Initial Development Discussion

In the first instance, developers and consultants are encouraged to meet with Council staff prior to commencement of design to discuss engineering development issues.

This initial discussion is to review the development proposal and to inform the developer/consultant of specific requirements relating to the parcel of land under consideration. This discussion will include but not be limited to:

- existing features that may impact on the engineering design, including: trees, historical items, topographical features, and otherwise significant features
- natural and proposed drainage flow paths
- export of material away from the site
- extent of impervious surfaces
- consideration of onsite waste management systems
- existing car parking, footpaths and landscaping
- proposed road layout, hierarchy and carriageway widths, based on a Traffic Engineering Report covering predicted traffic volumes, traffic generating facilities and other relevant information. The report should take into account the impact on the overall neighbourhood, not just the subdivision in question.

- proposed road reserve widths, and setbacks on existing roads, to allow for future arterial roads and utility corridors
- proposed intersection treatments taking into account the Traffic Engineering Report recommendations
- proposed lot layout
- proposed open space and linkages, recognising the importance of access for all users, seeking to avoid proximity to major roads, with good sight surveillance lines, and preferably with frontage to at least 3 streets and avoidance of bordering rear yards
- footpath and car parking details
- identification of commercial, social and community infrastructure requirements and traffic generating development, based on a master plan and the Traffic Engineering Report
- landscaping, including proposed vegetation, irrigation areas and significant furniture
- street lighting
- drainage
- water-sensitive urban design treatment
- the impact of flooding
- the provision of facilities in accordance with any approved strategy or plan for a particular area.

3.3 Submission of Construction Specification

The specification is the responsibility of the applicant, and is to include reference to requirements contained within the Guidelines, together with the appropriate standard specifications selected from other relevant sources. Specifications should reflect best industry practice.

Specifications must be supplied with the drawings to allow site assessment of works.

3.4 Approval of Engineering Drawings and Construction Specification

Council or an accredited certifier will review the Detailed Engineering Drawings and Construction Specification for compliance with these guidelines. It is the responsibility of the applicant to ensure that the designs and specification are technically correct and comply with the following:

- Council's Engineering Guidelines
- Relevant Australian standards
- Relevant Austroads guidelines
- Relevant Local, State and Federal Government Legislation
- Conditions relating to the development consent for the subdivision

Council's approval is conditional on the above basis and does not relieve the developer from rectifying any errors or omissions which become evident during construction.

The development consent approval is current for five years. If work has not substantially commenced inside the period of currency of the development consent,

Council may require that revised drawings and specifications be submitted for approval with the new Development Application. The developer will be required to comply with the current Guidelines.

3.5 Commencement of Works

Before the Developer commences the civil engineering works, detailed engineering drawings and construction specification of the proposals shall be submitted to and approved by Council or an accredited certifier, and the Council/accredited certifier advised of a contact for the construction contractor. Once a Construction Certificate is issued and before the site works are commenced Council must be notified at least two days prior to commencement (section 81a (2)(b) of the EP&A Act).

3.6 Developers Responsibility

When consent for a subdivision or other development includes conditions of construction which are embodied in the approved plans and specification, the onus is primarily on the applicant to whom the approval is given to ensure that the work is completed in accordance with the plans and specifications, meets workplace safety regulations and is to the satisfaction of Council or an accredited certifier.

The Approved Plan of Subdivision will not be released until the engineering works (including works as executed plans) are completed and all other conditions of the development consent are satisfied (section 109J(2) of the EP&A Act).

The contractor carrying out subdivisional works is responsible to the developer, not Council, for constructing and maintaining the works to the

approved standards to the satisfaction of the Council or accredited certifier. Council retains the right to audit any development control process or activity and ensure that works are carried out in accordance with the approved plans and specification.

The works and the works site are the responsibility of the developer prior to the asset being formally handed over to Council.

4. inspection of works

4.1 Inspection and uninterrupted access

The whole of the road, drainage, kerb and gutter, and sewerage construction works, which the developer is required to carry out in respect of a development, will be inspected under the direction of Council or an accredited certifier.

All works are to be carried out to the entire satisfaction of the Council or accredited certifier. The developer/contractor is to provide uninterrupted access for the examination of any facilities, works and materials as requested by Council or the accredited certifier.

No works can commence until Detailed Engineering Plans have been approved. The first works shall include implementation of the Sedimentation and Erosion Control Plan.

From time to time, the Council will audit elements of the work and hence Council or its agents will require uninterrupted access to the site. The cost of such audits will be at Council's expense, but items requiring alteration or inclusion will be at the developer's cost. The developer and accredited certifier will be given 24 hours' notice of such audits.

4.2 Public safety

The developer will be held responsible for the safety of the public to the extent that the works being undertaken influence or impact on the safe and efficient passage of the public around and/or through the works. The developer shall not obstruct the free passage of the public unless public safety is at risk and no other means of ameliorating that risk is readily available.

The developer shall provide all watchmen, lights, barriers, signs and fences necessary to prevent any accidents to the public or private damage or loss. The developer shall provide, erect and maintain all necessary signs, temporary roads, bridges, footways, drains and trench supports, fences and protection in order to ensure the above.

4.3 Damage to services

The developer must enquire as to the location of all services with Dial Before You Dig or the relevant utility authority. Where proposed works have the potential to conflict with services, the services must be physically located on site and documented on plans.

In the event of any of the above mentioned services being damaged or interrupted, the developer shall forthwith notify the responsible utility and take all necessary steps to provide for the safety of the public and to have the damage repaired as quickly as possible. The cost of all repairs is the responsibility of the developer.

4.4 Traffic control

The developer must prepare and implement an approved traffic management plan so as to ensure safe, continuous movement of traffic with a minimum of disturbance in public roads.

Signs, barricades, barriers, warning lights and other devices shall be placed where works are in progress in accordance with AS 1742 – 'Manual of Uniform Traffic Control Devices'.

The developer must comply with RMS Traffic Control at Worksites guidelines.

4.5 Fire fighting provision

The developer shall provide and maintain adequate fire fighting equipment and take adequate fire protection measures during the works and shall take action to prevent damage to, or destruction by fire of bushland trees, shrubs or grasses.

4.6 Work within railway property

Before starting any work across a railway line or railway property, the developer shall obtain from the State Rail Council, an approval in writing to commence such work. The developer shall comply with all requirements of the Rail Council and complete such work to the Rail Council's satisfaction.

4.7 Notification

The developer must provide to Council or an accredited certifier the name, address and contact telephone number of the contractor at least seven days prior to the proposed date of commencement of any construction.

The developer shall provide to Council or an accredited certifier twenty four hours prior notice in respect of the following:

- completion of formwork/stringlines for kerb and gutter
- opening of trenches ready for pipe laying
- placing of pipes in trenches prior to backfilling
- placing and pouring of concrete
- testing of sewer mains
- completion of subgrade preparation before placing of pavement
- completion of each pavement layer ready for testing
- sealing of roadworks.

The developer shall, if required by Council or an accredited certifier, submit dockets from the supplier of asphalt and/or ready-mixed concrete and test results in order that the quality of the supplied product may be checked.

The developer shall provide written advice from its geotechnical consultant that the subgrade and pavement are to specification prior to sealing any road.

The developer shall, within seven days of the sealing of any pavement, supply to Council or an accredited certifier all supply dockets and spraying records in respect of such work.

Council or an accredited certifier shall inspect the works to ensure that the works are constructed in accordance

with Council requirements and the approved plans.

Council or an accredited certifier does not carry out the functions of 'Superintendent' as defined in the General Conditions of Contract - AS 2124, The developer is required to appoint a consultant to carry out this function.

5. fees and contributions

5.1 Subdivision/ Development Inspection Fees

Fees for examination of Detailed Engineering Drawings and Inspection of Subdivision works are as prescribed by Council's Fees and Charges.

For those developers who elect to use Council for the examination of engineering drawings and/or inspection of subdivision works, the fees for plan examination must be paid prior to the release of the Detailed Engineering Drawings, and for inspections, must be paid prior to release of the Approved Plan of Subdivision.

5.2 Services/Facilities and Headworks Contributions

The services provided by Council for which developer contributions may be obtained under Section 94 of the Environmental Planning and Assessment Act 1979 and Section 64 of the Local Government Act 1993 include:

- roads and traffic management facilities
- open space and recreational facilities
- community facilities
- commercial centre car parks
- stormwater drainage
- sewerage
- water supply (contributions are payable to RWCC)

These contributions are payable prior to the release of the Approved Plan of Subdivision or as prescribed by the development consent, and are based on the current Section 94 and Section 64 Contribution Plan. Works associated with the Section 94 and Section 64 developer contribution plans are as described in detail in those documents.

5.3 Testing of Works

Testing for compliance of works with the drawings and specifications shall be undertaken by the contractor or nominated sub consultants as part of a Quality Assurance Program as approved by Council or an accredited certifier and as specified in Part 7 of this document – 'Guidelines for Testing'.

Council may prescribe additional tests to determine that acceptable standards of workmanship have been achieved in relation to its interests in the subdivision but otherwise the full cost of quality assurance testing will fall onto the contractor and/or developer. Where additional tests show that acceptable standards of workmanship are not being achieved all additional testing costs will be at the developer's cost.

Council may also from time to time appoint an auditor to test materials, works and processes. The auditor's costs will be met by Council, but again any remediation costs will be met by the developer. Testing can also include off site testing to ensure quality of materials prior to delivery to site.

6. bonds and guarantees for performance

The Approved Plan of Subdivision will not be signed and released by Council or an Accredited Certifier until certification is provided that all engineering works, including water reticulation, have been satisfactorily completed and signed 'Work As Executed' drawings (see clause 7) are provided.

A maintenance bond is required from the developer prior to the release of the Approved Plan of Subdivision to the value of five percent of the contract price of the subdivision or as as prescribed by the development consent or Section 68 approval. The developer is to submit a copy of the successful tenderer's bid for the construction of the subdivision works to allow this bond to be determined.

The maintenance period shall be held for a period of 12 months from the date of when the subdivision is accepted into maintenance, subject to satisfactory rectification of any required maintenance.

Bank guarantees must not have expiry dates.

The acceptance of bonds and guarantees for performance are at the discretion of Council.

6.1 Deferred Works

Subject to mutual agreement between the developer and Council, where Council determines that it is not practical to physically construct works and that the deferment of works will result in improved community outcomes through co-ordination with other works, Council may consider a payment equivalent to the full cost of construction of the works. Deferred works typically relate to minor road widening that includes kerb and gutter extensions, footpaths and driveways.

7. bonds and guarantees for performance

Following the completion of engineering works in a subdivision or development, Works-As-Executed (WAE) plans are to be prepared and signed off by a registered surveyor/professional engineer and forwarded to Council prior to the release of the final plan of subdivision.

WAE plans shall show only the current stage of works that has been constructed (existing or future stages of subdivisions works must not be included in the WAE plans).

The WAE plans must be certified by a registered surveyor or professional engineer and shall include the following:

- 1 set of signed hard copy plans (A1 size)
- 1 full set of electronic coloured stage drawings in Adobe pdf format
- the Council plan reference number (referenced as C...& K...) on each page of drawings. This to be obtained from Council at the start of the project.
- notation that all works have been completed in accordance with the approved plans and specification (including approved variations and amendments)
- clear notation of any departure from the approved plans
- notation of any additional work that has been undertaken
- WAE levels on longitudinal sections, kerb returns, swale drains and tail-out structures
- location of conduits, subsoil lines, stub mains and

inter-allotment drainage lines, etc.

- WAE levels on drainage and sewer pipeline longitudinal sections, showing the constructed invert levels of each pipe at each pit/manhole
- WAE levels along swale and tail-out drainage
- WAE levels along road centrelines and kerb returns
- location (including footprint) of any site fill, the natural surface levels, finished surface levels and compaction achieved
- all other details which have a bearing on the extent of works and their acceptance by Council
- WAE locations of sewer maintenance holes, sewer junctions, inter-allotment drainage inlet points and stormwater drainage pits. Information must also give assurance that the component of the pit below the precast pit top is located and orientated correctly, in accordance with the approved plan.
- CCTV is to be used in accordance with applicable standards to locate all sewer junctions and confirm the integrity of the installation. A DVD format record is to be provided to Council as part of the conditions of compliance of the works.
- location and depth of services using survey accuracy GPS equipment, submitted to Council in electronic format appropriate for overlay on Council's mapping system.

The following certificate is to be appended to each page of the plans and signed by the registered surveyor or professional engineer:

* I hereby certify that engineering works shown on the plan are Works-As-Executed and have been constructed in accordance with the plans and specifications approved by Council/Accredited Certifier (strike out whichever is inapplicable).

Name:

Signature:

Capacity:

Date:

The registered surveyor responsible for the Approved Plan of Subdivision covering the subdivision is to supply a signed certificate stating that all pipes and associated pits are located wholly within the respective easements or street allocation as per the approved engineering plans. This certificate must be supplied before the Subdivision Certificate will be issued.

A statement certifying that all works have been completed in accordance with the construction certificate must be produced with the WAE before the Subdivision Certificate is released.

An electronic copy of WAE plans is to be supplied by the developer in ACAD format (version 2000 or better) with AHD Levels and MGA Coordinates.

8. handover of completed works

8.1 Notification of Completion

When the developer is of the opinion that subdivision works have been completed, arrange an Info Maintenance inspection with Council's Subdivision Engineer.

Within fourteen days of the receipt of the request, Council or an accredited certifier shall inspect the works and shall issue an Info Maintenance certificate for the works or shall give the developer, in writing, the reasons for not issuing the above. The developer or his agent shall be present for the inspection and assist Council or an accredited certifier with the checking of levels and opening of pits/maintenance holes etc., as required.

8.2 Maintenance of Works

The Maintenance Period (Defects Liability Period) will be twelve months and will commence on the date of the issue of the Into Maintenance Certificate.

The Maintenance Bond will be to the value as described in clause 6. This bond will be held by Council to cover any defects or omissions, which may arise or become apparent in the Maintenance Period.

At any time during the Maintenance Period, the Council may direct the developer to rectify any omission or defect in the work, which exists at Practical Completion or becomes apparent prior to the expiration of the Maintenance Period. If defects or omissions are not rectified to the satisfaction of the Council, the Council will be at liberty to rectify the same and apply the maintenance bond for payment of the cost thereof.

The nature of some defects, eg. water main breaks, may necessitate the Council's immediate repair. The maintenance bond may be used for the costs unless the developer elects to pay the Council separately.

8.3 Release from Maintenance Period

Shortly before the end of the Maintenance Period there will be a joint inspection which will require five working days' notice. Following the inspection and any necessary rectification works, Council will forward and Out of Maintenance certificate and arrange for release of any bonds or guarantees that may be in place.

9. survey and setting-out requirements

9.1 Centreline Marking

9.1.1 Urban

The centreline of the proposed road shall be set out at a maximum spacing of 20 metres. Recovery pegs shall be placed on both sides of the road (off-set approximately 15 metres) at each curve tangent point, intersection, and at spacing of no more than 150 metres on straights.

9.1.2 Rural/Rural Residential

The centreline set out shall be as required for urban roads except that the spacing shall be 40 metres and the provisions of RMS standards shall apply in respect to the pegging of curve transitions. Comply with longitudinal and cross sectional intervals in Part 2 of the Guidelines for the Design of Roads.

9.2 Datum and Co-ordinates

The survey shall be undertaken on Australian Height Datum and MGA co-ordinates.

9.3 Bench Marks

Bench Marks shall be established within the works area at intervals not exceeding 100 metres and in accordance with sound surveying practice.

9.4 Survey Control Marks

All plans of survey are to show connection to at least two survey control permanent marks where such exist in the vicinity of the subdivision or where practicable. In the case where it is intended to open a new road at least two control marks per sheet of the subdivision plan are to be established in the road by the registered surveyor and connected to the nearest allotment corner.

The survey control marks shall be in accordance with the Survey & Spatial Information Regulation 2012. Two copies of the locality sketch plans of the marks placed are to be forwarded to Council with the Approved Plan of Subdivision.

9.5 Lot Boundaries

Lot boundaries shall be established after the final trim, to the standard required by Survey & Spatial Information Regulation 2012, prior to the final inspection of works.

10. miscellaneous

10.1 Public Liability Insurance

Contractors engaged on Development or Subdivision Works shall take out Public Liability Insurance to the minimum value of \$20 million. The policy shall specifically indemnify Council from all claims arising from the execution of the works.

Council will check annually on each contractor's public liability insurance.

10.2 Compliance with Acts and Legislative Requirements

It is the responsibility of the developer or his contractor to ensure that all works are undertaken in a safe and efficient manner. The Contractor shall ensure compliance with the Work, Health and Safety Act and any other relevant Acts, Ordinances and Regulations in New South Wales.

10.3 Location of Services

The location and offset of services shall be as per Council's Standard Drawing for service locations.

All services shall generally run parallel to the road centreline and shall cross the road centreline as close as possible to perpendicular to it, unless otherwise approved by the Council, with a minimum cover of 600mm below gutter lip. A mark shall be inscribed into the face of the kerb to denote the location of the service conduit under the road (e.g. 'T' for telecommunications, 'E' for Electricity, 'W' for Water).

11. references and standards

The format of the Guidelines has been simplified by making reference to applicable standards. Where these standards vary from the referenced standards the variations are highlighted and cross-referenced. The current version of the referenced standard will apply. This document shall take preference over the referenced standards. In addition to the criteria outlined in this manual, any relevant acts, regulations and Australian Standards will apply.

References and standards include the following:

11.1 Part 2 Design of Roads

- AS 1742 Manual of Uniform Traffic Control Devices
- AS 2890 Parking Facilities
- AS 3798 Guidelines on Earthworks for Commercial and Residential Development
- Australian Rainfall and Runoff
- Australian Runoff Quality
- AS 1428 Design for Access and Mobility
- Austroads Guide to Pavement Technology
- Austroads Guide to Road Design
- Austroads Guide to Road Safety
- Austroads Guide to Road Transport Planning
- Austroads Guide to Traffic Management
- Building Regulations 2006 Part
- Guide to residential streets and paths, Cement Concrete and Aggregates Australia

- Integrated Movement Study (Traffic Study) for City of Wagga Wagga (2008) Urap-TTW Pty Ltd
- Landcom Guidelines including Soils & Construction - The Blue Book
- RMS Delineation Manual
- RMS Road Design – Supplements to Austroads Guide to Road Design
- RMS Traffic Management – Supplements to Austroads Guide to Traffic Management
- RMS Transport Planning – Supplements to Austroads Guide to Transport Planning
- RMS QA Specifications for Roadworks and Bridgeworks
- RMS Traffic Control at Work Sites Manual
- Survey & Spatial Information Regulation 2012
- The Australian Model Code For Residential Development (1995)
- Wagga Wagga CBD Parking Study (2008) Stepfair-Samsa Partnership

11.2 Part 3 Design of Drainage

- Australian Rainfall and Runoff (AR&R)
- Australian Runoff Quality
- Publications of the National Building Technology Centre for roof drainage

11.3 Part 4 Design of Water Reticulation

- Water Services Association of Australia (WSAA) “Water Supply Code of Australia (WSA03)
- AS 2280 “Ductile iron pipes and fittings”
- AS 1477 “PVC pipes and fittings for pressure applications”
- AS 1432 “Copper tubes for plumbing, gas fitting and drainage applications
- AS 2544 “Grey iron pressure fittings”
- AS 4799 “Installation of underground utility services and pipelines within railway boundaries
- Building Code of Australia

11.4 Part 5 Design of Sewer Reticulation

- Water Services Association of Australia (WSAA) “Sewerage Code of Australia (WSA02)
- Section 88b of the Conveyancing Act 1919
- AS 1260 “PVC-U pipes and fittings for drain, waste and vent application”

11.5 Part 6 Landscaping / Erosion, Sedimentation Control

- AS 3959-2009 Construction of buildings in bush fire prone land
- Department of Environment and Climate Change
- Managing Urban Stormwater, Soils and Construction, Office Environment & Heritage
- Native Vegetation Conservation Act
- Rivers and Foreshores Improvement Act 1948
- Section 13 of the Bush Fires Act
- Section 41 of the Bush Fires Act
- Tree Preservation Policy

11.6 Part 7 Testing

- AS 3798, Guidelines on Earthworks for Commercial and Residential Developments
- RMS Specification for Densely graded base (DGB) 20
- RMS Test Methods – Guide Notes
- RMS Test Methods - Volumes 1, 2 & 3
- RMS Test Methods T601, T603, T605, T606 and T612
- RMS DCM Materials specification DCM 3151
- RMS QA Specifications for Roadworks and Bridgeworks
- Sewerage Code of Australia (WSA02) Part 3 Construction
- Water Supply Code of Australia (WSA03) Part 3 Construction

part 2
guidelines for design of roads

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1. introduction

This section of the Guidelines outlines the recommended practice for the design of rural and urban roads. It is not a 'design manual' and is to be read in conjunction with and as a supplement to referenced standards.

The Engineering Guidelines comprise:

Part 1 General Requirements

Part 2 Guidelines for Design of Roads

Part 3 Guidelines for Design of Drainage

Part 4 Guidelines for Design of Water Reticulation

Part 5 Guidelines for Design of Sewer Reticulation

Part 6 Guidelines for Landscaping and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Guidelines for Testing

Part 8 Standard Drawings

The objectives for Roads are:

- To develop a network and alignment that balances the existing and future requirements
- To provide a serviceable pavement for the specified lifetime with minimal maintenance
- To ensure that staged construction methods are planned to meet the immediate, median term and ultimate traffic, pavement and drainage design requirements

- To provide smooth, safe, trafficable alignments, adequate sight distance, with consideration also being given to road classification, road users and utilities.

2. Guidelines for design of roads

Urban Roads

The following section applies to the provision of roads in urban areas. The classification of these roads as urban will be a determination of Council.

As a starting point, attention is drawn to the requirement of preparation and submission of a Traffic Engineering Report prior to commencing Detailed Engineering Design.

2.1 Plans

Plans are to be submitted on paper and in electronic form as A1 sheets, and include the following:

- cover sheet with locality plan, drawing list and Council construction plan number
- lot boundaries, nominal dimensions and lot numbers
- road centreline chainages, radii, tangent points and deflection angles intersection layouts
- limit of construction and/or stage boundary
- benchmarks at spacings of 100 metres within the development site
- street names and north point
- bar scales
- existing surface levels, features including trees, subsoil drainage, location of drainage pits, sewer maintenance holes, other services and structures
- proposed service crossings

- road reserve and carriageway width
- Australian height datum
- a schedule of symbols
- radii on kerb returns and kerb lines
- vehicular crossings
- footpath and pram ramp locations
- contours and finished surface levels on lot corners
- details of abutting roads and streets (minimum survey of 50m) necessary to ensure matching in of levels and grades
- use of 1:500 scale throughout

Infrastructure service design is not to be undertaken in isolation but rather as an integrated approach that anticipates conflict. For complex intersections where there is potential for service conflict, show service levels in section.

2.2 Centreline longitudinal section

The centreline longitudinal section should include the following:

- scales of 1:500 horizontal; 1:100 vertical
- chainages
- reduced level of existing surface and of design level of road, left and right kerbs where variations in crossfall occur and building lines
- design grades

- length of vertical curves
- existing and proposed services
- longitudinal levels at
 - 20 metre intervals on straight grades
 - 5 metre intervals in vertical curves
 - at all intermediate changes of grade

Longitudinal sections and cross sections should be taken along existing intersecting roads (approx. 50 metres) to enable design of kerb returns, dish crossings and drainage.

2.3 Cross sections

Boxed cross sections are to be viewed from the direction of increasing chainage. Information to be provided as follows:

- 20 metre intervals
- natural scales of 1:100
- chainage
- reduced levels of existing surface
- the design level and cross fall of pavement
- batters of cuttings and embankments are to be shown beyond the property alignment, to where the batter intersects with the natural surface
- typical cross sections shall provide information as follows
- type of kerb & gutter

- depth and type of material in each layer of pavement
- type of surfacing
- subsoil drainage
- pavement and nature strip crossfalls
- footpath offset
- service corridors
- landscaping
- road width between kerb inverts and property boundary location
- centreline
- road crown

such departures:

- improve traffic flow
- improve environmental and stormwater quality outcomes
- improve landscaping and urban design outcomes
- are regarded as contributing to the amenity of the area.

2.4 Kerb returns

Kerb return profiles should be nominated for all kerb returns, cul-de-sac bulbs, roundabouts and traffic islands.

For plans and sections, a scale of 1: 200 horizontally and 1:20 vertically is suggested with levels shown at ¼ points, along with grades and vertical curve details.

Kerb return radius shall be 10 metres in residential streets and 12 metres for industrial areas. Vehicle-turning paths shall be provided at intersections for 19m articulated vehicles and on bus routes.

Intersection contour plan shall be provided at a scale of 1:200 showing road design levels at 0.1 metre intervals.

2.5 Standard road classifications and associated widths

In general, classification of roads should be based on the projected traffic study levels and the use of the following classification chart. Council will consider departures from the below guidelines where it can be clearly established

Table 2.5.1 Road Standards for the Urban Street Network specific to Wagga Wagga City

Classification of Road	Target Design Speed (km/h)	Max. No of Lots	Minimum Width (metres)			Footpath	Cycleways	Kerb Type	Indicative Design ESAs
			Road Reserve	Carriageway	Verge				
Lane	25	10	14.5	7.5	2 x 3.5	None	On road shared	As discussed with Council staff	1 x 10 ⁵
Access Street (Shareway)	25	10	14.5	7.5	2 x 3.5	None	On road shared	Barrier or fully mountable	1 x 10 ⁵
Cul-de-sac	50	10	14.5	7.5	2 x 3.5	None	On road shared	Barrier or fully mountable	1 x 10 ⁵
			18.5*	7.5	2 x 5.5*				
Local Access	50	100	20	9	2 x 5.5	1.5m one side	On road shared	Barrier	2 x 10 ⁵
Collector	60	300	24	13	2 x 5.5	1.5m one side	Marked	Barrier	3 x 10 ⁶
Sub Arterial	80	500-750	30	19	2 x 5.5	1.5m one side	2.5m wide shared cycleway footpath on one side	Barrier	Subject to traffic study but not less than 6 x 10 ⁶
Industrial	60	-	30	19	2 x 5.5		Marked	Barrier	Subject to traffic study but not less than 1 x 10 ⁷

*Subject to location of services and as approved by Council

Roads used as bus routes are usually designed to sub arterial standards, i.e. 19-metre carriageway width or provision for two moving and two parking lanes

Standard road widths are measured between kerb inverts as shown on the standard drawings

2.6 Kerb and Gutter

All urban streets are to have a sealed pavement with kerb and gutter.

The design of kerb and gutter shall comply with drainage requirements of Australian Rainfall and Runoff.

Kerb types are to be as shown on Council's Standard Drawings.

Alternative kerb and gutter treatments that will achieve water sensitive urban design outcomes are encouraged subject to prior approval as part of a concept development.

2.7 Road Surfacing

All new roads should be minimum 40mm asphaltic concrete (AC), with the following exceptions:

- roundabouts - Concrete or AC10 polymer modified, 50mm minimum thickness to geotechnical consultant's recommendations
- widening of existing roads - seal to match the existing
- laneways – concrete or AC, to geotechnical consultants recommendations
- classified roads - to be determined in consultation with RMS.

A primer seal is to be applied prior to surfacing. This is to be inspected by Council prior to the placement of asphalt.

2.8 Access and vehicular crossings

Vehicle cross overs are to be provided into each allotment and are to be in accordance with Council's standards and are to be within the following width ranges. Vehicle crossings are to be provided at the time of house/premises construction, not as part of the subdivision process.

Crossing type	Minimum Width (m)	Maximum Width (m)
Residential	3.0	6.0
Light Industrial/Commercial	3.6	9.0
Heavy Industrial	3.6	12.0

Note: Widths are at the property boundary and do not include splays.
Table 2.8.1 Vehicular crossings

Where kerb and gutter is provided:

- Crossings are generally not required to be constructed in urban areas for the purpose of lot access at time of road construction unless to an existing development.
- Access and vehicular crossings are to be a minimum of 1000mm clear of all drainage structures on the kerb and gutter and are not to interfere with the other existing public utility infrastructure. Where a driveway impacts on drainage structures it is to be relocated clear of the structure unless otherwise approved by Council.
- Vehicular crossings should be provided at suitable locations as part of the subdivision process for open space so as to allow access by maintenance vehicles.
- Property access is to provide for forward entry and

exit for other than single residential development.

- Access to residential corner allotments shall be at least 6 metres from the kerb tangent point.
- The portion of the crossing that passes through the footpath is to be designed to AS 1428 Design for Access and Mobility.
- Where driveway access slopes are in excess of 1:10 then a design car template should be used to check access.
- On steeper sites that include battle axe blocks, the design and construction of the driveway is to account for stormwater.
- Bridge type gutter crossings are not permitted.
- Road access to cuttings is to be clear of services located in the embankment.

2.9 Staged road construction

The barricade should be made from a D4-2-1 Chevron or similar (refer AS 1743 Supp 1-1992).

Where roads are constructed in stages as part of staged subdivision development, a permanent type barricade is to be constructed at the end of each stage to warn motorists of the dead-end and prevent their passage beyond.

Turning heads shall be constructed at dead ends with a minimum 9.5 metre radius. The extension of the road to be constructed utilising the appropriate pavement design standard for the road width and is to incorporate a two-coat seal.

A kerb return shall be constructed extending one metre beyond the limits of construction to direct surface water away from the temporary turning head.

A sign is to be placed at nearest intersection advising 'No Through Road'. Barricades and associated signage are to be removed when it is safe for through traffic to use this road and approval from Council has been received in writing.

2.10 Road crossings

All conduit trenches should be at a grade of not less than one percent and should be clearly located on relevant drawings. Trench backfill is to be stabilised sand to subgrade level. Conduit finished cover should be 600mm minimum below gutter lip. Conduits should be located perpendicular to the road centreline, however Council will accept up to 10° skew. Conduit location should be neatly inscribed into the face of the kerb.

2.11 Traffic generation

A local area traffic management plan based on a Traffic Engineering Report shall be provided for the subdivision as part of the agreed master plan. Qualified traffic consultants shall carry out the Traffic Engineering Report and determine projected traffic volumes that account for existing traffic patterns, predicted future development and associated traffic generation.

This plan should detail average annual daily traffic volumes (AADT), within the subdivision taking into account through traffic, traffic generating activities, number of residences and assess the impacts of traffic on the surrounding street network. Where adverse impacts are identified traffic mitigation measures shall be implemented. For developments less than 20 lots and not forming part of the collector network, an assessment of trip traffic generation shall be based on 10 vehicle trips per allotment per day.

2.12 Pavement design

2.12.1 Flexible pavements

The Designer shall detail how the design, construction and testing of the pavement shall be managed.

Council requires a design pavement life of 30 years. Asphalt surfacing of 40mm thickness is not considered to contribute to the design of the pavement thickness.

Council requires a Pavement Report at the Detailed Engineering Design stage that sets out design assumptions, proposed subgrade treatment (supported by appropriate geotechnical test results), proposed pavement type, proposed quality of material, proposed source of such material, use of any stabilisation, proposed depth, proposed testing and proposed quality assurance process, signed off by a qualified experienced geotechnical engineering consultant. This should be submitted with the Detailed Engineering Plans.

Designers are to submit traffic loading calculations based on the Australian Road Research Board's (ARRB) publication A Structural Design Guide for Flexible Residential Street Pavements - Special Report No. 41 (Special Report 41). In determining traffic loading, consideration needs to be given to increased heavy vehicles due to construction vehicles associated with house construction and possible development of future subdivisional stages.

Design subgrade CBR values should be determined by either geotechnical consultants and/or agents of a NATA registered laboratory. The investigation will include logging of test holes to a depth not less than 600mm below design subgrade levels (unless rock is encountered). Soil samples should be taken at the design depth and CBR tests undertaken after soaking the samples for four days.

The frequency of test holes should be in accordance with Table 11 of Special Report 41.

A copy of the site investigation report including test results should be submitted with the pavement design and the Engineering Drawings.

Council will also require the geotechnical consultant to monitor the pavement construction and verify it has been constructed with the specified materials and in accordance with the pavement design. A certificate warranting the design and construction of the pavement for a 30-year life shall be submitted by the developer and signed off by the geotechnical consultant prior to the release of the Approved Plan of Subdivision.

Road pavement design shall be based on the provision of flexible road pavement with a minimum pavement depth of 280mm in accordance with:

- AUSTROADS Guide to Pavement Technology, Part 2: Pavement Structural Design
- ARRB Pavement Design for Light Traffic: a supplement to the AUSTROADS Guide to Road Design

Classified road and industrial road pavements are to be designed in accordance with the AUSTROADS Guide to Structural Design of Road Pavements.

Council will consider the construction of road pavements from materials that do not conform with RMS QA Specification 3051 provided that:

- a pavement with a design life of not less than 30 years is prepared by a suitably qualified person in accordance with AUSTROADS Guide to Pavement Technology Part 2: Pavement Structural Design
- the pavement design nominates the proposed source of material
- the pavement design nominates any departure in the source material from RMS QA Specification 3051
- the pavement design specifically states that the design has been undertaken to allow for the departure(s) from RMS QA Specification 3051
- the pavement design specifies the maximum allowable departure(s) from RMS QA Specification 3051
- a set of test results is provided from a NATA approved laboratory confirming that the nominated source material meets the requirements of the pavement design
- sampling and testing are undertaken by a NATA approved laboratory at the frequencies specified in RMS QA Specification 3051 to ensure that the pavement material conforms with the requirements of the pavement design.

2.12.2 Rigid pavement design

Concrete pavements are to be designed in accordance with Guide to Residential Streets and Paths, Cement Concrete and Aggregates, Australia.

2.13 Subsoil drainage

Subsoil drainage is to be provided as required by the Standard Drawing. Flushing points are to be provided at all upstream ends. The minimum grade for subsoil drainage is 1:250 with an absolute minimum grade of 1:300.

Subsoil drainage shall be used for all roundabouts and medians.

Subsoil drainage shall be provided on the topside of the road in the absence of stormwater drainage.

RMS standard specifications shall apply.

2.14 Geometric standards

The geometric design of arterial and sub arterial roads is to be based on the current AUSTROADS design standards for urban roads for an 80 km/hour travel speed. The above guidelines should also be taken into account for the design of all other urban roads, to provide smooth, safe trafficable horizontal and vertical alignments, and adequate sight distance.

Consideration should also be given to the road classification requirements, pedestrian access to each allotment, provision for utilities and stormwater drainage. Roads shall also provide sufficient space such that emergency vehicles, buses, removalists, waste collection vehicles and street sweeping vehicles may carry out their normal functions safely whilst travelling in a forward direction through the development.

The design speed to be used for a particular road is as per AUSTROADS. For design speeds up to 60 km/hour, the use of transition curves is not considered necessary. The minimum radius of horizontal curves is:

Minimum Deflection Angle	Minimum Radius (m)
90°	Std Elbow
75°	20
60°	33
40°	65
30°	75
20°	100

Table 2.14.1 Minimum Radius of Horizontal Curves

Where the deflection angle is 90° and travel speed is not an issue, the size of the horizontal curve is to be related to the turning requirements of vehicles such as single unit trucks (removalist vans and garbage trucks). Details on the relationship between speed, radius and tangent lengths are referred to in The Australian Model Code of Residential Development (AMCORD).

2.15 Vertical alignment

Vertical alignment will allow for adequate sight distance at intersections and crests.

The maximum permissible grade on an arterial road is to be 8%, with an absolute minimum grade of 0.5%.

The maximum permissible grade on all other roads is to be 16% for a maximum distance of 50 metres and 12% where the length of straight grade exceeds 50 metres. The minimum grade is 0.33%.

A maximum permissible grade of 10% (1 to 10) should be used adjacent to street intersection, locations of poor visibility, horizontal curves of radius 15 metres or less and at cul-de-sacs. Turning circles in cul-de-sacs on steep grades should have grades less than 5%.

Council's drainage requirements on steep grades may involve special structures and extensive piping through

easements. Refer also to AR&R limitations on velocities.

Kerb and gutter is to have a desirable minimum grade of 0.50% (1 in 200) with an absolute minimum of 0.33% (1 in 300). Saw-tooth shaped profiles that are reliant upon pipe drainage are discouraged. Special consideration is required to direct the major flow path of water to designed flow paths. All flows up to and including the 1 in 10 ARI shall be accommodated in the pipe system.

Roads are to be designed to provide accessibility to the adjacent footpaths in accordance with AS 1428.2 Design for Access and Mobility.

Grades through intersections are not to exceed 4% to provide for stationary vehicles queued at intersections.

2.16 Vertical curves

Vertical curves are to be provided at all changes of grade) and where practical should coincide with the horizontal curvature. The values given in the AUSTRROADS Guide to the Geometric Design of Rural Roads are applicable to urban conditions in the relevant ranges.

Eccentric vertical curves will only be accepted in difficult design situations with prior written approval.

2.17 Pavement crossfalls

The normal crossfall on bituminous pavements should be 3%.

The maximum crossfall permitted is 6% and will occur in super-elevated curves, sideling land and road intersections.

Minimum crossfall other than on curves shall be 2.5%, including through intersections, cul-de-sacs and roundabouts.

Super-elevation of horizontal curves is to be based on

the current AUSTRROADS design policy for urban roads. The relative change in grade of kerb line and centreline is not to exceed 0.5%.

2.18 Offset crown

The crown may be shifted towards the higher side of the road. The crown should be not closer to the kerb line than 2.5 metres to ensure that the kerb retains capacity to transport stormwater flows. The designer is to assess the storm water capacity of the system.

2.19 Batters

All roads should be cleared full width and 0.5 metres inside the lot boundaries, or to a sufficient width to accommodate cut and fill batters.

Nature strips should be formed so as to extend 0.3 metres past the road alignment into the adjacent allotments to enable fences to be constructed at road level. Road batters should lie wholly within the adjacent allotments commencing 0.3 metres beyond road boundaries.

Such batters should be 1 vertical to 6 horizontal to allow for safe maintenance. Steeper batter slopes of 1 vertical to 4 horizontal may be acceptable but are a minimum requirement.

Where the developer provides special treatments to these batter slopes that control erosion, reduce maintenance and work, health and safety issues, then steeper slopes may be tolerated subject to Council approval

2.20 Batter encroachment

Where any cutting or filling undertaken by a developer, whether shown on the plan or not, encroaches on any private or crown property, is retained by an existing

structure, or could possibly undermine or remove the support of any existing or future structure, the developer should either:

- Take out an easement of support over such batter in favour of Council and pay such compensation as may be satisfactorily arranged with the owner or decided by a judicial body; or
- Construct an engineer-designed retaining wall.

2.21 Road embankments

Road embankments should be checked for safety and protection provided in accordance with AUSTRROADS Guide to Road Safety Part 9: Roadside Hazard Management. Safety barriers should not be used on road boundaries adjacent to residential allotments or gates.

2.22 Road reserve boundaries

Road boundaries may be curved, but where they are to be fenced as chords, these should be not less than six metres in length. Where a number of such chords occur adjacent to each other, they should, as far as possible, be practically equal.

2.23 Culs-de-Sac

Culs-de-sac shall be of a circular geometry. 'T' or 'Y' culs-de-sac are not permitted.

Cul-de-sacs must demonstrate compliance with the turning path requirements for service vehicles.

The kerb line radius of a cul-de-sac should not be less than 9.5 metres.

Special provision should be made to take drainage from downhill cul-de-sacs through easements or drainage

reserves that accommodate extreme flood events via underground drainage or overland flow paths. The capacity of the major drainage system should be the 1 in 100 year ARI stormwater event.

Safety-in-design principles require street lighting to be located to improve the safety and the illumination of any pathways or reserves.

2.24 Pathways, lanes, footpaths and nature strips

2.24.1 Definitions

A Lane is a public road of width greater than three metres but not greater than six metres and is to only be used for access to the rear of premises.

A Pathway is a public road of width three metres or less. The minimum width to be adopted for pathways is 2.5 metres and is primarily for the use of pedestrians and/or cyclists.

A Footpath is that part of a public road exclusive of the carriageway constructed within the nature strip. In the case of residential roads may not be less than 1.2 metres in width and generally 1.5m in new developments.

A Nature Strip is that part of a public road exclusive of the carriageway and in the case of residential roads may not be less than 3.5 metres. Residential roads are public roads used primarily for access to residences.

2.24.2 Lanes

Lanes dedicated to the public as access from or between roads, or as access to public gardens and recreation space, should be cleared, formed, graded, sealed, kerb and guttered and drained and be suitable for vehicular access. In general, the maximum

permissible grade to be used in lanes should be 15%.

2.24.3 Pathways

Pathways dedicated to the public as access from or between roads, or as access to public garden and recreation space should be designed in accordance with safer-by-design principles. These pathways should be clear, paved, drained, have cycle barrier rails and provide uninterrupted lines of sight with lighting located at the ends of the pathway.

The maximum permissible grade to be used in pathways providing access to public gardens and reserves shall be 8%.

For other locations, in general, the maximum permissible grade to be used in pathways should be 15%.

The developer should grade and provide drainage for pathways.

2.24.4 Footpaths

Pedestrian Access and Mobility

Footpaths are required as part of all subdivision development. These footpaths are to be provided consistent with the requirements of Council's footpath master plan and mobility plan.

Element	Requirement
Paved footpath width	1.5 metre – for new developments 1.2 metre – in existing areas containing 1.2 metre wide footpaths
Shared footpaths and cycle ways	2.5 metres wide
Construction of the footpath	At developer's cost after 80% of buildings are completed. Council will require a bank guarantee to cover this work. Alternatively, reinforced concrete of a minimum thickness of 100mm provided at time of subdivision construction.
Footpath materials	Reinforced concrete, minimum 75mm thick and minimum 100mm thick at driveway crossings, except as noted above An alternative for extended length shared footpath and cycle ways may be 30mm asphalt over a 150mm gravel pavement, subject to Council's consent on a case-by-case basis
Crossfall	Minimum 1%, maximum 3%
Longitudinal Grade	Maximum of 7%
Location	600mm from the property boundary
Requirement for footpath	Refer to Road Standards for the Urban Street Network and master plan

Table 2.25.4 Paved footpath requirements specific to Wagga Wagga City Council

Perambulator ramps must be provided at all kerb crossings. Tactile indicators are to be in accordance with current RMS and Australian standards.

The requirement for footpaths is dependent on road classification and city-wide master planning for footpaths and cycle ways.

Design is to be in accordance with Australian Standard AS1428 Design for Access and Mobility.

2.24.5 Nature strips

In areas where the footpath is unpaved or only partially paved, crossfall from kerb to the adjacent boundaries is to be 1 in 25 (4%) towards the kerb. Alternative treatments that achieve water sensitive urban design outcomes are encouraged subject to prior approval. The design of footpath crossfalls shall comply with the drainage requirements in Australian Rainfall and Runoff with 1% ARI flows contained within the road reserve, public reserves or pipes.

In areas where the footpath reservation is to be totally paved from the top of the kerb to the adjacent boundary, the crossfall is to be a minimum of 1 in 50 (2%) towards the kerb.

Vehicle access across nature strips is to be checked using standard vehicle templates.

2.25 Cycle ways

Cycle ways are to be provided in accordance with Council's cycle way plan that encourages alternative forms of transport. Cycle ways shall be designed in accordance with AUSTROADS guidelines.

2.26 Street signs

Street signs are to be erected at all street intersections and are to be in accordance with Council's standard drawings and requirements.

2.27 Half-width construction

Half-width construction is at the discretion of Council and will be considered on a case by case basis.

Where proposed subdivisions or developments front an existing sealed road and the existing pavement is of adequate strength and the vertical alignment is satisfactory, the existing pavement may be retained. The remainder of the half-width construction is to be carried out to the equivalent standard of full-width construction.

Should Council determine the existing pavement is unsatisfactory, then the pavement construction is to be extended to the road centreline plus 0.5 metres.

In all cases, the new seal should extend to the road centreline plus 0.5 metres to avoid irregularities.

Any unsealed road must be sealed for the full width as per these Guidelines for the entire length of the development.

2.28 Intersections

Intersection design should be based on the AUSTRROADS publication Intersections at Grade, Part 5.

T-junctions should be adopted in preference to four-way intersections. Where staggered T-junctions are to be provided, the intersecting roads should be located a minimum distance of two times the stopping distance for the travel speed along the through-road (1.5 second reaction time).

Roads should intersect at an angle of not less than 70°.

The minimum centreline spacing between intersections is 50 metres in urban areas.

Four-way intersections or cross intersections shall be designed with roundabouts or traffic lights.

Where intersections are in a location likely to cause

traffic problems, the construction of tapers, widening, traffic islands, or other such traffic facilities, are required to provide traffic control and safety.

2.29 Turning movements for design vehicles

Turning movements shall be provided for the design vehicle. Prior to commencement of design process, consultation is required with Council to determine the design vehicles for the different street classifications. The fire/emergency services vehicle is frequently the design vehicle.

Vehicle turning movements must allow for left turn from the left lane without crossing lanes for design vehicles. Where requested, traffic movement paths shall be presented using such packages as Autoturn or similar. A clearance of 500mm shall be provided to the total swept path.

2.30 Local area traffic management

Traffic management devices are to be designed in accordance with AUSTRROADS publication Guide to Traffic Management – Part 8: Local Area Traffic Management. Local Area Traffic Management Devices may be required as a condition of Development Consent. Alternatively, developers may elect to install these devices where appropriate. The use and installation of the devices should be in accordance with Australian Standard 1742 (Part 13) - Local Area Traffic Management.

2.31 Guide posts

Guideposts and protection fencing are to be provided in accordance AS 1742, AUSTRROADS and RMS guidelines.

2.32 Signposting and pavement markings

Signposting and pavement markings are to be provided where required, in accordance with AS 1742 Manual of Uniform Traffic Control Devices Parts 1 to 13 and RMS road design guidelines.

2.33 Car parking

Car parking is to be provided in accordance with:

- DCP and LEP
- AUSTRROADS Guide to Traffic Management Part 11 – Parking
- AS 2890 Parking Facilities

Indented parking will only be considered as part of an integrated solution that enhances environmental and aesthetic outcomes such as for water-sensitive urban design and entry features.

The developer is responsible for providing parking associated with development onsite. Parking on the street is regarded as being additional to development-generated parking and is for general public parking.

All car parking and manoeuvring surfaces are to be bitumen sealed or reinforced concrete 150mm min.

2.34 Flooding

The design of the road system must account for major flow paths associated with flood events. The piped stormwater drainage network caters for water flow during minor events. However, the flow path of water during major events frequently involves the road network. In particular intersections shall be designed to direct the major flow path of water in accordance with the approved subdivision master plan and/or Outline Development Plan.

Road longitudinal section sag points must direct flows to major open channels or intersections. Sag points mid-block are discouraged and will only be approved if consistent with an agreed drainage master plan. Direction of water to closed cul-de-sacs is not permitted.

2.35 Earthworks

In all new development areas, lot filling is required to ensure that finished house floor levels will be at least 500mm above the 1% ARI flood levels. Where infill development occurs developers must consult with Council regarding local requirements and Council flood policies.

Filling of depressions or near overland flow paths requires consent, as there is potential to redirect the major flow path of water. Earthworks are to be in accordance with AS 3798 Guidelines on Earthworks for Commercial and Residential Development.

If it is intended to move fill off site, the Developer/ Contractor must inform Council of the disposal site and ensure the remote fill location is appropriate. If filling involves a low area subject to flooding, separate Development Consent will be required. Care should also be taken that external fill sites are re-topsoiled and seeded/grassed after filling.

For residential subdivisional land, lot classification in accordance with AS2870 – 2011 will be required when the subdivision certificate application is submitted to Council.

Fire trails are to be graded to divert stormwater away from residential properties, to either drainage reserves or road reserves.

Consideration is to be given to the benching or levelling of lots to minimise cut and fill for future building works.

2.36 Testing of roads

All pavement courses, surfacing and subgrade are to be inspected and tested in accordance with an approved testing regime and are to demonstrate that the pavement meets the requirement of the specification. Refer to Part 7 Guidelines for Testing. Such inspections and testing are to be part of a quality control process to ensure pavement design life and is to be managed and signed off by a qualified Geotechnical Engineer.

2.37 Street lighting

Developers must comply with the current Australian Standard and is to provide for pedestrian and vehicular movements. Lighting designs are to be prepared by consultants approved for lighting design by the Energy Council and Council.

2.38 Road safety audits

A road safety audit is to be undertaken of the road design to provide documentary evidence that the road design has taken into account risk and safety issues.

In addition to the forgoing section relating to urban road design this section applies to the provision of roads and access to rural and rural residential areas. The Council is responsible for making the determination of areas where rural residential design standards apply.

Rural/Rural Residential Roads

2.39 Standard Road Widths

New road widths require discussion with Council and should generally be in accordance with the standards outlined in table 3.1.1.

AADT (vehicles per day)	Road Element Width (metres)				
	Road Reserve	Carriageway	Shoulder	Seal	Formation
500	23	6.0	1.0	7.0	8.0
500-1000	23	6.5	1.0	7.5	8.5
1000-2000	23	6.5	2.0	8.5	10.5

Table 3.1.1: Road Standards - Rural/Rural Residential Network

> 2000 (and all B double routes)	Minimum 30	7.0	2.0	9.0	11.0
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NB:

- In all cases AADT is that predicted by the Traffic Engineering Report at the end of the design period (usually 30 years)
- The designed pavement thickness is to extend for the full formation
- The road reserve width is nominal only and consideration is to be given to the extent of cut and fill batters, catch drains, intersection layout requirements, and provision for public utilities adjacent to the road reserve boundary. A minimum allowance of three metres from the batter point to the boundary is to be provided

2.40 Plan

Plans should be drawn at a scale of 1:1000 and show contours, lot boundaries and numbers, road centreline chainages, radii and bearings, road names, locality sketch and a north point.

Road numbering shall be in accordance with rural road addressing principles.

Plans should show the following:

- the location and reduced level of the bench marks used in the survey works
- the location of vehicular entrances. Council will not permit individual property entrances onto arterial roads.
- existing and proposed drainage structures, overland flow paths (depth and width), plus drainage calculations
- proposed fill areas
- trees
- public utilities
- schedules including location and reduced levels of recovery pegs and/or control points for co-ordination surveys
- all datum references referred to Australian height datum

2.41 Longitudinal section

A longitudinal section of the centreline of the roads should be supplied at scales of:

- 1:1000 horizontal
- 1:100 vertical
- The longitudinal section of the centreline of roads should show:
 - chainages
 - reduced level of existing surface and of design level of road
 - design grades and intersection points
 - length of vertical and horizontal curves
 - drainage culvert information
 - extent of roadworks.

Longitudinal levels are to be at:

- 40 metre intervals along straight alignments and horizontal curves exceeding R1000 metres
- 20 metre intervals for horizontal curves between R 150 metres and R 1000 metres
- 10 metre intervals for horizontal curves less than R 150 metres
- all intermediate changes of grade.

Longitudinal sections and cross sections should be taken along existing intersecting roads for a sufficient distance to enable design requirements to be satisfied.

2.42 Cross sections

Cross sections are to be at:

- 20 metre intervals along straight alignments and horizontal curves
- all culvert sites
- the SS, TS, TP and SC of each horizontal curve
- the scale should be 1:100 natural.

Cross sections should not be terminated at the property alignment but should be levelled sufficiently beyond the road boundaries to enable batters of cut and fill to be shown.

Cross sections should show:

- chainages
- reduced level of existing surface
- design surface levels on the road centreline
- cross falls
- centreline offsets
- lateral dimensions if pavement and formation widths vary
- batter slopes that vary from those shown on the typical cross section.

Typical cross sections shall show:

- pavement details
- typical width
- subsoil drainage
- road surfacing.

2.43 Pavement design

The designer shall utilise an experienced geotechnical engineer to detail how the design, construction and testing of the pavement shall be managed.

Council will require a Pavement Report at the detailed design stage that sets out matters such as: design assumptions, proposed subgrade treatment, proposed pavement type, proposed quality of material, use of any stabilisation, proposed depth, proposed testing and proposed quality assurance process. The Pavement Report must be signed off by the geotechnical engineer. This is to be submitted with the Detailed Engineering Plans.

Council will also require the geotechnical engineer to monitor the pavement construction and verify it has been constructed in accordance with the pavement design.

Road pavements are to be designed in accordance with the Australian Road Research Board Publications:

- Rural Residential Pavement Design for Local Traffic: a supplement to the AUSTRROADS Pavement Design Guide
- Rural Sealed Local Roads Manual.

Design subgrade CBR values should be determined by either geotechnical engineering consultants and/or a NATA registered laboratory. The investigation will include logging of test holes to a depth not less than 600mm below design subgrade levels (unless rock is encountered). Soil samples should be taken at the design depth and CBR tests undertaken after soaking

the samples for four days.

The frequency of test holes should be in accordance with ARRB Pavement Design for Light Traffic: a supplement to the AUSTRROADS Pavement Design Guide.

A copy of the site investigation report including test results should be submitted with the pavement design and the Engineering Drawings.

2.44 Geometric standards

The Geometric design of rural roads is to be based on AUSTRROADS Guide to Geometric Design of Rural Roads. The design speed to be used for a particular road should be the legal road speed limit for that road.

2.45 Sight distance

Adequate horizontal and vertical sight distance should be provided for the design speed in accordance with AUSTRROADS Guide to Geometric Design of Rural Roads.

Vehicular access to properties is not permitted where the stopping sight distance is unavailable.

Where practical, horizontal and vertical curves should coincide.

2.46 Vertical alignment

The maximum permissible grade on an arterial road is to be 8% with a minimum grade of 0.5%.

The maximum permissible grade on all other roads is to be 16% for a maximum distance of 150 metres on straight alignment with a minimum grade of 0.5%.

A maximum permissible grade of 10% (1 in 10) should be used adjacent to street intersections, locations of

poor visibility, horizontal curves of radius 15 metres or less and at culs-de-sac. Turning circles in culs-de-sac on steep grades should have grades less than 5%.

2.47 Pavement crossfalls

The normal crossfall on bituminous pavements should be 3% and the normal crossfall on unsealed shoulders should be 4%.

The maximum crossfall permitted is 6% and will occur on super-elevation curves and road intersections.

2.48 Clearing and grubbing

All road reserves should be cleared approximately 0.5 metres beyond the extent of roadworks. All trees to be removed must be clearly marked on the plan with a diameter of the canopy and the trunk represented diagrammatically on the plan.

Native and threatened species impacts are to be identified and are subject to approval.

2.49 Vehicular access

Roads should be located and designed so that vehicles can readily and safely access every lot of a subdivision. Where the natural surface slopes steeply to or from the road, the access to each lot should be given special consideration. Vehicle access to individual properties from arterial roads is not permitted. Where a rural subdivision adjoins a classified road or arterial road, property access shall be off internal or service roads with appropriate intersection treatments.

Access to rural properties shall provide safe ingress and egress, having regard to sight distance and fire risk.

The driveway access is to be all-weather construction of a minimum depth of 200mm compacted road gravel.

Where the access way connects to a sealed road the access way is to be bitumen seal or equivalent hard surface between the property boundary and the road carriageway.

All vehicle access requiring pipes shall utilise 4.88 metres minimum length culverts, setback for clear zone requirements and sized to ensure that table drain flows do not encroach onto the carriageway.

Hydraulic capacity of vehicular access pipe structures shall be a minimum of 1 in 5-years.

Minimum single diameter pipe culvert in the table drain is 375mm.

End walls are to be trafficable if located within a clear zone (refer to RMS standard drawings) Culvert or dish crossing invert levels are to be obtained from Council prior to construction.

Guide posts with delineators are to be provided at either side of the access point in accordance with the Australian Standard.

Site specific plans must be submitted for approval.

Pipe flows in the drain are to be calculated and must provide capacity for 1 in 100-year overland design flows. For flows in excess of the pipe capacity the flow path must be checked to ensure that risk to the public and physical assets is minimised or eliminated. Major flow paths of water are to be clear of the edge of gravel and sealed roads.

2.50 Bus routes

Where there is potential for future access by school bus services, turning provision is required.

2.51 Guide posts

Guideposts and protection fencing are to be provided

in accordance with AS1742, AUSTRROADS and RMS guidelines.

2.52 Road name signs

Road name signs are to be manufactured to accord with Council's standard and must be erected at all intersections. The road name and colour of signs are to be in accordance with an approved sign location drawing.

2.53 Intersections

Intersection design should be based on the AUSTRROADS publication Intersections at Grade, Part 5.

T-junctions should be adopted in preference to four-way intersections.

Roads should intersect at an angle of not less than 70°.

Where intersections are in a configuration likely to cause traffic problems, the construction of traffic islands, or other such traffic facilities, are required to provide traffic control and safety.

Splays must be provided at intersections.

2.54 Public utilities

All public utilities in subdivisions should be provided underground. An early approach is to be made to those authorities for their requirements regarding conduits, contributions, layout plans and other relevant details.

The location of proposed service conduits beneath the carriageway is to be shown on the plans. Location markers are to be attached on the kerb or property boundaries following completion of works.

2.55 Steep grades

Where grades exceed 6%, a one-coat bitumen seal is to be provided on the road shoulders. Where shoulders are sealed, edge line marking is to be provided.

Where the grade of the table drain exceeds 6% and scouring is likely, a concrete lined drain is required.

Where the terrain permits, batters in the region of 4 horizontal to 1 vertical are desirable. Proposed batters of greater slope than 4 horizontal to 1 vertical require separate approval.

2.56 Signposting and pavement markings

Signposting and pavement markings in accordance with Australian Standard AS 1742 - Manual of Uniform Traffic Control Devices, are to be provided where required.

2.57 Fire trails

Fire trails are to be provided as part of an integrated network that improves community safety from the risk of fire.

Fire trails are to have a desirable maximum grade of 1 in 200. In localised sections steeper grades will be permitted with these sections requiring erosion treatment of gutters and drains.

2.58 Road surfacing

The carriageway of rural/rural residential roads should be sealed to a minimum standard of two-coat spray bitumen seal. The carriageway is to be marked with a 150mm wide edge line for roads with projected AADT greater than 1,000 vehicles per day.

The shoulder adjacent to a barrier centreline is to be widened to 3.0 metres.

A prime coat will be required prior to application of a two-coat seal.

At property accesses, the whole shoulder is also to be sealed.

The seal design, including application rates of aggregates and binder, and the Average Least Dimension of aggregates, shall be submitted for approval prior to commencement of sealing on-site.

2.59 Dust suppression

Consideration is on a case-by-case basis having regard to:

- existing impacts on buildings within 100 metres
- potential future impacts
- providing a sealed surface 75 metres each side of access to building
 - a 4.5 metre wide seal is to be provided for less than 30 vehicles per day
 - a 6.2 metre wide seal is to be provided where there are greater than 30 vehicles per day.

2.60 Causeways and flooding

Rural roads that include causeway crossings require calculation of flows and recurrence interval of events. Direction from Council will be required on the design criteria and risk assessment approach required.

2.61 Erosion protection

Erosion protection must be provided where water is concentrated, such as for piped culverts.

2.62 Rural road design philosophy

Rural road pavements are typically elevated in comparison to urban pavements, which are depressed to provide for the major flow path of surface water.

2.63 Guardrails

Guardrails must be provided in accordance with AUSTRROADS standards.

2.64 Maintenance

The road reserve area shall be constructed with batter and drain slopes that permit routine access for mowing. This requires desirable minimum batter slopes of 4 horizontal to 1 vertical.

2.65 Standard drawings

All work is to be in accordance to the approved Council Standard Drawings, refer to Part 8.

part 3
guidelines for design of drainage

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1. introduction

This section of the Engineering Guidelines outlines Council's recommended practice for the design of stormwater and drainage systems. It is not a design manual and it is to be read in conjunction with and as a supplement to relevant documents.

The Engineering Guidelines comprise:

Part 1 General Requirements

Part 2 Guidelines for Design of Roads

Part 3 Guidelines for Design of Drainage

Part 4 Guidelines for Design of Water Reticulation

Part 5 Guidelines for Design of Sewer Reticulation

Part 6 Guidelines for Landscaping and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Guidelines for Testing

Part 8 Standard Drawings

2. general

The objective is to identify and document the manner in which the quantity and quality of stormwater shall be managed for any catchment in which a development occurs, showing the drainage infrastructure works involved.

- The management of development and urban stormwater within the context of total urban water cycle management is addressed in the Engineers Australia publication Australian Runoff Quality: A Guide to Water Sensitive Design. It presents best practice for mitigating stormwater quality impacts in new development and presents the following information:
- procedures for the estimation of a range of urban stormwater contaminants
- design guidelines for commonly applied stormwater quantity and quality management practices
- procedures for the estimation of the performance of these practices; and
- advice with respect to the development/consideration of integrated urban water cycle management practices

Stormwater drainage design is based on another Engineers Australia publication, Australian Rainfall and Runoff (AR&R). The first edition of this document was released over 50 years ago and it has been revised several times. The aims and principles of the current edition state “that the main purpose of the urban stormwater drainage system is to collect and convey stormwater to receiving waters, with minimal nuisance, danger or damage.”

Other objectives are listed as:

- limitation of pollutants entering receiving waters and other adverse impacts of urbanisation, such as litter, erosion and sedimentation
- water conservation
- integration of large-scale drainage works into town planning schemes, with multiple use of land for drainage, recreation or transportation

As well, for Wagga Wagga, there is a need to avoid aggravating salinity and rising water tables in vulnerable areas.

AR&R lists the following four fundamental guiding principles:

- 1) Description and analysis of stormwater drainage systems should be based on measured or observed real system behaviour
- 2) Drainage systems must be viewed in relation to the total urban system
- 3) Drainage systems should be designed and operated to maximise benefits to the community
- 4) Designers should be influenced by professional considerations such as ethics, standardisation and innovation.

The objectives and guiding principles are important considerations that must be taken into account when determining stormwater drainage strategies and plans for subdivisional development.

Council has a standalone document On Site Detention Policy. A copy is attached as Appendix B.

In regard to developer contributions for drainage, developers should refer to Council's Development Servicing Plan – Stormwater, available through Council's web site.

3. water sensitive urban design (WSUD)

Stormwater drainage design needs to include the principles of Water Sensitive Urban Design in subdivisional works. The extent to which these principles can be incorporated into the subdivision master planning and urban landscaping are to be discussed at the pre-development meeting.

Urban stormwater is to be managed as both a resource and for protection of receiving waters. Except in saline recharge areas, Council encourages outcomes that promote the retention of water on site and relieves potential of flooding on areas downstream.

3.1 Water sensitive urban design

The sustainable management of the Water Cycle

Principles of water consumption

Water recycling

Waste minimisation

Environmental protection

3.2 Environmental benefits

Improving the urban landscape

Reduction of the export of pollution from the site

Retardation of storm flows

Reduced irrigation requirements

3.3 Context

Council's consideration of water-sensitive urban design elements into subdivision design will take into account:

- lifecycle cost implications on the maintenance of the infrastructure
- the maintenance period and the success of the initial establishment
- community safety and the safety of maintenance staff
- the provision of consistent city-wide themes but which recognise the individuality of each locality such as soil conditions and flooding
- focus on catchment-wide systems rather than site-specific systems.

4. stormwater drainage calculations

All drainage design calculations shall be undertaken in accordance with the current version of Australian Rainfall and Runoff (AR&R). Designers should also have access to the companion reference Australian Runoff Quality. It details techniques to manage and minimise stormwater impacts of development on the natural environment.

AR&R offers a variety of methods to calculate runoff. The most appropriate method of drainage calculation should be selected, having regard to catchment size, the magnitude of flows and the potential for flooding.

Typically the Rational Method is the most common method used for urban drainage design and is suited to small subdivisional design. The Rational Method is not suited for flood modelling.

Rational assumptions are based on statistical analysis of data to produce a 'standard' design flow rate or discharge.

4.1 Factors effecting estimates of flowrates

There is an inherent variability in rainfall and runoff values as this data is obtained from fitted statistical distributions. Council has adopted a major/minor drainage network philosophy for street drainage in accordance with AR&R. The minor system is the pipe system and the major system is the overland flow system.

Council has also undertaken a Major Overland Flow

Flood Study (2011) which addresses major flows and flooding in the urban area and is available for drainage designers' use, from Council's website.

4.2 Catchment discharge

Developments shall be designed such that the rate of discharge will not increase as a result of development, unless otherwise approved by Council, and in accordance with an integrated catchment-wide drainage strategy. Designs shall consider events up to and including the 1 in 100 ARI event.

4.3 Design recurrence interval

The pipe drainage network shall be designed for average recurrence interval flows as depicted in Table 4.3.1.

Type of Development	Design Average Recurrence Interval (ARI)
Residential areas	1:10
Industrial and commercial areas	1:10
Rural and Rural Residential	1:10

Table 4.3.1 Wagga Wagga Specific Design Recurrence Intervals

4.4 Standards of performance

There are a range of performance levels that need to be met. These include:

- maintenance requirements (frequent event)
- a convenience or nuisance reduction requirement (infrequent event)
- a flood damage prevention requirement (severe or rare event)
- a disaster management requirement (extreme event)

It is emphasised that there is inherent variability in rainfall or run off values obtained from fitted statistical distributions. Designers must allow for stormwater events larger than that calculated as part of the design process to occur, without causing damage to property or life.

4.5 Property drainage

Rear of lot property drainage systems shall be installed where roof and yard water cannot discharge under gravity to the kerb and gutter. Also, property drainage systems shall be provided so that roof water will not discharge onto adjacent open space or drainage reserves. Stormwater discharge into rear laneways will only be permitted when discharging directly to a kerb and gutter.

Unit development greater than 2 units, medium density

residential, and industrial/commercial development will need to connect directly to the piped drainage system.

Minimum interlot pipe diameter is 150mm. Interlot drainage shall be sized based on hydraulic analysis. Interlot stormwater pits shall be provided in accordance with Standard Drawing EDS 03.11. Property spurs shall be located in the lowest corner of the lot and consist of a 90mm spur with 450 x 250mm dia “poly” pit.

Approved precast pits are acceptable but the surround must be backfilled with stabilised sand and pipes neatly trimmed and sealed at entry and exit points. Pits for line junctions and pipes bigger than 150mm diameter, shall be a minimum of 600mm x 600mm internally.

Minimum 2.0 metre wide easements are to be provided for trunk drainage and rear of block drainage and sewer. Combined drainage and sewer easements shall be minimum 2.5m wide. These easements must be created in favour of Council.

Property drainage and sewer trenches need to be backfilled to AS3798 Guidelines on Earthworks for Commercial and Residential Developments with a minimum relative compaction of 95% and indicative testing as per Table 8.1 of one test per two layers per 40 lineal metres.

4.6 Pipe and other system drainage

When considering street drainage, use the major/minor concept.

The major system relates to drainage systems operating during storms of large magnitude and involves overland flow. The minor system is the gutter and pipe network capable of carrying runoff from minor storms. Pipes are sized to carry flows to 1 in 10-year ARI to prevent nuisance flooding of streets. The major system includes

overflows which are then routed along streets and drainage reserves.

Hydraulic capacities of flow paths are to be checked for 1 in 100-year ARI events. Overflow calculations need to determine the route for these overflow quantities, ensuring hazardous situations do not arise on streets and footpaths, and that residential buildings are protected by a freeboard of 500mm from floodwater ingress. Commercial and industrial development should be protected to a minimum ARI of 20 years with 500mm of freeboard.

Pipe lines of 525mm diameter and less laid longitudinally along the street are to be placed 700mm behind the face of the kerb. For longitudinal road pipelines larger than 525mm diameter, these should be located with centreline 2m from the kerb face under the road pavement. Spurs back to inlet pits will then be required.

For trunk drainage pipelines, ideally these should be located in road reserves or drainage reserves. However, if located within private property, easements shall be created in Council’s favour. Easement widths should take into account the line of influence of the trench on adjacent building footings, but be a minimum of 2 metres wide for drainage only, and if sewer is also included, the minimum width shall be 2.5 metres.

In private property, backfill of trenches will be to AS3798 Guidelines on Earthworks for Commercial and Residential Developments.

For open channels and detention basins, reserves and easements should accommodate the 1 in 100-year flow with 500mm freeboard. The designer should also take into account Council’s maintenance of these systems. If no trickle flow pipe is provided (minimum diameter 375mm) for open drains, an extra 3.0 metre width shall be provided to the reserve or easement width to accommodate a maintenance vehicle.

For detention basins, embankments should be compacted of suitable cohesive soils compacted to 98% Standard Maximum Dry Density as per AS1289 Method of Testing Soils for Engineering Purposes, and keyed 500mm deep and 2.5 metres wide into natural clay. Batters should be a minimum of 1 vertical to 4 horizontal. Spillways should be a minimum width of 3 metres and freeboard for design surcharge volume should be at least 500mm. Inlet/outlet pits shall be grated letter box pits.

4.7 Stormwater drainage pits

4.7.1 Location

Stormwater side entry gutter drainage inlet pits are to be provided at suitable spacings to limit gutter flow spread to 2 metres on any section of road other than a kerb return where the width is limited to 1 metre.

The maximum spacing between side entry gutter inlet pits is approximately 75 metres subject to hydraulic calculations demonstrating acceptable flow widths and stormwater velocity.

The inlet capacity of stormwater drainage pits must match or exceed design inflow.

Drainage pits should not conflict with driveway inverts.

4.7.2 Drainage pit design

Standard pits should be provided in drainage lines at all changes in grade, level or direction and at all pipe junctions.

Kerb inlet pits shall be located to minimise clashes with potential future driveway locations.

The minimum freeboard from the design water level (hydraulic grade line) in the pit to the gutter invert (or

surface level for grated surface inlet pits) should be 150mm, to minimise surcharge.

Pipe junctions should be avoided where the deflection angle of the major flow exceeds 90°.

Pipe grading across pits:

- no change in direction or diameter – minimum 50mm
- no change in diameter but direction change – minimum 70mm
- changes in diameter shall be graded obvert to obvert.

Every endeavour is to be made to maintain flow velocities through pits and excessive drops will not be permitted.

Pits are to be located and constructed in accordance with the standard drawings in Part 8 of this document. Precast pits are acceptable, subject to structural certification and prior Council approval to the type and design.

Minimum size drainage pits that require access are to be 900mm x 900mm internally.

Precast headwalls designed by qualified structural engineers and approved by Council will be acceptable.

Temporary headwalls shall be approved by Council.

A 3 metre length of 100mm diameter subsoil drainage pipe shall be laid out of the bottom of all pits, in the upstream direction, to minimise build-up of ground water in trenches.

4.7.3 Gross pollutant traps

The selection of a Gross Pollutant Trap (GPT) is subject to Council approval and the designer shall apply the following criteria in designing GPT:

- Selecting a design flow rate will require the designer to balance the cost and space requirements of the

device (a higher design flow will usually require a larger facility with additional costs) and the volume of water that could bypass the unit and avoid treatment. The minimum design flow should be 1 year ARI peak flow. The designer will include the provision of all-weather access to treatment sites, permitting crane access to GPT units, which should be assumed to require cleaning every six months. In new developments or public areas, the design will ensure maintenance vehicles are able to travel in a forward direction at all times.

- The designer is to ensure that the quality of the water being discharged will meet the requirements of Council, and to submit supporting evidence to Council for review and approval.

4.8 Surface runoff and travel times

4.8.1 Kinematic wave equation

Stormwater design shall account for overland flow prior to discharge to the pipe network.

The recommended formula to determine time of overland flow is the Kinematic Wave equation as detailed in AR&R.

There are restrictions on the use of this formula as this expression applies to planar or sheet flow of water. The maximum length applicable should not exceed 60 metres.

Where overland flow is concentrated, naturally or by design, into an earth or grass lined channel, Manning's Formula for open channel flows can be used to estimate flow times and characteristics.

4.9 Dimension of flow

Limit flow width to 2 metres, along kerb and gutter and 1 metre around kerb returns for a 1 in 10-year ARI storm. Gutter flows are not to overtop the kerb

Free board for floor levels of habitable rooms in properties is 500mm above the 1 in 100-year design flows to be determined at Development Application stage.

The product of depth (metres) and velocity (metres/sec) should not exceed 0.4m²/s for safety of pedestrians or 0.6 – 0.7 m²/s for the stability of parked vehicles.

Bypass gutter flows shall not exceed 15% of total pit flow.

4.10 Pit entry capacities

Hydraulic design calculations must demonstrate adequate capacity of the stormwater drainage network to accept the design flows.

4.11 Estimation of flowrates by the rational method

A peak flowrate for a particular time of concentration is calculated. While this is adequate for design, the model is unsuitable for the simulation of drainage system behaviour in actual storms.

4.12 Partial area effects

The time of concentration most commonly used is the full area time, which is the travel time for runoff from the longest flow path. Partial area calculations may be approximated by obvious partial catchment areas and for partial areas based on the concentration times of impervious zones directly connected to the pipe system.

4.13 Runoff coefficient 'C'

In the current version of Australian Rainfall and Runoff, a 'probabilistic' interpretation of the value of C is used. This represents the ratio of runoff to rainfall frequency curves. It does not represent the ratio between runoff and rainfall volume nor the ratio of their peak rates.

The probabilistic interpretation covers the whole range of events involving different combinations of rainfalls and antecedent conditions.

4.14 Fraction impervious

Typical fractions for impervious areas are:

Open space/parkland	0.20
Normal house block	0.60
Duplex block medium density	0.70
Road reserve including roads and footpath	0.85
Commercial and industrial block	0.95

In situations where more accurate estimates of impervious area fractions can be determined the accurate estimates should be used in preference to the typical fractions given above.

4.15 Rainfall data and intensity

The Rational Method uses uniform rainfall patterns taken from Intensity Frequency Duration (IFD) relationships. Refer to Appendix A.

4.16 Pipe system hydraulics

Hydraulic grade calculations shall be used for the design of pipe systems in accordance with examples provided in AR&R.

4.16.1 Limiting Velocities

The minimum allowable velocity for design is normally taken as 1 metre/sec. The absolute minimum allowable velocity is 0.6 m/s to provide self-cleansing velocities.

This hydraulic requirement is a different approach to the minimum grade approach. The basis of the minimum grade approach relates to construction problems and tolerances. Minimum grades of 1 in 200 are acceptable for normal pipeline design.

4.16.2 Calculation of Pipe Friction

The Colebrook-White Equation is recognised as the best relationship for the full range of turbulent pipe flows. It follows the curved lines shown on the Moody Diagram.

4.17 Pipeline construction

Pipes are to be RCP rubber-ring jointed with a minimum diameter of 375mm, except for Interlot pipe drainage, refer to Section 4.5.

The minimum cover under road pavements is 300mm below subgrade level or 600mm below pavement surface level, whichever is greatest.

Inter-allotment drainage pipe materials may be UPVC or Stormpro where located in the road reserve. Larger diameter pipes can be RCP rubber-ring jointed.

The minimum cover over inter-allotment drainage is nominally 500mm.

No reduction in pipe diameter is allowed for pipe reaches progressing downstream.

Council will consider other materials on a case-by-case basis.

Backfilling must be in accordance with Australian standards.

4.18 Standard Drawings

All work to be in accordance to the approved Council Standard Drawings, see Part 8.



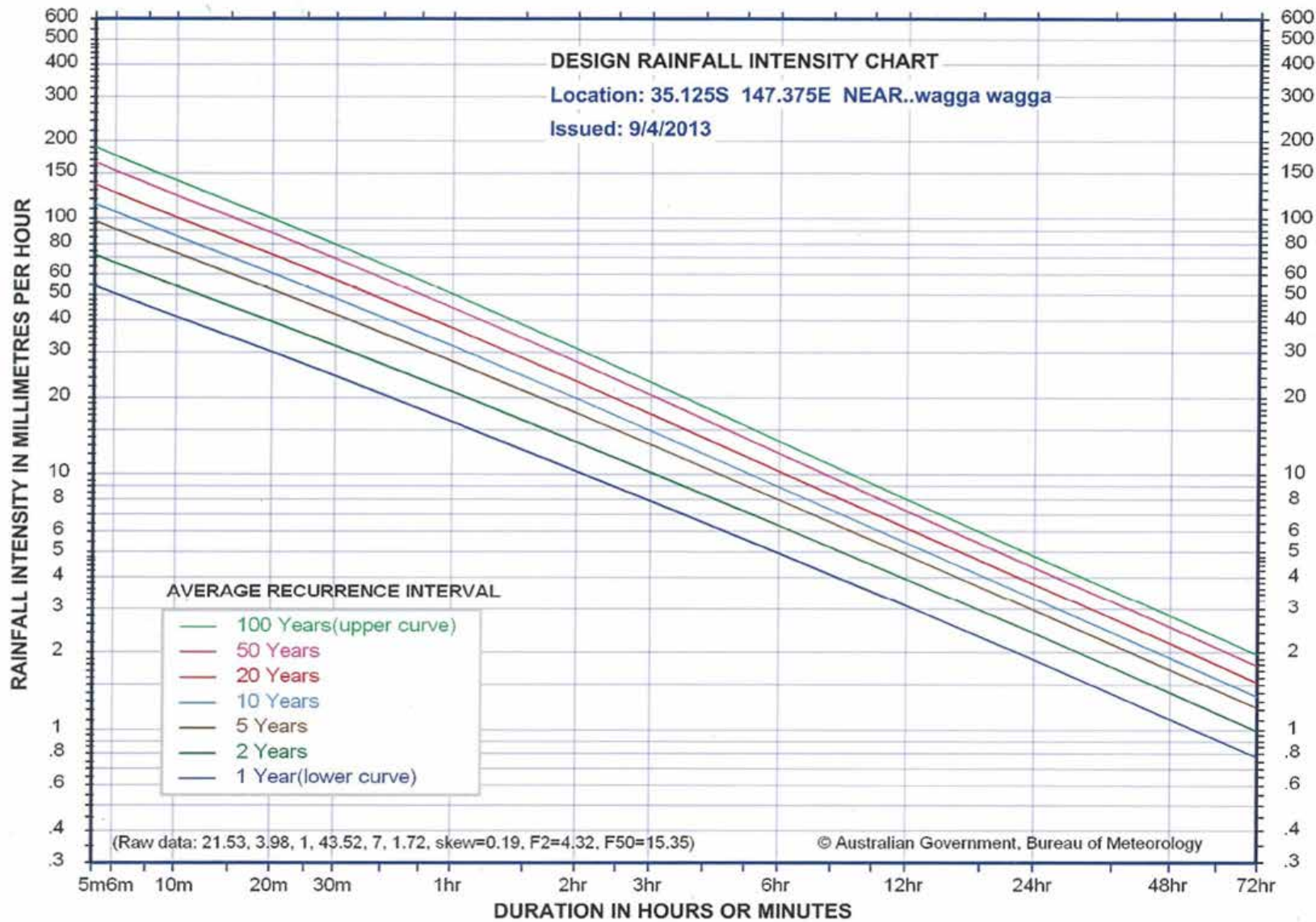
5. salinity

The designer shall seek specialist advice in regards to designing for urban salinity where it has been identified as an issue during the development assessment process or where the site investigation by the geotechnical engineering consultant identifies salinity as an issue.

The designer shall provide measures and specifications to:

- prevent any impacts of salinity on proposed infrastructure
- mitigate the impacts of salinity on private land
- prevent any immediate or progressive increase in severity or coverage of areas affected by salinity.

appendix a - IFD Analysis based on BoM data (2014)



Intensity-Frequency-Duration Table

Rainfall intensity in mm/h for various durations and average recurrence interval

Location: 35.125S 147.375E near Wagga Wagga

Issued: 9/4/2013

Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5mins	54.6	72.1	97.7	114	136	166	190
6mins	50.9	67.1	90.7	106	126	154	176
10mins	41.4	54.5	73.3	85.3	101	123	141
20mins	30.1	39.5	52.7	61.1	72.2	87.5	99.7
30mins	24.3	31.8	42.2	48.8	57.6	69.6	79.1
1hr	16.1	21.1	27.7	31.8	37.3	44.8	50.8
2hrs	10.3	13.4	17.4	19.8	23.1	27.5	31.0
3hrs	7.89	10.2	13.1	14.8	17.2	20.4	22.9
6hrs	4.94	6.33	7.98	8.96	10.3	12.1	13.5
12hrs	3.07	3.91	4.86	5.42	6.20	7.23	8.03
24hrs	1.88	2.39	2.94	3.27	3.73	4.33	4.80
48hrs	1.10	1.40	1.72	1.91	2.18	2.53	2.80
72hrs	.781	.990	1.22	1.35	1.53	1.78	1.97

appendix b - On-site detention

1. Definitions

Afflux: The rise in water level in a stream, retention, channel or flow path caused by a construction or impediment downstream

AHD: Australian Height Datum. The datum, to which levels are referred, based upon an approximation of mean sea level

AR&R: Australian Rainfall and Runoff is an Australian design guide which is published by Institution of Engineers, Australia providing engineers with the best available information on design flood estimation

ARI: Average Recurrence Interval. The long term average number of years between floods which will equal or exceed the selected storm event

Backwater: That part of stream, retention, channel or flow path where the water is kept back due to some controlling influence or obstruction down stream

CC: Construction Certificate

DCP: Discharge Control Pit

Drainage Easement: The legal rights attached to private land whereby another parcel of land has the right to use part or all of the land for the purpose of drainage

Drainage Reserve: Land vested in Council for drainage purposes

Hydrology: The study of water or flow behaviours as it relates to rainfall and the runoff process, in particular catchment behaviours, flow rates and volumes

Impervious: The area does not allow water to penetrate or absorb

Inter-allotment Drainage: A common stormwater drainage system that serve one or more properties mainly through their properties and connect to Council system

Invert: The lowest point of a channel or gutter or flow path, or internal base of a pipe

OLFP: Overland Flow Path

OSD: On Site Detention system; holding stormwater and store temporarily to control and reduce downstream flow rates. OSDs are designed to retard stormwater runoff during intense rainfall and to empty once the peak of the storm passed

Orifice: A narrow opening into a pipe or cavity designed to allow PSD

PCA: Principal Certifying Council

Peak Discharge: The maximum discharge that occurs during a particular storm event

Pervious: Area allows water to penetrate or absorb

PMF: Probable Maximum Flood

Pollutant: A substance that adversely affects the physical, chemical or biological properties of the environment

PSD: Permissible Site Discharge, the controlled flow rate of runoff allowed from a particular site

Runoff: Rainfall that ends up as stream flow

SCP: Stormwater Concept Plan

Sediment: Solid material, either mineral or organic, that is in suspension, is being transported or has been

moved from its site of origin by air, wind, water or gravity

Site area: The land contained within the title boundaries of the site excluding an access corridor

Stormwater: Untreated rain water that runs off the land onto which it falls

Stormwater System: The system of pits, pipes, overland flow path, creeks, and canals used to make a system to carry stormwater to the receiving waters

WSUD: Water Sensitive Urban Design

2. Introduction

On-site detention (OSD) is a temporary water storage system created either as a depression in a paved/landscaped area, an underground tank or a combination of both. This system detains a volume of water for a short duration during intense storms whilst slowly releasing this water through a restricted stormwater outlet. OSD forms part of an overall site drainage system including gutters, pipes, pits, grates, kerbs, walls, graded surfaces and overland flow paths which assist in directing stormwater runoff to the OSD system.

On Site Detention (OSD) is required where an increase in stormwater runoff, from a new development site, has an adverse effect to the receiving stormwater system. Provision of OSD is intended to reduce the potential for local flooding and damage to existing properties by slowing runoff from new developments, to pre-developed discharge rates. Notwithstanding the following criteria, Council may consider the need for OSD on a case by case basis where justified by sound engineering principles.

3. Objectives

The objectives of OSD systems are as follows:

- The capacity of existing drainage infrastructure shall not be exceeded as a result of developments which increase the volume and rate of stormwater runoff beyond the capacities it was originally designed for.
- The likely cumulative impact of similar developments shall not adversely impact on the capacity of the existing drainage system.
- To minimise drainage infrastructure costs of development due to increased runoff and peak flows.
- That OSD systems are able to be effectively maintained by landowners and provide a cost effective method of stormwater detention.
- Provide a method for developers to determine Council's requirements for OSD in relation to volume of detention and permissible rate of discharge to Council's drainage system.
- Urban salinity exists throughout the Wagga Wagga region. When designing OSD the designer needs to avoid large unlined OSD storage in sensitive recharge areas.

4. Developments that require OSD

The following developments will require OSD when any of the following occur:

- Where there is an existing stormwater system that does not have the capacity to accept additional discharge resulting from the development
- Where the development will result in an increase in impervious area
- Where it is intended to discharge stormwater directly to the kerb and the discharge for the 1:10 year storm event exceeds 20 litres per second.

Exemption to OSD

OSD will not be required for:

- single dwellings, family housing, outbuildings
- residential unit development/redevelopment which does not increase the site impervious area to greater than 60% which can be directly connected to the piped stormwater system.
- a proposed subdivision that does not involve the creation of a road reserve or alter existing building footprints or alter the impervious area. Council may require OSD as part of the future development on the new lots at the building construction stage.
- if proven to Council's satisfaction that the lack of OSD will not have an adverse effect on downstream drainage systems. A full local catchment analysis may be required. Developers are advised to contact Council to find out specific OSD requirements for each catchment.

5. Location of OSD

OSD shall be located away from any natural watercourses and OLFPs from catchments external to the site, and are not to be inundated by a natural watercourse or external OLFP's in any events up to and including the 100 year ARI event. Developers and designers shall use principles of good aesthetics and landscaping and consider long term viability and maintenance when locating the OSD system.

For multi-unit/dwelling developments the OSD system is to be wholly contained within common areas, i.e. common car park/driveway areas and common landscape areas. Storage in private courtyards shall not be permitted.

6. Emergency Overflow Spillway

An emergency overflow spillway, free of obstructions

such as buildings, must be provided in a location not having an impact on adjoining properties. Where runoff from such a spillway would flow over private property external to the site, a piped overflow system shall be provided within a suitable drainage easement where possible.

7. Freeboard to Finished Floor Levels

Finished floor levels of existing and new buildings are to be set so they are a minimum of 0.3m above the OSD storage's maximum design water surface level, and the OLFP flood level. This requirement does not apply to above ground storage tanks.

8. Ponding Depths

In the interests of safety and amenity, ponding water in OSD must not exceed depths as follows:

- Pedestrian Ways – 0.05m
- Parking/Paved Areas – 0.2m
- Landscaping – 0.3m
- Fenced Storage – 1.5m
- Underground with lockable access – no limit

9. Runoff from adjacent properties

Surface runoff from outside the development site shall not be allowed to enter the OSD system. In the event that it is impossible to design the system to exclude runoff from outside the site, then the design must provide sufficient storage to detain the runoff from the upstream catchment.

10. Connection to Council's Stormwater System

OSDs shall be connected to Council's drainage system by gravity means. Commercial and unit developments comprising of three or more dwellings shall connect

directly to Council's piped stormwater system. Mechanical means (i.e. pumping) for disposal of stormwater runoff will not be permitted. The exception being basement car parks.

The acquisition of drainage easements over downstream properties will be required where direct access is not possible to Council's drainage system (i.e. street kerb and gutter, piped system or open channels and watercourses). All costs associated with the value of land and easement creation are to be borne by the developer.

Inability to provide a gravity stormwater drainage system and easement to drain water in favour of the development site may prevent the granting of Development Consent. Written consent for the piping and acquisition of an easement is to be obtained from adjoining owners and provided to Council at the time of lodging the Development Application. Creation of easement(s) shall be completed prior to the issue of the Construction Certificate.

An exception to acquiring an easement may be given at the discretion of Council, for sites that do not drain to the street, only where extensions to an existing residential building or replacement of an existing house or dual occupancy is proposed, and genuine attempts at acquiring a downstream easement have failed. Written documentation of these attempts, including reasonable financial consideration, must be included for any application for exemption. If an exception is granted an alternative drainage system may be considered by Council.

Where an outlet pipe exceeds 100mm diameter (or insufficient cover exists over the pipe) and flow is to be discharged to the kerb and gutter of a Council roadway, then a minimum 450mm x 450mm grated converter pit is to be constructed inside the front boundary of the property.

Where an outlet discharges directly to the kerb, the flow shall not exceed 20 litres per second for the 1 in 10-year ARI and total post development flows off site do not exceed pre development flows.

11. Approved types of OSD

There are various systems that have been approved for use as follows:

- The use of above ground water storage tanks
- The use of above ground storage areas such as driveways or landscaped areas
- Excavated earthen storages with gravity outfalls in low density residential Developments
- Underground tanks discharging via gravity through an orifice plate

12. Stormwater Drainage Concept Plan (SDCP)

For developments that require construction of stormwater drainage, a SDCP shall be submitted with the Development Application demonstrating the feasibility of the proposed drainage system within the site and connection to Council's system. Early consultation between engineers and architects is required to reduce possible conflicts in the final plan.

This plan shall show:

- overland flow paths (including 100-year Average Recurrence Interval overland flow paths).
- any easements required. A letter of intention to grant an easement, where inter-allotment easements are proposed, is required by downstream properties
- location, extent, size and type of on-site detention storage and method used to estimate storage required. Cross-sections through each basin with approximate levels.

- site constraints (e.g. location of services, heritage orders, aesthetics and trees)
- location of discharge points (show levels at these points) and method of connection
- the location and layout of drainage pits, pipes, swales and retaining walls (if applicable) and concept design levels in AHD
- overflow weir location (if applicable)
- site layout and finished floor levels
- existing contours at 0.1m intervals extending to site boundaries
- the plan is to be to Australian Height Datum (AHD)

NOTE: Detailed designs and calculations, together with engineering plans, will be required to be submitted with the Construction Certificate, supporting the concept upon which the Development Consent was granted.

13. OSD Design Requirements

The OSD storage is to be designed to the storage/discharge relationship appropriate to the development type.

Computations must be performed for the existing site conditions for a low recurrence interval (5 and 10-year ARI), a medium recurrence interval (20 or 50-year ARI), and the upper value, which will be the 100-year ARI storm. Times of concentration for the site are to be calculated and not assumed.

The rate of stormwater runoff (both piped and overland) from the post-developed site shall not exceed the rate of runoff from the pre-developed site for the above storm events.

The determination of the volume of the site storage requirement (SSR) is to be undertaken by trial and error, using the above runoff constraints.

At Development Application stage computations based

on the approximate triangular method or rational method will be accepted. At Construction Certificate Stage a full hydrographical calculation method such as the ILSAX method shall be used. This can be carried out in computer models such as DRAINS.

All designs submitted to Council must include detailed print outs of all input, together with a copy of electronic data files with submission of the completed design.

14. Discharge Control Devices and Storage Pits

A high level outlet is to be provided at the discharge control pit to cater for surcharge during major storm events. Access to the discharge control pit is to be provided for inspections and maintenance of the silt trap and mesh screen. Such opening is to have a minimum size of 600mm x 600mm to be fitted with a removable galvanised steel grate and to be placed above the outlet and silt trap. Additional access may be required for larger underground storage. Underground storage shall not be allowed without approval by council and evidence that above ground storage cannot be provided anywhere else on site. Essentially, the system is to be designed to maximise ease of maintenance and ensure safety for the proprietor. To avoid unpleasant odours and health risks, maintenance of the OSD structure must be carried out on a regular basis by the owner.

The minimum pit sizes are to be:

- 600mm x 600mm for pits up to 800mm in depth
- 600mm x 900mm for pits greater than 800mm in depth.

Step irons are required for pits greater than 1200mm in depth.

A stainless steel or galvanised mesh screen (Maxi-mesh RH3030 or equivalent) fitted with a lifting handle, shall be provided between the orifice and the inlet. The screen is

to be a minimum distance from the orifice equal to 1.5 times the diameter of the orifice or 200mm, whichever is the greater. The screen should be positioned so that the inflows are directed perpendicular to the screen.

The orifice plate is to be a minimum 200mm x 200mm flat stainless steel plate, 3mm thick. The orifice is to be tooled to the exact dimensions as calculated, uniform circular shape with sharp (not rounded) edges. The plate is to be affixed onto the wall and epoxied and securely fixed over the outlet pipe by at least four dyna-bolts or similar, one at each corner.

For safety, all maintenance access to storage must conform to the current Confined Spaces Regulations.

Venting shall be provided where there is potential for gas build up. A hydrostatic valve is to be provided where necessary.

Step irons are to be installed where the depth of the underground tank is 1200mm or greater.

Generally an orifice diameter which is smaller than 25mm will not be approved.

15. Surface Storage Systems

It is intended to allow the designer flexibility when designing above ground surface storage systems. The minimum requirements are detailed below. If OSD systems are going to be effective in retarding stormwater flows it is important that Council can inspect these systems to ensure that the landowner is properly maintaining their system in accordance with Council requirements.

All drainage structures and storage areas are to be designed to be visually unobtrusive and sympathetic with the environment. This requirement is necessary to help ensure that future occupants do not adjust or remove facilities for aesthetic reasons without

understanding the functional impact of such actions.

16. Landscape storage

- Maximum ponding depth shall not exceed 300mm. Any depths greater will require pool safe fencing surrounding proposed ponded area and council engineers approval.
- Storage volumes in landscaping areas shall include an allowance for 20 per cent additional storage for vegetation growth and construction inaccuracies.
- The desirable minimum surface slope is 1.5%, with the absolute minimum being 1.0%.
- Maximum batter slopes shall be 1 vertical to 4 horizontal.
- Subsoil drainage around the outlet shall be provided to prevent the ground becoming saturated during prolonged wet weather
- Where the storage is located in an area where frequent ponding could create maintenance problems or personal inconvenience to property owners, the first 10-20% of the storage should be provided in an area able to tolerate frequent inundation. For example, a paved outdoor entertainment area or a rock garden can be used.
- The structural adequacy of any retaining walls, including the hydrostatic loads caused by a full storage should be checked and certified by a suitably qualified engineer. Walls used in storage should be watertight and continuous.

17. Driveway and car park storage

To avoid damage to vehicles, depths of ponding on driveways and car parks shall not be greater than 200mm.

Transverse paving slopes within storage areas should not be less than 0.5%.

Where the storage is to be provided in a commonly used area where ponding will cause inconvenience (e.g. a car park), the area should only flood about once every year on average. This will require approximately the first 15% of the storage to be provided in a non-sensitive area.

18. Surface Flow Paths

Overland flow paths, including the provision of an emergency overflow to cater for blockage of the system or flows in excess of the 100-year ARI storm flow must be provided. The flow route must be capable of carrying the flows generated by a 100-year ARI storm with a freeboard of 300mm to the adjacent habitable floor levels of the development site and adjoining properties.

Development activities must not cause any adverse impact on adjoining or any other properties. This includes maintaining surface flow paths and not increasing water levels in these flow paths. Diverting flows from one catchment to another will generally not be supported.

19. Legal Requirements

The OSD systems are long term structures intended to control discharges from the site over the entire life of the development. A well-designed and properly constructed system can still be rendered ineffective by alterations, such as filling of the detention basin and planting of garden beds across flow paths, or by poor maintenance. Therefore, it is necessary that these systems are protected and regularly maintained. This is achieved by an instrument setting out terms of restriction on use and positive covenant created pursuant to Section 88 of the Conveyancing Act, 1919. The location of the 'Stormwater Detention System' shall be shown on the deposited plan or included as a site plan attached to the Section 88B Instrument.

Prior to the issue of the Occupation Certificate or

occupation of the site, the creation of a Restriction on Use of Land and Positive Covenant over the On-Site Detention system(s) is to be registered with the Land Titles Office. Wagga Wagga City Council shall be nominated as the body empowered to release or vary the Restrictions and Covenants.

part 4
design of water reticulation

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1. introduction

This part of Council's Engineering Guidelines is related to water reticulation.

In the Wagga Wagga local government area, the responsible authority for water supply is the Riverina Water County Council (RWCC). Developers need to liaise with RWCC in regard to design and financial contributions, including a separate Section 64 charge for water reticulation. Developers also need to obtain a Certificate of Compliance - Water Supply for the water reticulation system from RWCC, prior to release of the Approved Plan of Subdivision by Wagga Wagga City Council.

The Engineering Guidelines comprise:

Part 1 General Requirements

Part 2 Guidelines for Design of Roads

Part 3 Guidelines for Design of Drainage

Part 4 Guidelines for Design of Water Reticulation

Part 5 Guidelines for Design of Sewer Reticulation

Part 6 Guidelines for Landscaping and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Guidelines for Testing

Part 8 Standard Drawings

2. general

Riverina Water County Council (RWCC) is the agency responsible for supply of potable water in the City of Wagga Wagga Local Government area. The following information has been provided by RWCC.

RWCC has an information pack available (RWCC Water Supply Information Pack for Developers) that will assist developers to ensure proper provision is made for water supply in their planning, design and construction phases of development. This is available from the RWCC website, www.rwcc.com.au on the Plumbing, Building and Development tab.

RWCC is responsible for the design and construction of water supply infrastructure associated with the development.

The developer is responsible for certain fees and charges (payable to RWCC) associated with provision of water supply to the development. These costs include, but may not be limited to:

- developer servicing charges

- water supply pipelines

- water service connections.

The RWCC Water Supply Information Pack for Developers will provide more detailed information regarding these developer fees and charges.

Early engagement between developers and RWCC is essential for a streamlined and efficient process of supplying water to the proposed development. Developers are also encouraged to include The City of

Wagga Wagga and other utility providers in this early engagement so that a co-ordinated approach is taken towards location of the various facilities, services and utilities within the development.

Early engagement will also familiarise the developer with the formal RWCC application process for servicing their proposed development with water.

Developers should discuss their proposed development with RWCC at concept stage. This will allow identification of any major water supply issues that may require changes to the concept plan.

The City of Wagga Wagga requires a 'Certificate of Compliance - Water Supply' from RWCC before they will issue a Certificate of Practical Completion for the development and release the Approved Plan of Subdivision. RWCC will not issue this certificate until:

- all associated developer payments to RWCC have been made

- all water supply reticulation for the development has been constructed

- any other RWCC requirements associated with the development have been satisfied by the developer.

part 5
guidelines for design for sewer
reticulation

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1. introduction

Introduction

This part of the Engineering Guidelines is related to sewer reticulation. References to the Sewerage Authority are references to Council.

The design and construction of sewerage reticulation shall be in accordance with the latest version of the Water Services Association of Australia (WSAA) Sewerage Code of Australia (WSA02-Part 1). However, this part of the Engineering Guidelines takes precedence over the WSAA Standards in the event of any inconsistency.

The Engineering Guidelines comprise:

Part 1 General Requirements

Part 2 Guidelines for Design of Roads

Part 3 Guidelines for Design of Drainage

Part 4 Guidelines for Design of Water Reticulation

Part 5 Guidelines for Design of Sewer Reticulation

Part 6 Guidelines for Landscaping and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Guidelines for Testing

Part 8 Standard Drawings

This part of the Engineering Guidelines is set out in the same order as WSA02-Part 1 for ease of cross-referencing.

2. general

2.1 Scope

Refer to WSA02-1.1.

The planning and design of the sewerage system must utilise Sewerage Code of Australia (WSA02-Part 1) produced by the Water Services Association of Australia (WSAA). It sets out the requirements for planning and design of gravity sewerage.

Identification of the need for pumping stations is an element of system planning. Council has an objective of minimising the number of pump stations to reduce ongoing maintenance costs and liabilities. Pump stations and rising mains shall be designed and built in accordance with Council standards. These standards encourage a consistent approach to telemetry, electrical, pumps and maintenance issues throughout the system. The design of sewage pumping stations is addressed in WSAA Sewage Pumping Station Code of Australia WSA 04-2005.

References to either 'Council' or the 'Sewerage Authority' where mentioned in WSAA documentation shall mean 'Wagga Wagga City Council'.

In regard to developer contributions and sewer infrastructure development, consultants should refer to Council's Development Servicing Plan No 1: Sewerage Services.

Refer to WSA02-2.

3. system planning

3.1 Estimating future catchment loads

Refer WSA02-2.4.2.

4. flow estimation

Refer WSA02-3.

4.1 Design flow estimation method

Refer WSA02-3.3.

4.2 Traditional design flow estimation method

Refer WSA02-3.3.2

5. detail design

Refer WSA02-5.

5.1 Detail design considerations

Refer WSA02-5.2.

5.1.1 Catchment design

Refer WSA02-5.2.1.

Where future development has the potential to occur beyond the subdivision, the sewer reticulation is to be consistent with a catchment master plan. In the absence of a master plan prepared by Council a master plan must be prepared by the developer to an extent necessary to determine sewerage component sizing and location within the subdivision so that orderly development can occur. Council's Development Servicing Plan No 1 – Sewerage Services will assist in preparing proposed layouts.

Sewerage reticulation shall be extended through the subdivision boundaries by the developer to service future upstream catchments. Sewer extension to service the upstream catchment shall be designed in consultation with the Council. Easements shall be created as part of an approved estate master plan to enable sewer construction that is not dependent and restricted by subdivision staging and lot release. Construction may be either directed by the Council or alternatively constructed by the Council or its representatives.

5.1.2 Design accuracy

Refer WSA02-5.2.2.

Location in plans shall be referenced to MGA coordinates.

5.1.3 Easements

Refer WSA02-5.2.8.

Sewers located in property not owned by Council are to have an easement created in favour of Council. The developer is responsible for obtaining this easement and the release of the Deposited Plan of Subdivision is subject to the creation of this easement.

The developer is to transfer to Council sewer easements provided in the subdivision and execute a transfer and grant of easement in favour of Council pursuant to Section 88b of the Conveyancing Act 1919, as amended.

Notwithstanding the requirements of WSA02 Section 5.2.8 Easements, the minimum width of sewer easement shall be 2.0 metres for sewers only, or 2.5 metres if for sewer and drainage. For sewer only, the pipe centerline shall be 1.25 metres off the property boundary. For sewer and drainage, the sewer centreline shall be 0.7 metres off the edge of the easement and likewise the drainage, leaving a distance between service centerlines of 1.10 metres. This will accommodate both sewer maintenance holes and stormwater pits.

Development that requires the submission of a development application to the Council for approval will require the provision of an easement over existing sewer infrastructure, if none already exists.

Backfill of all trenches on private property shall be in accordance with WSA02 requirements in order to minimise potential problems associated with subsidence.

Where Community Title occurs, Council's sewer responsibility ends at the property connection point (typically where the property vertical is located and visible on site or at a maintenance hole inside the boundary line of the property). There will be one connection to service the combined community lots. Council may require an easement to be created over part or all of the infrastructure.

Backfill of trenches on private property shall be in accordance with AS3798 Guidelines on earthworks for commercial and residential developments to minimise problems associated with subsidence.

5.2 Horizontal alignment of sewers

Refer WSA02-5.3.

Sewer centerlines in road reserves shall be 1.25 metres off the property boundary. On curved roads, mains shall be laid straight between maintenance holes with the distance between maintenance holes reduced to keep the pipeline within the sewer footpath allocation. Road

crossings are to be perpendicular to the road centreline unless otherwise approved.

5.2.1 Changes in Direction Using a Maintenance hole

Refer WSA02-5.3.6.

An internal maintenance hole drop between inlet pipe and outlet pipe is required as follows:

Deflection Angle	Drop (mm)
0° to 45°	30
46° to 90°	50
91° to 120°	100

Deflections between 91° to 120° are by approval only. Deflections greater than 120° through maintenance holes are not permitted.

5.2.2 Horizontal Curves in Sewers

Refer WSA02-5.3.8.

5.3 Obstructions and clearances

Refer WSA02-5.4.

Sewer mains located within lots adjacent to stormwater drainage lines should be a minimum of 0.75 metres clear of the stormwater pipe.

Where sewer lines cross drainage or other services, a minimum of 100 mm clearance should be achieved.

Council prefers that buildings are not located over sewer mains. Where this is unavoidable, subject to approval of Council, buildings may be constructed over sewer

reticulation mains provided they are constructed so that no load from the structure is transmitted to the sewer main. The portion of the main under the building (and for a distance outside of the building of 2.0 metres minimum) is laid in unlined cast iron or ductile iron pipe equivalent to Class PN 35. This concession is made primarily for buildings in established areas and will not be extended to new subdivisions unless special circumstances prevail. Council approval is required for encumbrance of mains/easements and a charge will be made.

5.4 Pipe sizing and grading

Refer WSA02-5.5.

5.4.1 General

Refer WSA02-5.5.1.

Sewers shall be designed for Peak Wet Weather Flow. The maximum and minimum allowable loadings for various pipe diameters are as shown in Appendix A of these standards.

5.4.2 Minimum pipe sizes for maintenance purposes

Refer WSA02-5.5.4.

The minimum sewer main diameter is 150mm.

5.4.3 Minimum grades for sewers

Refer WSA02-5.5.7.

At the ends of lines the minimum grade is 1 in 80.

5.4.4 Minimum grades for self cleansing

Refer WSA02-5.5.7.

5.4.5 Minimum cover over sewers

Refer WSA02-5.6.3.

5.4.6 Minimum depth of sewer connection point

Refer WSA02-5.6.5.

The depth of the junction is to be such that any location within the lot can be drained to it via a pipe with a minimum 300mm of cover laid at a grade of 1 in 60. The pipe is to be located parallel to boundaries and account for raft slab construction.

5.4.7 Depth of connection point

Refer WSA02-5.6.5.4.

The maximum depth to the invert is 2.0 metres.

Sewers that provide for future connection to other areas must be terminated by extending them above ground at time of constructing the subdivision.

6. property connection

Refer WSA02-6).

6.1 Limitation of connection to sewers

Refer WSA02-6.2.

Written approval is required from Council for connection to the existing sewerage system. All work is to be carried out by Council-approved contractors at the developer's expense, in accordance with drawing EDS 05.05. Seven days prior notice is required. All materials are to be supplied by the developer.

All work conducted on live sewers is to be in accordance with the relevant Work, Health and Safety Regulations and Confined Spaces Regulations.

6.2 Methods of property connection

Refer WSA02-5.3.

WSA 5.3.3 buried interface method (type A) is approved. However, WSA 5.3.2 IO interface method is not approved for use in Wagga Wagga.

6.3 Location of property connection points

Refer WSA02-6.5.

Where an unsewered dwelling is located on land that is being developed, the developer shall connect the dwelling to the sewerage reticulation at his cost as part of the subdivision work. The developer shall be responsible for the removal of any septic tanks and backfilling of the excavation to the satisfaction of Council. All new sewer mains and maintenance holes must be tested prior to the dwelling being connected.

7. maintenance structures

Refer WSA02-7.

7.1 Spacing of maintenance structures

Refer WSA02-7.3.

Maximum spacing of maintenance holes is 80 metres.

7.2 Maintenance holes

Refer WSA02-7.6.

All maintenance structures shall be maintenance holes unless otherwise approved by the Council.

Maintenance holes are required at all dead ends exceeding 30 metres in length. Sewer mains (referred to as junction and lead) that exceed 10 metres in length are sidelines that require a maintenance hole with a 150 mm connection where they enter the main at the downstream end. Maintenance holes are not to be located in road carriageways without specific approval of Council.

Where the development is utilising existing sewer mains or junctions, the mains, maintenance holes or junctions must be upgraded to meet the current guideline requirements.

8. structural design

Refer WSA02-9.

8.1 Products and materials

Refer WSA02-9.2.

Reticulation pipes and fittings must be in accordance with the manufacturers and relevant standards. The following materials are approved for use:

- gravity sewer reticulation pipelines
 - uPVC non pressure pipe and fittings (AS1260) minimum class SN8
 - polyethylene and polypropylene profile walled non pressure pipe and fittings (AS5065) minimum class SN10
 - ductile iron, minimum class PN35 (lining type to be confirmed with Council).

Other materials may be considered however these will require approval on a case-by-case basis.

part 6
guidelines for landscaping and
measures for erosion, sedimentation
and pollution control

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1. introduction

This section of the Engineering Guidelines outlines Council's recommended practice for the Landscaping and Measures for Erosion, Sedimentation and Pollution Control. It is not a 'Design Manual' and it is to be read in conjunction with and as a supplement to referenced standards and Development Conditions of Consent.

The Engineering Guidelines comprise:

Part 1 General Requirements

Part 2 Guidelines for Design of Roads

Part 3 Guidelines for Design of Drainage

Part 4 Guidelines for Design of Water Reticulation

Part 5 Guidelines for Design of Sewer Reticulation

Part 6 Guidelines for Landscaping and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Guidelines for Testing

Part 8 Standard Drawings

2. general

The object of this Part is to:

- promote an integrated approach to urban landscaping and the provision of engineering infrastructure
- protect the environment against soil erosion and soil loss from development sites
- improve water quality
- prevent the degradation of drainage systems, waterways, creeks and rivers, from the deposition of soil and foreign material from development sites
- To minimise disturbances and provide necessary control measures to prevent loss of soil

This document has evolved and reference has been made to previous development standards that include 'Soil and Water Management Guidelines for Subdivisions' Albury, Hume, Wodonga and Wagga Wagga Engineering Guidelines.

3. landscaping

3.1 Landscaping plan

The developer may be required to provide landscaping as required by conditions of development consent approvals.

The design of landscaping shall be carried out by appropriately qualified persons. Vegetation and hard landscaping shall be selected so as to:

- avoid root intrusion to road pavements, drainage, sewer and other services
- avoid uplifting of paving or creating hazards to pedestrians
- avoid access restriction to buried services particularly at fittings, connections and inspection points
- not create unsound or hazardous structures
- not restrict sight views for pedestrians and motorists

4. guidelines for soil and water management planning

4.1 Soil and water management responsibility

Developers are responsible for the following:

- preparation and implementation of a Soil and Water Management Plan
- erosion and sediment control structures
- restoring vegetation cover
- site management to prevent off-site environmental impacts
- staging of works to minimise impacts
- controlling contractors and service providers who undertake work

4.2 Soil and water management planning

A Soil and Water Management Plan (SWMP) is required for all subdivision works where development consent and approval of engineering plans are required. The SWMP must address stormwater management practices that will contain sediment and other material onsite by outlining the following:

- the location of onsite control measures
- installation sequence and staging of works
- maintenance requirements

Council may require soil and water management measures to be carried out in addition to, or instead

of works specified in any approved plan, where circumstances change during construction and those circumstances could not have been foreseen.

4.3 Erosion and sediment control structures

Any structures installed must be in accordance with Managing Urban Stormwater: Soils and Construction, March 2004.

4.4 Restoring vegetation cover

The SWMP should include maps of impacted vegetation cover and specifications of proposed measures for its restoration. Suitable methods for site stabilisation using vegetative cover can be found in Managing Urban Stormwater: Soils and Construction, March 2004.

5. guidelines for clearing and establishment of vegetation

5.1 Clearing of vegetation

Removal of trees is subject to Council's Development Control Plan (2010), Section 5.2 Preservation of Trees. There are different requirements for different zonings. Selected information is detailed below, but developers must abide by the requirements of the whole document.

The removal of trees, shrubs and ground cover shall be minimised to protect the ground surface from erosion.

Trees greater than 200mm in diameter or equal to or exceeding 5 metres in height are covered by the tree preservation order and their removal shall be undertaken only with Council consent under the Tree Preservation Order. Removal of dead trees over 500mm in diameter shall also be subject to Council consent. Any trees to be removed should be clearly identified on a plan.

A plan should accompany each Development Application showing clearly the genus location and health of all existing trees that are over 200mm in diameter or equal or exceed 5 metres in height, either on-site or on adjoining lands and within two metres of boundaries of the subject site. In addition to Council requirements, approval may be required under the Native Vegetation Conservation Act

Minimal clearing of vegetation, including trees less than 5 metres in height, may be undertaken without consent or in accordance with approved plans for the following purposes:

- survey or geotechnical investigations where clearing

is limited to obtaining site lines or essential vehicle access

- reduction of the fire hazard in accordance with a notice under
 - Section 13 of the Bush Fires Act
 - a plan under Section 41 of the Act
 - according to the needs of a fire radiation zone at the direction of council, providing the material is removed in a way that does not disturb the ground surface
- in compliance with a notice for the destruction of noxious weeds or vegetation harbouring vermin
- activities not requiring development consent, providing the material is removed in a way that does not disturb the ground surface and/or the land is not within 20 metres of an urban stream (clause 7) and/or the gradient is not steeper than 1(V):4(H) or not covered by the Native Vegetation Conservation Act.

For subdivisional work clearing must be limited to 2 metres from the edge of any essential construction activity as shown on the approved engineering plans.

All reasonable care must be taken to protect other vegetation from damage during construction. This will include the following:

- clearly marking trees to remain
- avoiding compaction of ground within the dripline of trees to remain
- clearly delineating the area of disturbance and

keeping all vehicles, building materials and refuse within that area

- limiting the number of access points to the site
- clearly restrict access to no go areas and provide exclusion fencing prior to the commencement of works on site.

5.2 Establishment of vegetation

Developers must note and comply with the following requirements for establishment of vegetation:

- revegetation of disturbed areas must be promoted
- native vegetation must be conserved
- equal consideration should be given to the use of native grasses, legumes, shrubs and trees
- seasonal conditions must be taken into account to match the time of year to seedling germination and survival
- any damaged vegetation must be replace or re-established
- the use of perennial vegetation is preferred
- 90% of the disturbed areas must be revegetated within eight months of the initial revegetation planting
- revegetation must comply with an approved master plan.

6. earthworks and erosion control

6.1 Planning for site works

Approvals including sediment control measures are to be in place prior to removal of vegetation or site disturbance.

Where practicable, the construction program should be scheduled to minimise the potential for soil loss so that the time from the beginning of land disturbance activities to rehabilitation is of a duration of less than six months.

On lands with a high erosion hazard:

- attempt to confine land disturbance to those times of the year when the rainfall is low
- show special measures on the Plan to address the high erosion hazard.

Site excavation must be designed and located with the aim of minimising cut and fill requirements.

Runoff and erosion controls must be installed before clearing, these controls must include:

- diversion of upslope runoff around cleared and/or disturbed areas to be cleared/disturbed, providing that
 - such diverted water will not cause erosion
 - the upslope catchment area is more than 2000 square metres
 - waters are diverted to a legal discharge point
 - sediment control fences or other measures are placed at the downslope perimeter of cleared/disturbed areas, and at regular intervals on sloping

sites to prevent sediment leaving site

- erosion and sediment control measures are maintained at, or above their design capacity, until the land is effectively rehabilitated.
- On sites where more than 1000 square metres are to be disturbed, runoff and erosion controls must also include:
 - barrier fencing of undisturbed areas
 - control measures (grass strips, sediment fences etc.) which restrict slope length to 80 metres, minimising runoff water velocity

Where possible, topsoil must be stripped only from those areas designated on the approved Plan, and must be stockpiled for later use in rehabilitation and landscaping.

Stockpiles (topsoil, spoil, subsoil, sand or otherwise) must be:

- located at least 2 metres from any flow paths, driveways, footpaths, nature strips, kerblines, gutters, swales, steep slopes or standing vegetation
- protected from upslope stormwater surface flows
- provided with sediment filters downslope.

All erosion and sediment control measures (e.g. sediment fences, grass strips, traps, sediment basins) must be systematically checked on site, including the storage capacity of pollution control structures.

All measures must be maintained in an effective operational condition, affecting repairs where necessary.

Erosion control measures must be inspected after major storm events.

6.2 Planning access and roads

Vehicular access must be controlled to prevent tracking of sediment onto adjoining roadways, particularly during wet weather or when the site is muddy.

Vehicular access must be to approved areas and, where practicable, access must be stabilised and confined to one location.

Runoff from access surfaces must be drained into an adjacent sediment-trapping device before leaving the site. Council may require devices to remove soil materials from vehicles if dirt and sediment is being deposited on adjacent roads. These devices must be placed prior to site exit locations.

On subdivisions, footpaths, roads and batters are significant erosion hazards and must be stabilised as quickly as practicable. Where circumstances preclude the construction of kerbs and guttering, the following erosion control measures are to be employed:

- on longitudinal grades that permit natural grass establishment (<3%), the batters and associated table drains must be topsoiled and hydro mulched or turfed, having dimensions that simplify maintenance mowing
- on rural road longitudinal grades that don't permit

natural grass establishment (>3%), the shoulders and associated table drains must be stabilised with appropriate erosion control measures (e.g. jute mesh and bitumen, cross drains, erosion, hydro mulching matting), and revegetated

- on longitudinal grades greater than 7% alternative techniques such as trickle flow pipes, rock or concrete lining of table drains shall be utilised
- where table drains are utilised as open drains to convey significant flows, they should be addressed separately with road reserve widening and appropriate drop structures where required, and pipe or box culverts utilised for property access

On subdivisional work, when practicable, newly sealed hardstand areas should be swept thoroughly five days after sealing/surfacing to prevent excess aggregate or gravel-entering street drains. Stormwater drain inlets are to be temporarily covered prior to sealing and are to remain in place until swept to remove all surplus aggregate.

7. urban stream management

Urban Streams should be managed in a way that is consistent with State Government Policy.

SWMPs should be consistent with the objectives of the Local, Regional and District plans.

8. additional guidelines for subdivision

Drainage and channel works should be carried out to prevent increased stormwater runoff from proposed subdivisions where that runoff is likely to accelerate erosion of any downstream watercourse(s).

Where practical to do so, a constructed wetland should be provided downstream from all other treatment facilities to intercept and treat all runoff from the site where more than 15,000 square metres will be disturbed.

Wetlands should not be regarded as a substitute for erosion and sediment control at source. In some circumstances, wetlands may be part of an integrated strategy or a complimentary measure designed to improve water quality

The developer should provide all supporting calculations for the operational volume of the ponds described above, together with a surveyors certificate attesting to the operating capacity of the structure when built.

All pollution control measures and facilities should be installed and stabilised before any earthworks other than those essential for their construction. This includes stormwater diversion facilities.

On lands where shaping has finished, soil stabilisation and initial revegetation should be carried out as per the site stabilisation methods outlined in Managing Urban Stormwater: Soils and Construction, March 2004.

The developer must nominate a representative or representatives to Council in writing before the commencement of construction activities. At least one of

these representatives should

- visit the site daily while work is being carried out, noting and legibly recording in a logbook:
 - any deficiencies in soil and water pollution control measures
 - the occurrence and approximate volume of all discharges from any sediment retention basin.
- ensure compliance with these guidelines and requirements as described in the soil and water management plan
- undertake additional practical measures and modify design to prevent or reduce pollution of waters
- inform Council of such additional measures as soon as practicable
- be appropriately qualified and experienced to effectively complete necessary duties.

9. operation and maintenance of pollution control equipment

The developer should certify compliance with any requirements of a Soil and Water Management Plan (SWMP) and any subsequent correspondence between the developer and Council. Such certification should occur within 14 days of the commencement of regular operation.

All facilities described in a SWMP or in these guidelines should be operated and maintained in an effective operational condition following good engineering and agronomy practice.

Structures designed to intercept sediment should be cleaned out as often as necessary to ensure continued effective operation. They should not be allowed to contain so much sediment that the design capacity is compromised.

The developer should inform Council in writing of any intended discharges from any sediment retention basins for maintenance purposes at least 24 hours before such discharge to receiving waters and provide test results demonstrating compliance with EPA targets.

The target concentration of non-filtrable residue discharging from the sediment pond shall be 50 milligrams per litre. At no time should the retention pond discharge from storms less than or equal to the design storm have non-filtrable residues greater than those existing in the receiving waters.

Wherever practicable, sediment retention basins should be maintained at a low water level in readiness for containing, for treatment and discharge, further rainfall

runoff.

Waters discharging from any sediment retention basin or other control measures should not cause erosion to spillways, channels or banks downstream.

Solid materials removed from sediment retention basins should be disposed of in a way that does not pollute waters.

Water from plant maintenance areas or other water polluted by petroleum products should be prevented from entering the stormwater system or contaminating soil.

Fuelling of vehicles and construction plants should be carried out with an operator or driver present and in a way that prevents spillage.

Where practical to do so, surface waters from uncontaminated lands should be diverted away from pollution control equipment in a way that will not result in their contamination.

Concrete wastes or washing from concrete mixers should not be deposited in any location where those wastes or washing can flow or be washed into any waters.

10. pollution control

The developer shall:

- introduce effective dust-control measures and maintain in accordance with the approved measures. All haul roads, access tracks and construction areas are to be regularly watered. Works will cease until such time as any particular dust nuisance has been controlled to the satisfaction of Council.
- install and stabilise all pollution control measures and facilities before commencing other site earthworks or measures including stormwater diversion facilities
- construct any required sediment basins upstream of any wet ponds or receiving waters, and preferably off-line
- design any required sediment retention basins to treat the design rainfall event as specified in Managing Urban Stormwater: Soils and Construction, March 2004
- operate and maintain all sediment control structures described on a SWMP or in this Code in an effective operational condition
- divert surface waters from any undisturbed lands away from pollution control equipment to prevent contamination of clean runoff, where practicable to do so
- provide appropriate measures to ensure that works do not cause flooding, erosion or scour. Such works include diversion and drainage structures, spillways, weirs, pipes and channels.

11. standard requirements for soil and water management

11.1 Soil and Water Management Plan Contents

Soil and Water Management Plan (SWMP) should identify and contain, but not be limited to the following:

- the site plus a 40m fringe, north point and scale
- existing contours of the site
- existing and proposed drainage patterns
- significant natural areas requiring special planning or management including water bodies, natural watercourses, floodplains, seasonally wet areas, unstable slopes, etc.
- approximate location of trees and other vegetation showing trees and vegetation for removal and retention, consistent with other plans attached to the application
- location of site access, proposed roads and other impervious areas
- access protection measures
- nature and extent of earthworks
- where applicable, diversion of runoff from upslope lands around the disturbed areas
- stormwater discharge points
- approximate location of all soil and other material stockpiles
- location and type of proposed erosion and sediment control measures
- site rehabilitation proposals

- proposed program for the works
- frequency and nature of any maintenance program.

The scale, type, operation and maintenance of all soil and water management devices in the soil and water management program must be specified. Maps and/or specifications of measures proposed to control soil erosion and pollution by sediment must be specified.

11.2 General Guidelines for SWMPs

SWMP will clearly list the constraints to development, including those relating to soil, landform and hydrology, including:

- soil erodability (K-factor)
- soil loss class
- soil hydrologic group
- soil texture group
- percent of whole subsoil likely to be dispersible.
- Runoff coefficient

All SWMPs will clearly identify measures to overcome site constraints, including options for:

- staging of works
- mitigation/control of on-site soil erosion
- movement of water onto, through and off the site
- mitigation/control of pollution to downslope lands and waterways

- rehabilitation/maintenance of the works area.

Any SWMP will include scaled drawings and detailed specifications that can be readily understood and applied on-site by supervisory staff.

11.3 Urban Stream Definition

Defining an urban stream is a difficult task due to the considerable modifications to channels and catchments in urban areas. For the purposes of these guidelines however, the definition can be fairly specific and relate to similar definitions under the principle river management legislation. These definitions are used by agencies such as the Department of Environment and Heritage to decide management approaches.

A river or stream is any perennial or intermittent stream of water with a catchment area of more than two square kilometres.

It does not matter whether it is flowing in a natural channel, or in a natural channel that has been artificially improved, or in any artificial channel that has changed the course of a stream of water. Nor does it matter where it flows to, including any affluent, conluent, branch or other stream.

These guidelines do not apply to:

- gullies, which are different to streams in that they are a drainage line lacking any overbank flow or floodplain

- drainage lines not mapped on 1:4000 scale or the photo maps as a broken or unbroken line.

Therefore, streams can be usually identified by:

- an obvious channel
- presence of a floodplain.

Where the principles refer to urban streams they are referring to the whole riparian system including the bed and banks, streamside vegetation, riparian land and stream flow.

part 7
guidelines for testing

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1. introduction

This section of the Engineering Guidelines outlines Council's recommended practice for testing roads, piped drainage lines, water reticulation and sewer reticulation. It is in no way a comprehensive 'Testing Manual' and it is intended to be read in conjunction with relevant Standards that includes:

- Australian Standards
- RMS/RTA NSW Standards
- Vic Roads Standards
- WSAA Standards for Water and Sewer
- State Government Authority Standards

The Engineering Guidelines comprise:

Part 1 General Requirements

Part 2 Guidelines for Design of Roads

Part 3 Guidelines for Design of Drainage

Part 4 Guidelines for Design of Water Reticulation

Part 5 Guidelines for Design of Sewer Reticulation

Part 6 Guidelines for Landscaping and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Guidelines for Testing

Part 8 Standard Drawings

2. roads

2.1 General

All pavements are to be designed by an experienced and accredited geotechnical consultant. The consultant shall verify that the design pavement will be fit for purpose (based on design life, projected traffic numbers and materials) and will supervise the construction of the pavement, organise the appropriate testing, and certify that it has been constructed in accordance with the design and specification.

Testing will involve appropriate checks on material at source, further testing to ensure that the delivered material is up to specification. During and after placement, quality, moisture content and thickness of subgrade, sub-base course and base course will be checked.

Each layer of subgrade and pavement material will be tested and approval obtained from Council prior to placing of subsequent pavement layers.

Written reports will be submitted to Council by the geotechnical consultant following pavement design and then again after pavement construction. A final report from the geotechnical consultant verifying design, quality of material, and construction of the pavement shall be provided to Council prior to the works being accepted into maintenance.

2.2 Subgrade

Test the Subgrade profile by template and make good irregularities by the addition or removal of material followed by further rolling.

Description	Requirement
Subgrade compaction requirement as obtained in the standard compaction test	98% of maximum dry density
Test every 500mm lift at	Maximum spacing of 100m
Minimum number of samples per road	2 samples
Compulsory subgrade inspection	In accordance with the quality control checklist

Table 2.2.1 Subgrade Testing Wagga Wagga

All fill material shall comply with the requirements of AS 3798 – Guidelines on Earthworks for Commercial and Residential Developments by the submission of test certificates prior to the commencement of work. Samples must represent a particular batch, lot or consignment and test certificates shall be no older than three months.

Every 500mm lift of subgrade shall be proof rolled. The subgrade shall be checked by proof rolling with a roller having an intensity loading of seven tonnes per metre width of roller. Any permanent deformation or movement of the subgrade under the roller shall be deemed a failure as well as excessive cracking and drying.

Upon completion of final boxing of the subgrade, the geotechnical consultant shall inspect the exposed subgrade to ensure that the samples taken accurately represent the subgrade condition and shall certify in writing to Council that this is so prior to the pavement of the first pavement layer.

As a minimum subgrade hold points will include proof rolling, compaction test results, confirmation of levels and Clegg Hammer testing.

2.3 Sub-base and Base

Sub-base and base course material must be initially tested for suitability. Further detail is listed in Section 2.12 - Pavement Design.

Each layer of pavement material is to be tested and approval obtained for each layer from Council or an accredited certifier prior to placing of subsequent pavement layers.

All sub-base and base course gravel must comply with RMS/RTA Specification RMS/RTA 3051- Unbound And Modified Base And Sub-Base Materials For Surfaced Road Pavements. Alternatively see Section 2.12 Pavement Design.

If not advised earlier, provision of written advice on source and quality of pavement material constitutes a hold point in the construction process.

As a minimum sub-base and base hold points will include proof rolling, compaction test results,

confirmation of levels and Clegg Hammer testing. For the wearing course, asphaltic concrete thickness details are to be submitted.

2.4 Density testing

All tests are to be undertaken and certified by an authorised representative of a laboratory registered by the National Association of Testing Authorities (NATA). The developer is to pay for all density testing with density test results supplied to Council or an accredited certifier for approval.

Clegg Hammer testing for testing pavement layers shall be a standard 4.5kg Clegg Hammer. Minimum readings to be achieved after 4 blows on the pavement layers to be subgrade: 25, sub-base: 30, base course: 35.

2.5 Pavement details

Sub-base and base course material must be initially tested for suitability unless advised otherwise by Council or an accredited certifier.

The minimum thickness of the base course is 150 mm.

No pavement material shall be placed without the prior approval of Council.

All sub-base and base course material must comply with RMS Specification, geotechnical testing investigations and approved by Council.

2.6 Asphaltic concrete

The supply and laying of asphaltic concrete must comply with RMS/RTA test method T612.

2.6.1 Stability of Mixes

The stability of the job mix shall be between 16 kiloNewtons (kN) and 36 kN, as determined by the modified 'Hubbard – Field Method' as per RMS/RTA Test Methods T601 and T603.

Mixes with stability of less than 8 kN below the limit or more than 12 kN above the upper limit shall be removed from the site. For mixes having stability outside the specified ranges, but within the above-mentioned limit for rejection, consideration will be given to acceptance of the mix subject to deduction in accordance with RMS/RTA test method T612.

2.7 Voids in compacted mixes

The design of job mixes shall be such that between 65% and 85% of the air voids in the total mineral aggregate will be filled by the binder when determined in accordance with RMS/RTA Test Methods T601, T605 and T606.

2.8 Sprayed bituminous surfacing

Spray seals shall be in one or two applications as specified on the drawings and shall conform with the RMS/RTA specification for the supply and spraying of bituminous material (MR Form 898) and with the VicRoads Standard Specification for Roadworks and Bridgeworks Section 408.

Aggregates shall conform to RMS/RTA NSW

specification for cover of aggregates RMS/RTA DCM materials specification DCM 3151 with proof of compliance submitted prior to the commencement of work. Samples tested must represent a particular batch, lot or consignment and test certificates shall be no older than three months.

2.9 Application Rates

The designed application rates of binder and aggregates and average least dimension of aggregates is to be submitted for approval 48 hours prior to the commencement of works.

2.10 Work Records

Details of bitumen and aggregate applied are to be recorded immediately after each run and if requested, submitted for approval prior to acceptance into maintenance.

2.11 Defective Work or Materials

Defective materials, including replacement of binder that has been overheated, deteriorated or contaminated prior to application to the road, must be removed. Where Council considers that work is not in accordance with the specification, whether caused by bad workmanship, defective materials or by materials made defective during construction, these materials shall be removed at the cost of the developer and contractor.

Alternatively, Council may consider accepting defective work subject to conditions.

2.12 Final road profile

2.12.1 Pavement crossfalls

The final road profile shall satisfy the following requirements (if not otherwise stated in the drawings):

- Mean crossfall 3% ± 0.25%
- Maximum crossfall 3.5% (5% in extenuating circumstances)
- Minimum crossfall >2.5%
- Standard deviation of crossfalls 0.35%

The above requirements do not apply where the road is super elevated.

2.12.2 Vertical alignment

The vertical alignment shall not deviate more than +/- 0.25% from the value shown on the drawings.

2.13 Concrete

Concrete testing must be undertaken in accordance with AS 1012 Methods of Testing Concrete.

2.14 Subdivision earthworks

All earthworks associated with commercial and residential developments must comply with the requirements of AS 3798 Guidelines on Earthworks for Commercial and Residential Developments.

Plans and specification for all earthworks are to be included with the Engineering Drawings and Construction Specification, for Council's consideration.

Any material deemed to be unsuitable as described in the Australian Standard shall be disposed of from the site. The contractor must advise Council, in advance, where any material exported from the site is to be taken.

Council must be assured that development approval for such fill is in place.

Any documentation for earthworks, including Works-As-Executed details, and testing, shall comply with Sections 3 and 7 of AS 3798. A copy of the documentation and test results shall be supplied to The Council. The Approved Plan of Subdivision will not be released prior to the receipt and approval of all earthworks documentation.

Developers shall also provide a plan of lot soil classification in accordance with AS 2870 Residential Slabs and Footings.

3. drainage

3.1 Drainage Pipelines

All drainage pipelines shall be checked to ensure that trenches are of appropriate width and pipes are joined as per the manufacturer's specification. They shall also be checked that they are on line and on grade as per the design drawings before back filling. Backfilling must be in accordance with Australian Standards and/or manufacturer's recommendations. Location with respect to easements and kerb alignments will be verified by a registered surveyor. Tolerances are +/- 25 mm horizontally and vertically.

3.2 Drainage Pits

All drainage pits shall be inspected by Council or an accredited certifier to ensure they are to the designed size and correctly located with regard to pipe and kerb location and are correctly orientated. Tolerances are +/- 25 mm horizontally and vertically.

As a minimum the hold points for drainage pits include: level confirmation of pipe inverts, inspection prior to backfilling, the pipe laid and side zones backfilled and compacted.

4. water supply reticulation

4.1 General (refer WSA03-10)

This section relates to water reticulation acceptance testing. The testing of water reticulation shall generally be in accordance with the latest version of the Water Services Association of Australia (WSAA) Water Supply Code of Australia (WSA03) Part 2 Construction: Third Edition.

In the Wagga Wagga local government area, Riverina Water County Council (RWCC) is responsible for the water reticulation system. RWCC will conduct its own inspections and testing.

5. sewer reticulation

5.1 General

Refer WSA02-11.

This section relates to sewerage reticulation acceptance testing. The testing of sewerage reticulation shall generally be in accordance with the latest version of the Water Services Association of Australia (WSAA) publication Gravity Sewerage Code of Australia (WSA02) Part 2 Construction: Third Edition. The Engineering Guidelines takes precedence over the WSAA standards wherever there is a conflict.

All sewers installations will be subject to best practice and manufacturer's specifications in terms of trenching, laying and backfill. Sewer mains and selected maintenance holes shall be subject to testing after construction (NATA accreditation is not mandatory). The tests shall be carried out before release of the Approved Plan of Subdivision.

Testing is intended to:

- a) reveal the existence of any assembly and structural faults
- b) ensure the sewer can operate without infiltration or exfiltration
- c) confirm the success of placement and compaction of pipe embedment and trench fill, design and placement of thrust and anchor blocks and installation of pipeline components.

Should sewers or maintenance holes fail any test,

defects shall be repaired by the contractor and the test repeated. The process of testing, detection and repair of defects and retesting shall continue until a satisfactory test is obtained.

All lines are to be clear and free from soil, slurry, liquids and other foreign substances at the notification of completion.

5.2 Compaction testing

Refer WS02-21.3.

All trench embedment and fill is to be compacted and tested in accordance with the minimum requirements WSA02 or WSA04 and AS3798 Guidelines on earthworks for commercial and residential developments.

5.3 Test of gravitation sewers

The testing of gravitation sewers shall be in accordance with the relevant requirements and method testing specified in Sections 5.4 or 5.5.

Before the test is performed, all pipelaying on the section shall be completed and backfill compacted to the level of the centre of the pipe barrel and the developer shall have requested Council to check the pipeline for line and grade.

The test may be carried out after risers and/or sidelines

are constructed, however Council will be reliant on the final test conducted immediately prior to acceptance into maintenance.

Any fault detected is to be rectified and a satisfactory test obtained before the remainder of backfill is placed.

5.4 Air pressure and vacuum testing of gravity sewers

Refer WSA02-21.4.

5.4.1 Equipment

All necessary equipment is to be supplied by the developer and kept in a condition acceptable to Council or an accredited certifier.

Pressure gauges are to be tested prior to testing of pipelines by static water column and NATA-calibrated at least three months prior to beginning of testings. At least one spare gauge per test rig is to be kept on the job at all times.

Compressed air is to be supplied by a compressor capable of supplying at least 1 m³/minute at 35 kPa. The air is to be fed through a pressure-reducing valve capable of reducing pressure from that supply to 28 kPa \pm 4 kPa. The air is then to pass through an airtight line fitted with a 150 mm Bourdon type pressure gauge reading from 0 to 50 kPa, a pressure relief valve that may be set to blow off at 28 kPa \pm 4 kPa and a gate valve to the pipeline to be tested.

5.4.2 Low pressure air testing

Refer WSA02-21.4.2.2.

The method of setting up and carrying out the test shall be in accordance with the requirements of WSA low-pressure air testing.

Pressure drop times, which are less than these, may indicate leakage or excessive air permeability through unsaturated pipe walls with some materials. Vitrified clay pipes, in particular, suffer from excessive air permeability under dry summer conditions. When this occurs, pipes must be thoroughly saturated with water before testing or a hydrostatic test applied.

In any case, where the allowable pressure drop time cannot be attained and there are no visible leaks, a hydrostatic test is to be applied at the request of Council.

5.5 Hydrostatic testing

Where Council permits hydrostatic testing, the hydrostatic test shall be carried in accordance with the specific requirements of Council.

5.6 Testing of concrete maintenance holes

Refer WSA02- 21.4.5.

Council may request the leakage testing of maintenance holes at its discretion.

Where a test is required the test shall be carried out with the maintenance hole cover surround fitted with rendering of the channels and benches completed.

As an alternative to vacuum testing referred to in WSA02-22.4.4, subject to the approval of Council, water testing will be undertaken by plugging all pipe openings

in the walls and by filling the maintenance hole with water to the lowest point on the top of the maintenance hole cover surround. The plugs shall be positioned in the pipes as near as practicable to the internal face of the maintenance hole.

After allowing 30 minutes for absorption, if not otherwise determined by Council, the maintenance hole shall be refilled and the loss of water during the following thirty minutes measured. The test on the maintenance hole will be considered satisfactory provided the water lost is less than 3 mm depth in the top section of the maintenance hole for each 1 metre depth of the maintenance hole. The depth of maintenance hole is to be taken from the bottom of the maintenance hole cover recess in the cover surround to the invert of the outlet from the maintenance hole. The plug of the outlet shall be fitted with a suitable release for emptying the maintenance hole on satisfactory completion of the test.

5.7 Infiltration testing

Refer WSA02- 21.5.

Whenever the pipeline is subjected to a significant head of groundwater (i.e. 1500 mm or more above the obvert of the sewer main) provided that groundwater is at least 150 mm above any sideline it shall be visually inspected for infiltration.

The developer shall propose full details of the method by which the infiltration is to be measured and rectified.

The developer at his own expense shall determine the head of groundwater by a method acceptable to Council or an accredited certifier.

5.8 Deflection (Ovality) testing of flexible sewers.

Refer WSA02-21.6.

Test In accordance with WSA requirements.

5.9 CCTV Inspection

Refer WSA02-21.8.

At the conclusion of all construction activities and prior to lodgement of a survey certificate application, sewer/ stormwater pipelines within the subdivision development that are proposed to be handed over to Council, are to be inspected using closed circuit television (CCTV). The CCTV footage is to be presented to Council for assessment.

CCTV Inspections shall be completed in accordance with the requirements of WSA05-2013 and shall address both ovality (WSA02-21.6) and grade (WSA02-21.7) compliance with WSA requirements unless other methods have already done so.

5.10 Tolerances on as constructed work

Refer WSA02- 22.

The testing of gravitation sewers shall be in accordance with the relevant requirements and method of testing specified in Section 22 of WSA02.

Before the test is performed, all pipelaying on the section shall be completed and backfill compacted to the level of the centre of the pipe barrel, and the developer shall have requested the Council to check the pipeline for line and grade. Tolerance is to be +/- 25 mm horizontally and +25/-5 mm vertically. Reverse grades are not permitted.

The test may be carried out after risers and/or sidelines are constructed however Council will be reliant on the final test conducted immediately prior to acceptance into maintenance.

Any fault detected is to be rectified and a satisfactory test obtained before the remainder of backfill is placed.

5.11 Testing of Rising Main

Refer WSA04-36.5.

Rising mains shall be pressure tested in order to detect any leakage and defects in the pipeline including joints, thrust and anchor blocks, if any. Hydrostatic Testing of pressure mains shall be completed in accordance with WSA04 (Sewage Pumping Station Code of Australia) requirements, or in the case of HDPE, with WSA01 (Polyethylene Pipeline Code) requirements.

Council allows some minor variation from WSAA requirements as detailed in this subclause.

Pipelines shall be tested in sections approved by Council or an accredited certifier as soon as practicable after each section has been laid, jointed and backfilled, provided that:

- if specified or if the developer so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of Council or an accredited certifier
- the pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast.

For the purpose of this subclause, a section shall be defined as a length of pipeline, which can be effectively isolated for testing, e.g. by means of main stop valves, but no greater than 1000 metres in length.

Unless otherwise approved by Council or an accredited certifier, pressure testing shall not be carried out during wet weather.

During pressure testing, all field joints which have not

been backfilled shall be clean, dry and accessible for inspection. During the pressure testing of a pipeline each stop valve shall sustain, at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes.

Before testing a pipeline section, it shall be cleaned to the satisfaction of Council or an accredited certifier 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. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.

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 Drawings, but shall not exceed the same by more than 20% (refer WSA03 section 36.5.2).

All pressure gauges used in testing shall have been NATA-calibrated within the previous three months. Pressure gauges shall have appropriate increments in order to determine pressure loss in the pipe.

Prior to commencing a full hydrostatic test, a pressure equal to 75% of the test pressure shall be applied to the test section for a period of no less than 12 hours in order to stabilise the main, achieve full saturation of absorbent materials, determine any leaks prior to start of official test and allow for pressure dependant increases in flexible pipework. Failure to do so may increase the risks of an unsatisfactory result on the official hydrostatic test. After the 12-hour period, pressure can be progressively increased until the test pressure is reached. The test pressure shall be maintained for a minimum of 4 hours.

For the purpose of determining the actual leakage losses, the quantity of water added in order to maintain the pressure during the period of testing shall be carefully measured and recorded at half hour intervals.

The pressure testing of a section shall be considered to be satisfactory if:

- d) there is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component
- e) there is no visible leakage
- f) the measured leakage rate does not exceed the permissible leakage rate as determined by the following formula,

$$(0.14 \times d_i \times LP \times H) / 1000 \text{ (L/h)}$$

where: d_i = internal pipe diameter, mm
 LP = length of pressure main under test (km)
 H = average value of test head (m)

Any failure, defect, visible leakage and/or excessive leakage rate, which is detected during the pressure testing of the pipeline or during the maintenance period shall be made good by the developer at his expense.

5.12 Inspection prior to backfilling

All sewerage lines shall be inspected and approved by council or an accredited certifier after laying and jointing and prior to the placing of any backfilling.

As a minimum the hold points for backfilling include:

- level confirmation of pipe inverts
- pipe laid with 150mm sand cover
- junction exposed and cement placed under risers.

5.13 Testing of Sewer Pump Stations

Refer WSA04-36.0.

All testing shall be in accordance with WSA requirements, which are mentioned in the preceding test clauses.

Wet wells and emergency storages shall be pressure tested by either vacuum or hydrostatic test methods as previously defined in the Engineering Guidelines. Infiltration testing shall also be completed on wet wells and emergency structures.

Compaction testing shall be completed on fill surrounding pump stations in accordance with the requirements as detailed in WSA04-36.0 and in accordance with the requirements of this document.

questions? comments?
contact us.

Wagga Wagga City Council
PO Box 20
Cnr Baylis & Morrow Sts
Wagga Wagga NSW

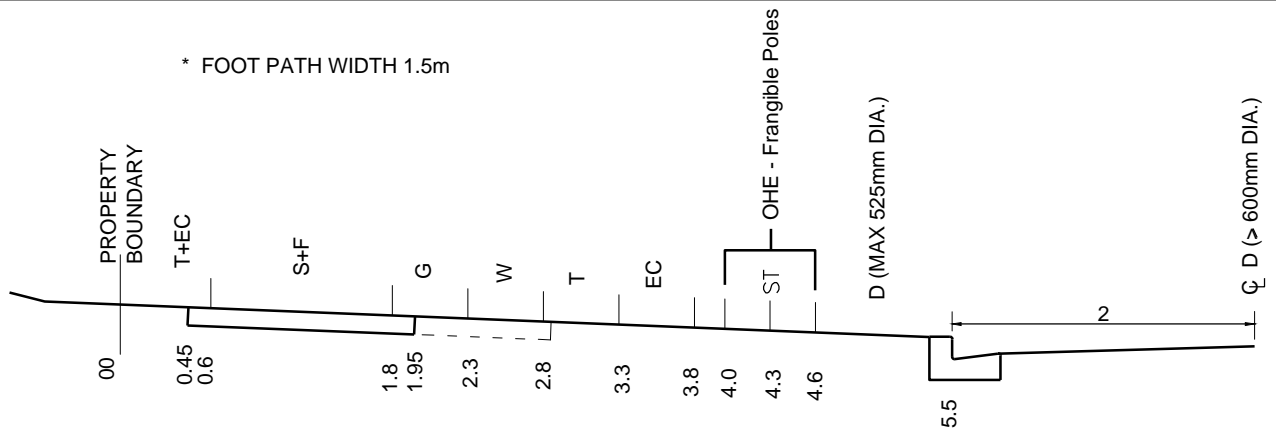
Ph: 1300 292 442

Fax: (02) 6926 9199

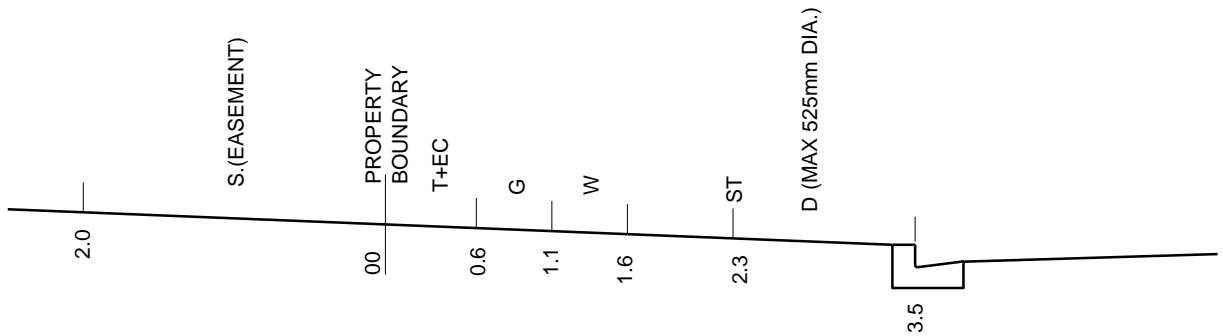
Email: council@wagga.nsw.gov.au

Follow [@WaggaCouncil](https://twitter.com/WaggaCouncil) on Twitter to get the news, events and emergency information straight from the source.

* FOOT PATH WIDTH 1.5m



5.5m NATURESTRIP - URBAN



3.5m NATURESTRIP - URBAN (Cul-De-Sac only)



ON RARE OCCASIONS
GENERALLY WITHIN LOT

RURAL/RURAL RESIDENTIAL

LEGEND

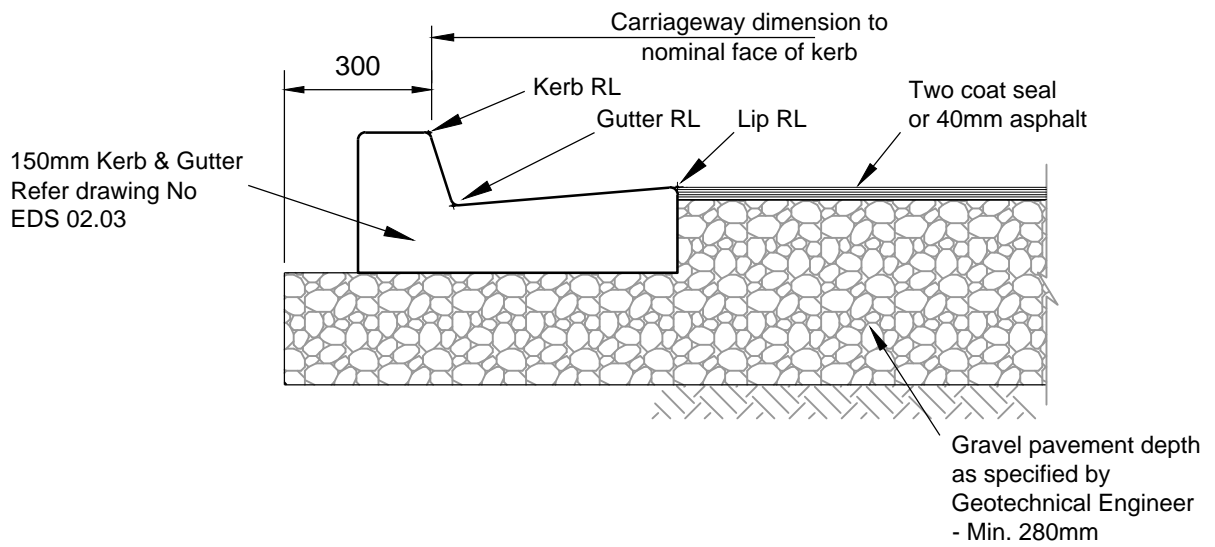
- T - TELECOMMUNICATIONS
- EC - UNDERGROUND ELECTRICITY
- S - SEWER
- F - FOOTPATH
- ST - STREET TREE/STREET LIGHT
- G - GAS
- W - WATER SUPPLY
- OHE - OVERHEAD ELECTRICITY WITH FRANGIBLE POLES
- D - DRAINAGE

* ALL DIMENSIONS ARE IN METRES
UNLESS MARKED OTHERWISE



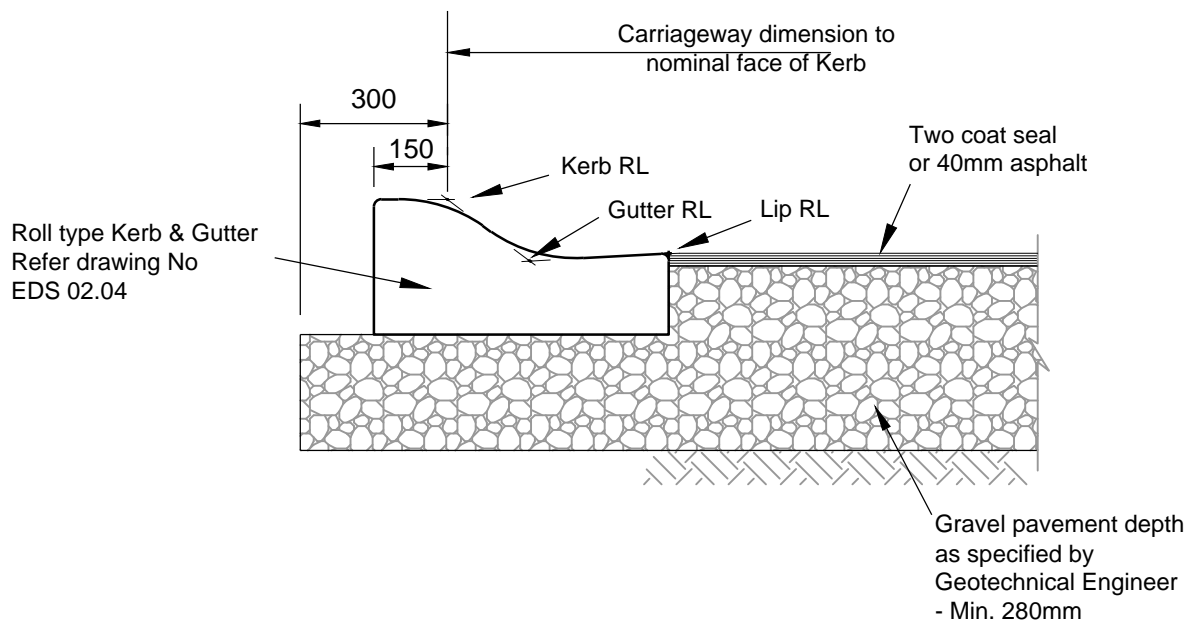
SERVICE LOCATIONS

WWCC Engineering Development Standards Paragraph Reference: Part1 - 10.3		Drawing No.
Scale: 1:50	A4	Date: 4.1996 Revised: 2.2017
		EDS 01.01



**NOMINAL 150mm HIGH INTEGRAL
BARRIER KERB & GUTTER**

N.T.S.



ROLL KERB & GUTTER

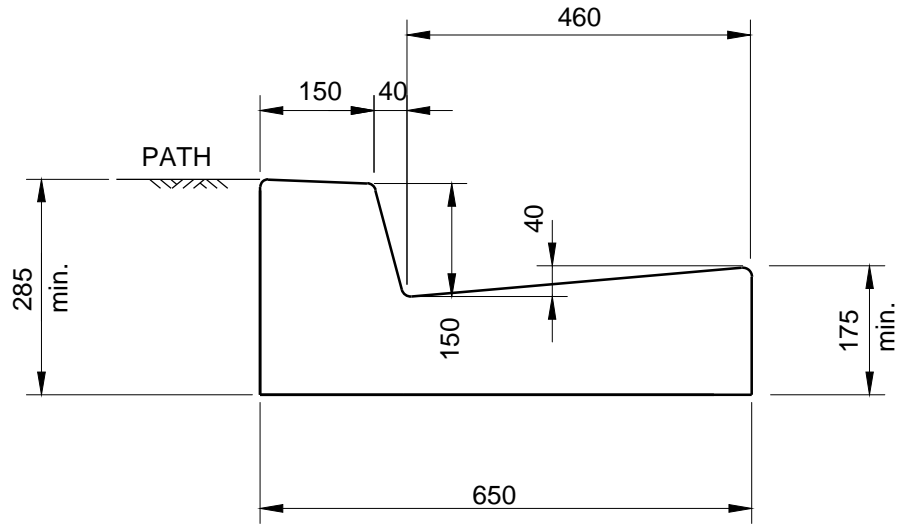
N.T.S.

* All dimensions are in millimetres

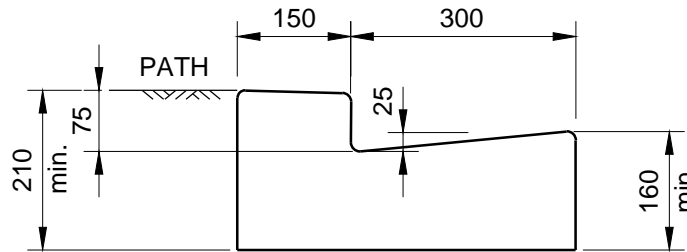


PAVEMENT SET OUT DETAILS

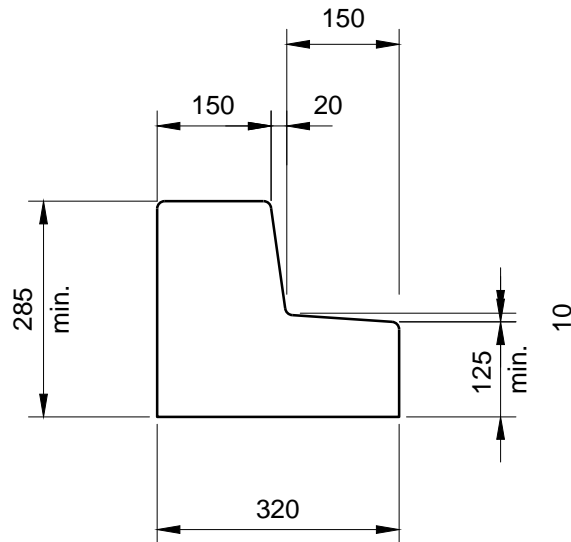
WWCC Engineering Development Standards Paragraph Reference: Part 2 - 2.3		Drawing No.
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Date: 9.2013	Revised: 2.2017	



150mm HIGH INTEGRAL BARRIER KERB & GUTTER



75mm HIGH INTEGRAL BARRIER KERB & GUTTER



150mm HIGH BARRIER KERB & TOE

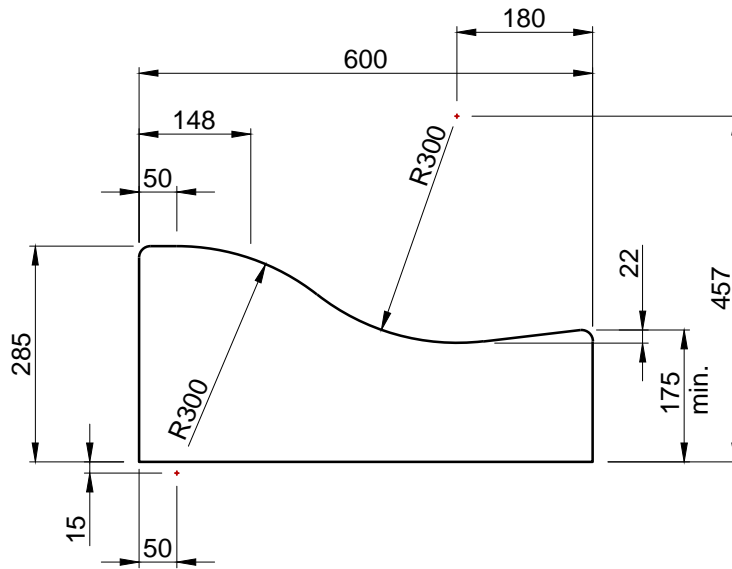
SCALE 1:10

- * 25MPa Concrete
- * All dimensions are in millimetres

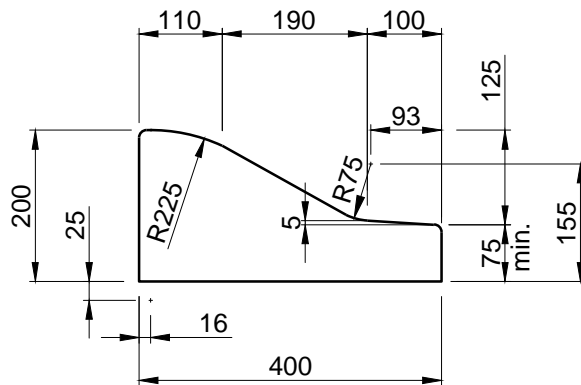


BARRIER KERB AND GUTTER DETAILS

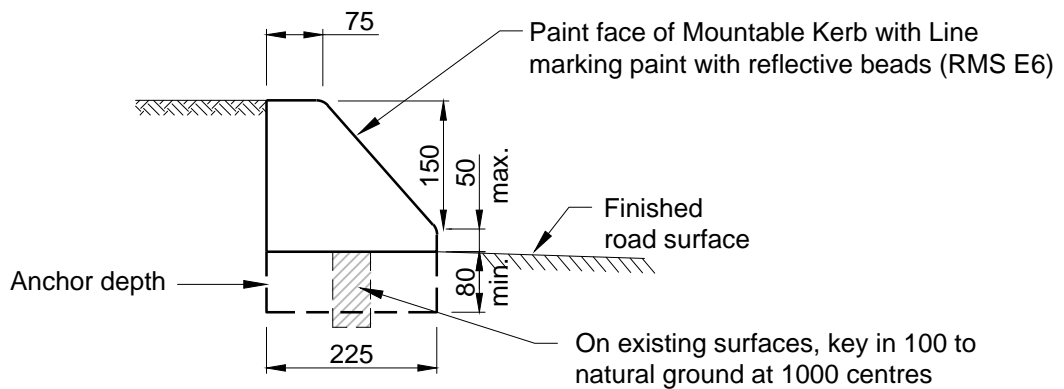
WWCC Engineering Development Standards Paragraph Reference: Part 2 - 2.6		Drawing No.	
Scale: 1:10	A4	Date: 9.2013 Revised: 2.2017	EDS 02.03



ROLL KERB & GUTTER



ROLLOVER KERB & TOE



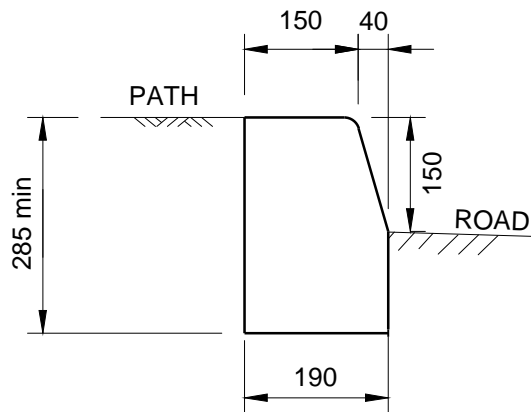
**MOUNTABLE KERB FOR TRAFFIC ISLANDS
ON EXISTING PAVEMENTS**

- * All dimensions are in millimetres
- * 25MPa Concrete
- * All exposed edges rounded to 20 radius except marked otherwise.



MOUNTABLE KERB AND GUTTER PROFILES

WWCC Engineering Development Standards Paragraph Reference: Part 2 - 2.6		Drawing No.
Scale: 1:10	A4	Date: 9.2013 Revised: 2.2017
		EDS 02.04



KERB ONLY

SCALE 1:10

- * 25 MPa Concrete
- * All dimensions are in millimetres



KERB ONLY PROFILE

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.6

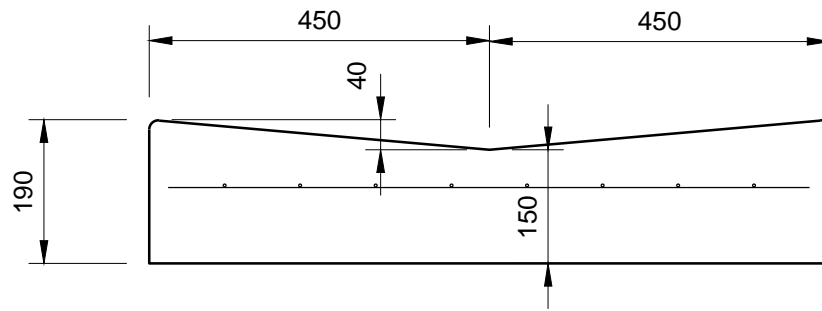
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Scale: 1:10

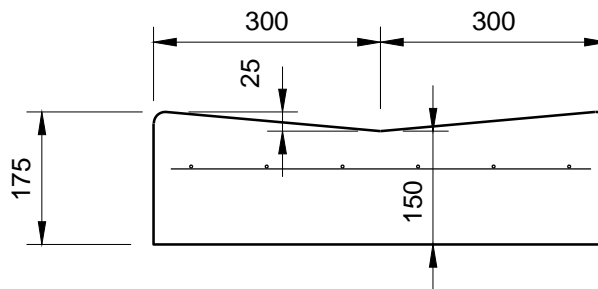
A4

Date: 9.2013
Revised: 2.2017

EDS 02.05



900mm DISH DRAIN PATH



600mm DISH DRAIN

- * 25 MPa concrete
- * Dish drains should be reinforced in vehicular traffic situations. (Min.SL72 mesh with 60mm cover or 256 EE Steel Fibre @50 kg/m³)
- * All exposed edges rounded to 20 radius
- * All dimensions are in millimetres



DISH DRAIN PROFILES

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.6

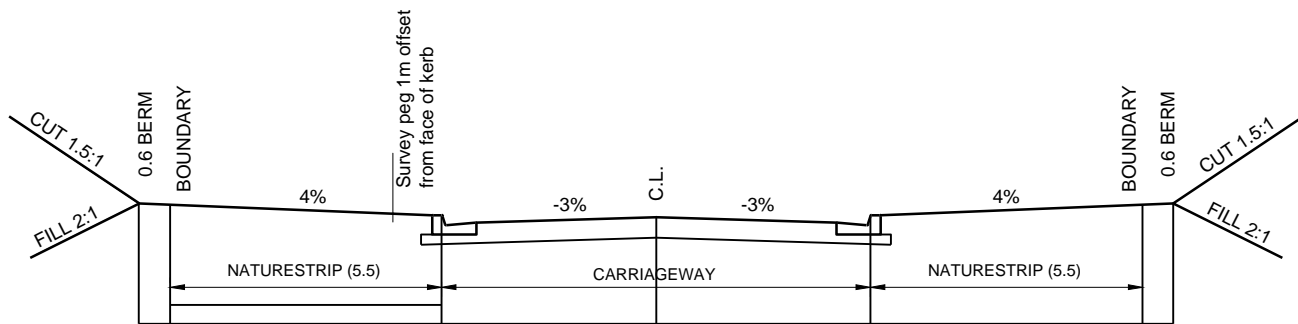
Drawing No.

Scale: 1:10

A4

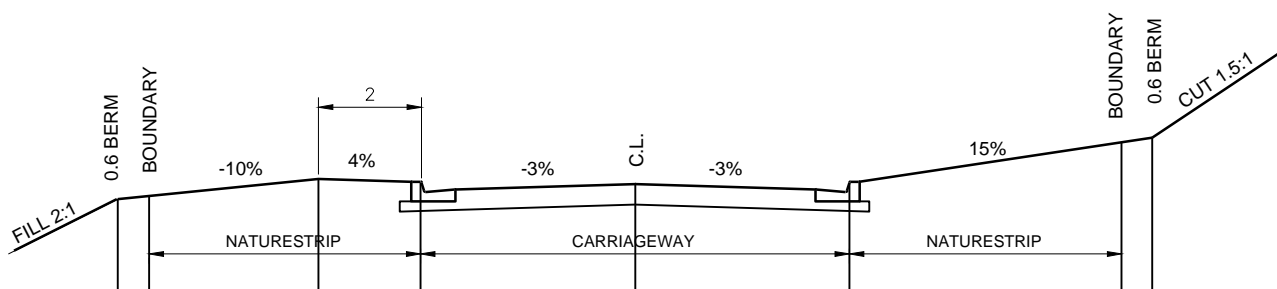
Date: 9.2013
Revised: 2.2017

EDS 02.06



N.T.S.

STANDARD CROSS SECTION - URBAN



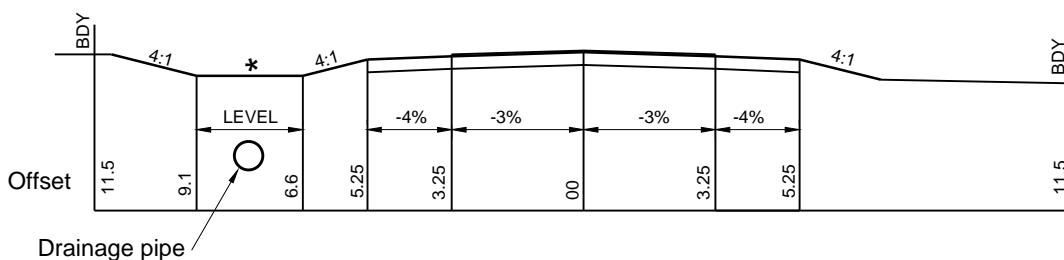
N.T.S.

MAXIMUM GRADES CROSS SECTION - URBAN

(subject to managers approval)

Note : Both cut and fill batters within open space shall be flattened to 4:1 or flatter

* Width of table drain and inclusion of a drainage pipe line subject to hydraulic analysis of total catchments



STANDARD CROSS SECTION - RURAL/RURAL RESIDENTIAL

See table 2.5 for more details

All dimensions are in metres unless marked otherwise



ALTERNATIVE ROAD CROSS SECTIONS

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.3 & 3.4

Drawing No.

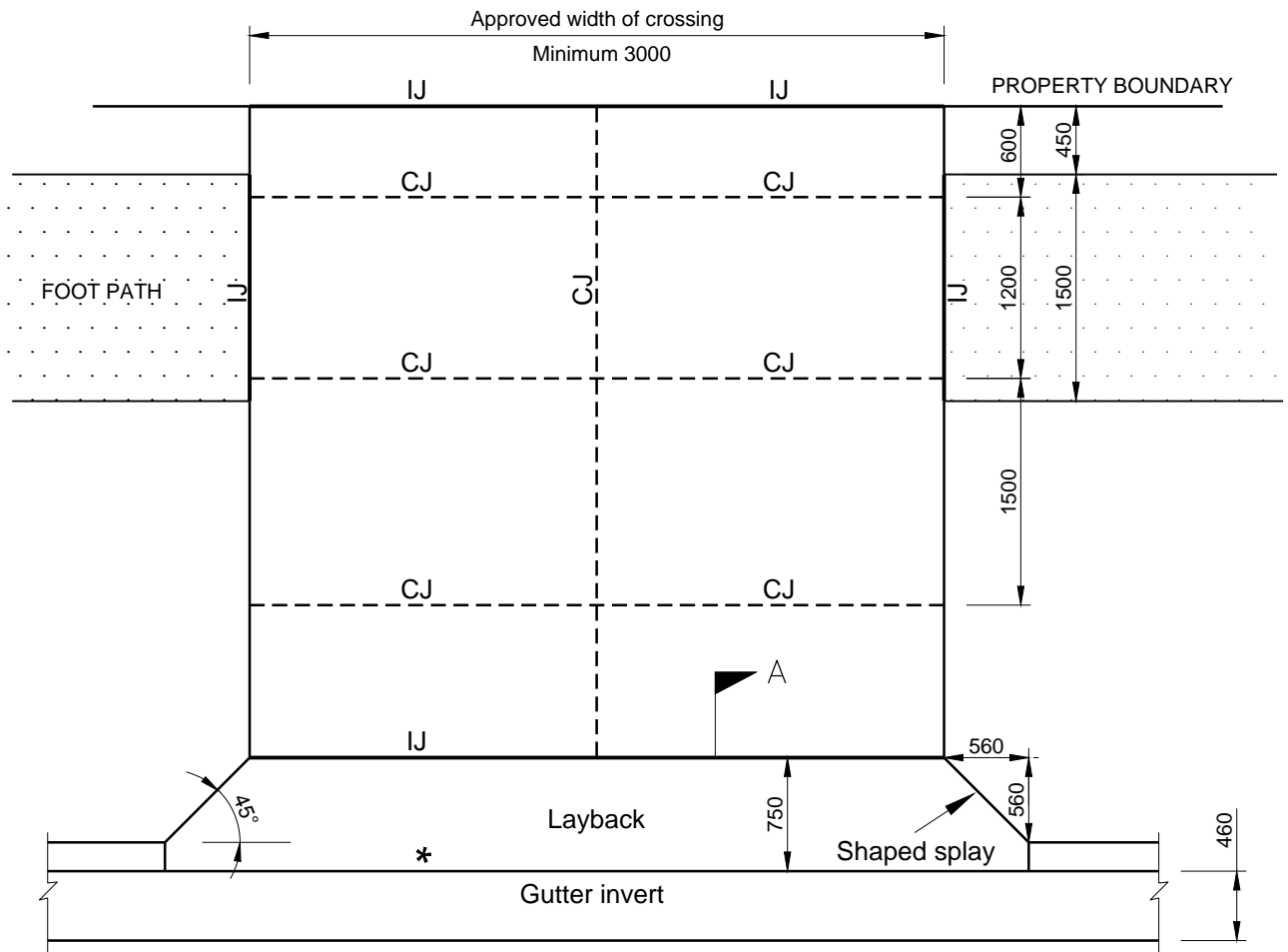
EDS 02.07

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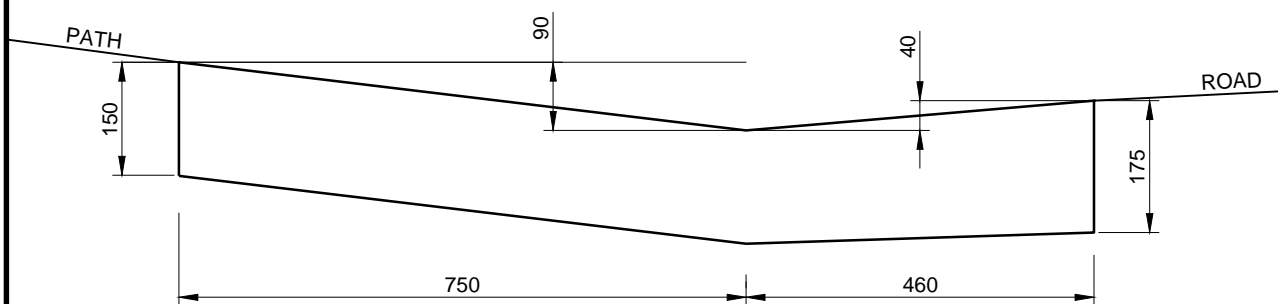
Date: 9.2013

Revised: 2.2017



* Where the invert crossing is constructed by removing existing kerb, the break line at gutter invert shall be saw cut to a depth of 70mm

PLAN
Scale 1:50



LEGEND:

- CJ - Control Joints
- IJ - Isolation Joints

STANDARD INVERT CROSSING

(SECTION A-A)
Scale 1:10

NOTE:

- Driveways 100mm thick, 25MPa concrete reinforced with SL72, 30mm top cover
- All dimensions in millimetres



VEHICULAR CROSSING - RESIDENTIAL

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.8

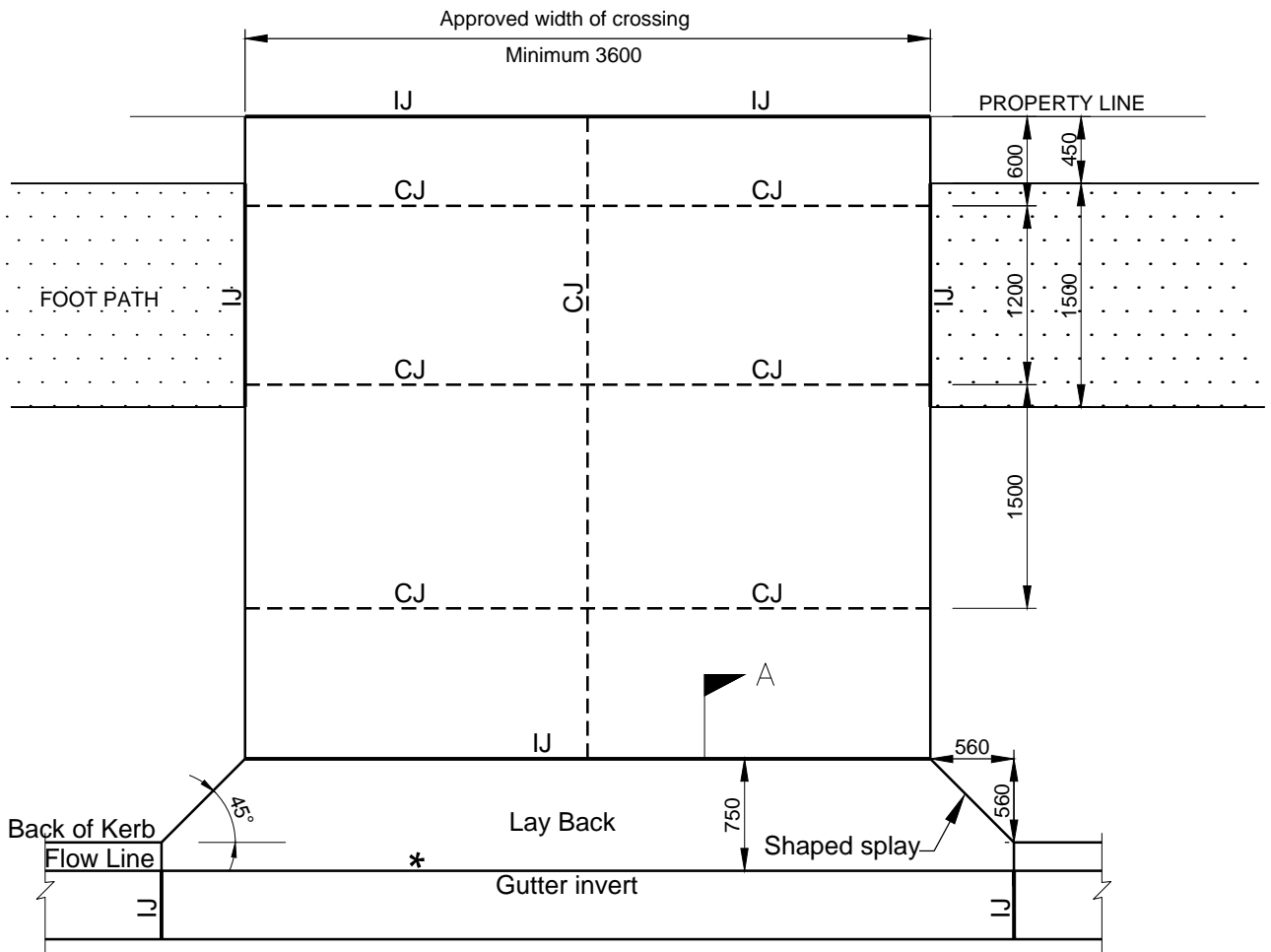
Drawing No.

Scale: As Shown

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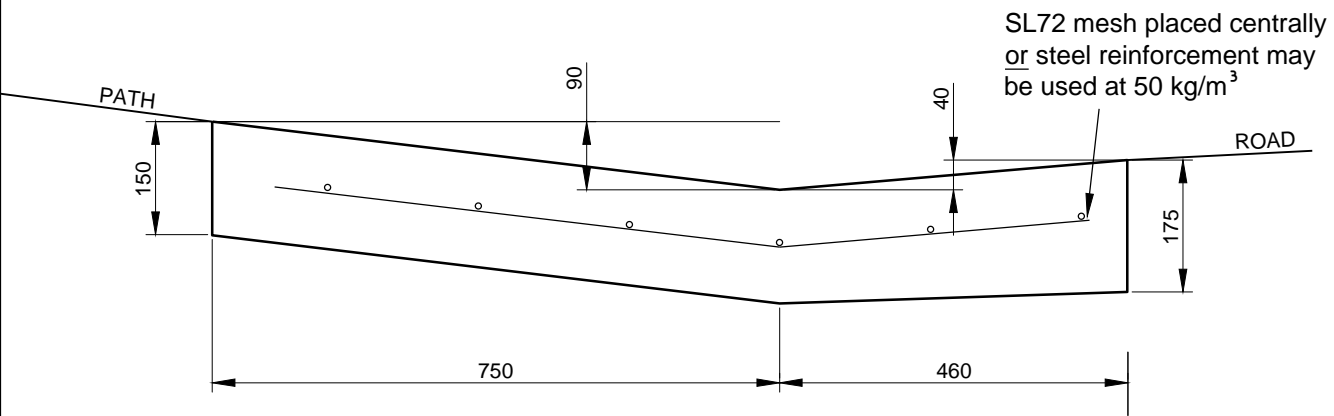
Date: 9.2013
Revised: 2.2017

EDS 02.08



* Where the invert crossing is constructed by removing existing kerb, the break line at gutter invert shall be saw cut to a depth of 70mm

PLAN
SCALE 1:50



STANDARD INVERT CROSSING

LEGEND:
CJ - Control Joints
IJ - Isolation Joints

(SECTION A-A)
SCALE 1:10

NOTE:
• Driveways 150mm thick, 25MPa concrete reinforced with SL72, 60mm top cover
• All dimensions in millimetres

	VEHICULAR CROSSING - INDUSTRIAL/COMMERCIAL		
	WWCC Engineering Development Standards Paragraph Reference: Part 2 - 2.8		Drawing No. EDS 02.09
	Scale: As Shown	A4	Date: 9.2013 Revised: 2.2017

ROAD CROSSING SERVICE CONDUITS

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.10

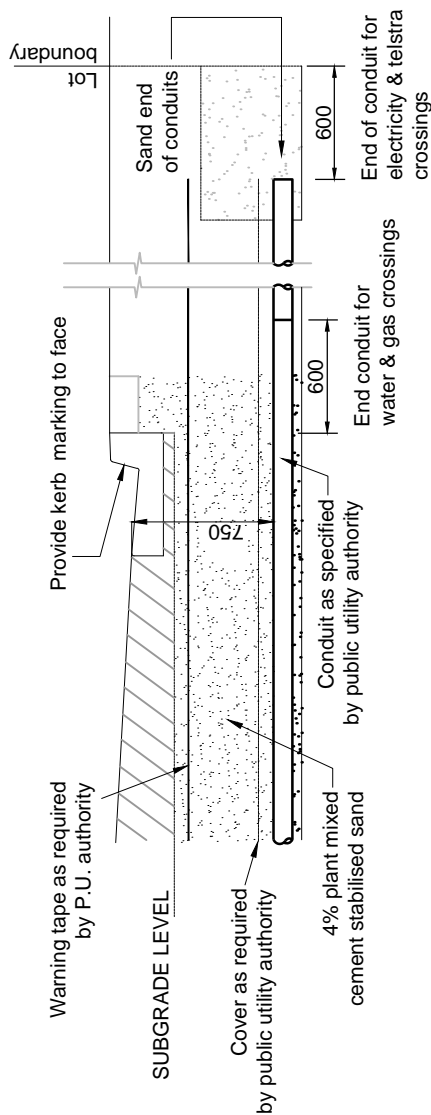
Drawing No.

Scale: As Shown

A4

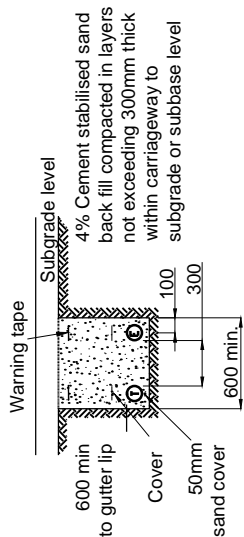
Date: 4.2014
Revised: 2.2017

EDS 02.10

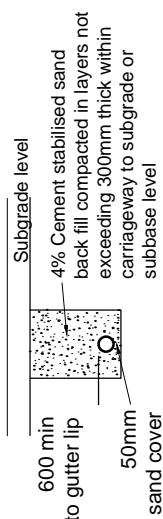


ROAD CROSSING CONDUIT

SCALE 1:40



ELECTRICITY & COMMUNICATIONS



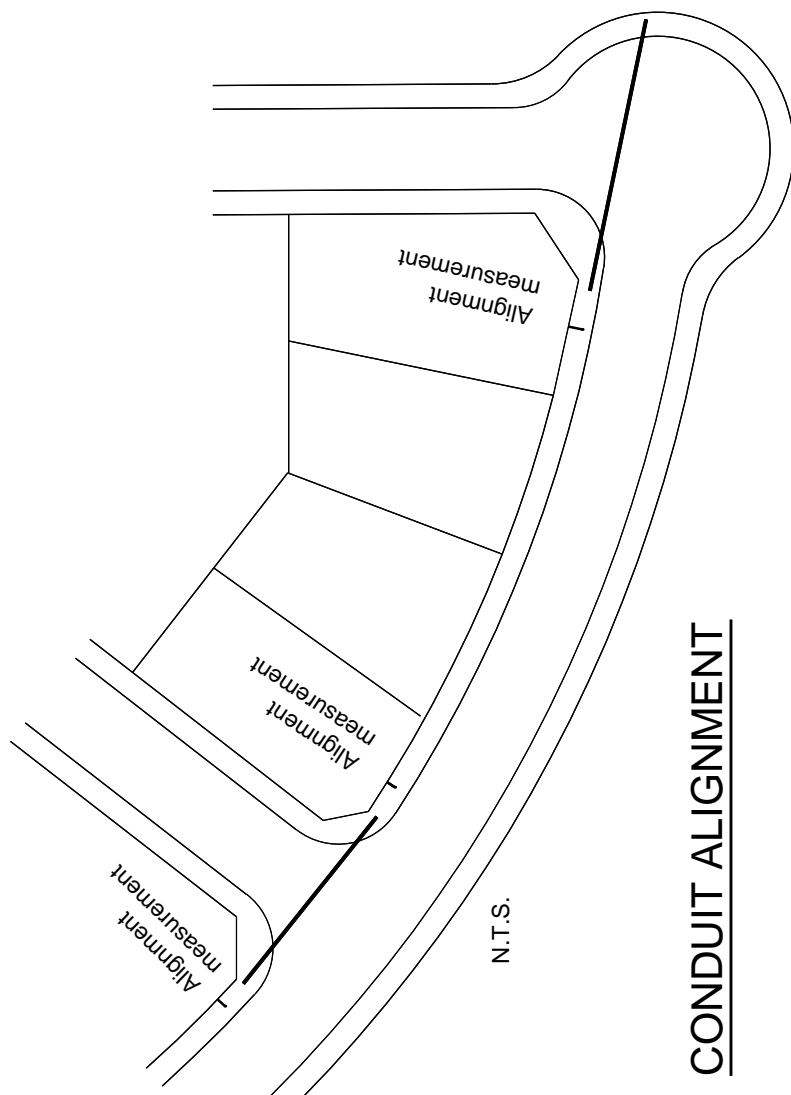
SINGLE CONDUIT TRENCH

* All dimensions are in millimetres unless marked otherwise

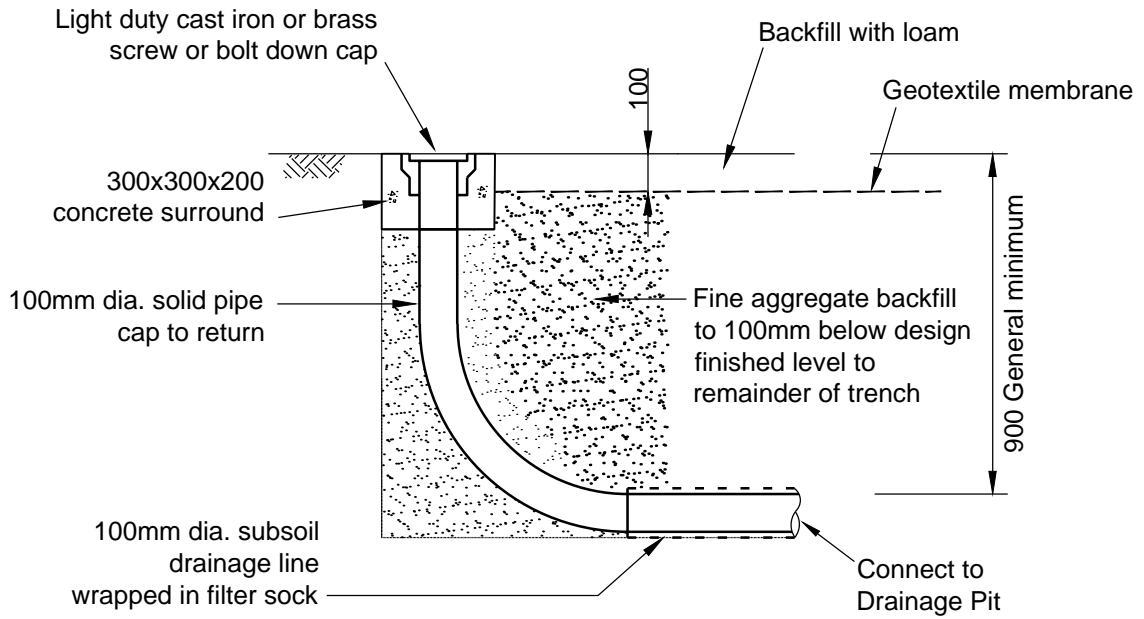
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Note:

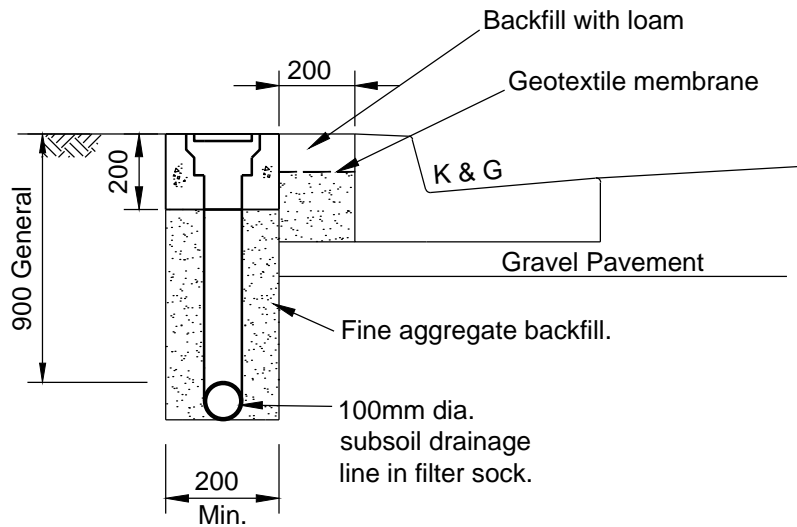
- Conduits should be perpendicular to road centrelines but Council will accept a 10° variance from perpendicular.
- Conduits should be laid with minimum 1% longitudinal grade.



CONDUIT ALIGNMENT



FLUSHING POINT DETAIL



SUBSOIL DRAINAGE DETAIL

* All Dimensions are in millimetres



SUBSOIL DRAINAGE DETAILS

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.13

Drawing No.

EDS 02.11

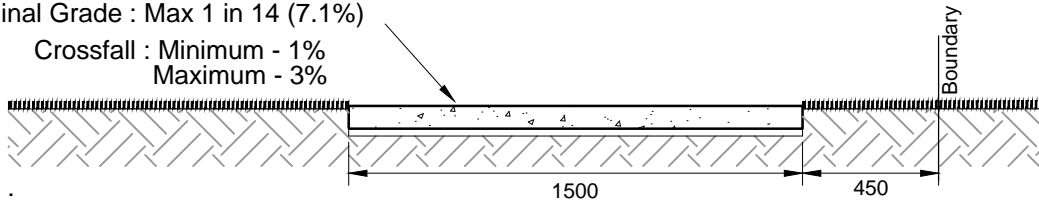
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A4

Date: 9.2013
Revised: 2.2017

Longitudinal Grade : Max 1 in 14 (7.1%)

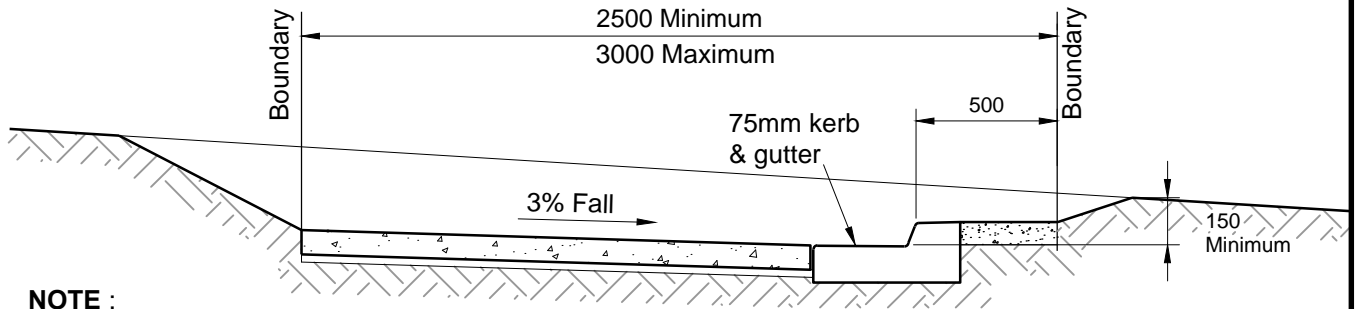
Crossfall : Minimum - 1%
Maximum - 3%



NOTE :

As an alternative for long lengths of footpaths and shared pathways, 150mm of compacted gravel with 50mm asphalt subject to council approval.

TYPICAL FOOTPATH CROSS SECTION

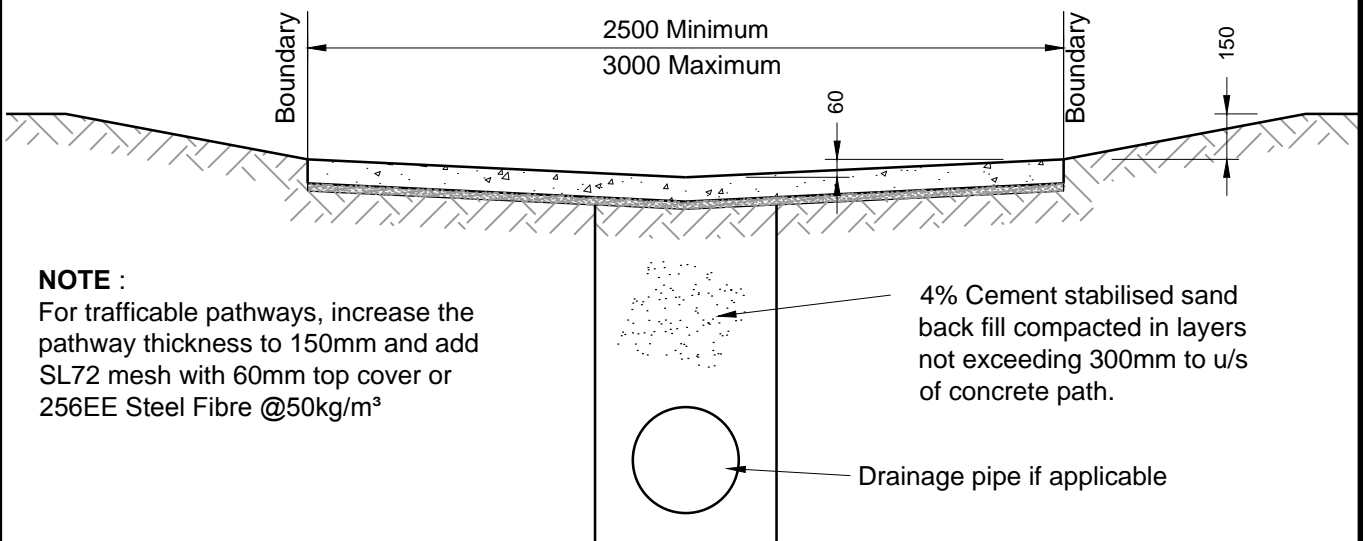


NOTE :

Depth of path relative to natural ground may be affected by required waterway area.

CONNECTING FOOTPATH BETWEEN RESIDENTIAL BLOCKS

CROSS SECTION - SLOPING GROUND



NOTE :

For trafficable pathways, increase the pathway thickness to 150mm and add SL72 mesh with 60mm top cover or 256EE Steel Fibre @50kg/m³

4% Cement stabilised sand back fill compacted in layers not exceeding 300mm to u/s of concrete path.

Drainage pipe if applicable

CONNECTING FOOTPATH BETWEEN RESIDENTIAL BLOCKS

CROSS SECTION - LEVEL GROUND

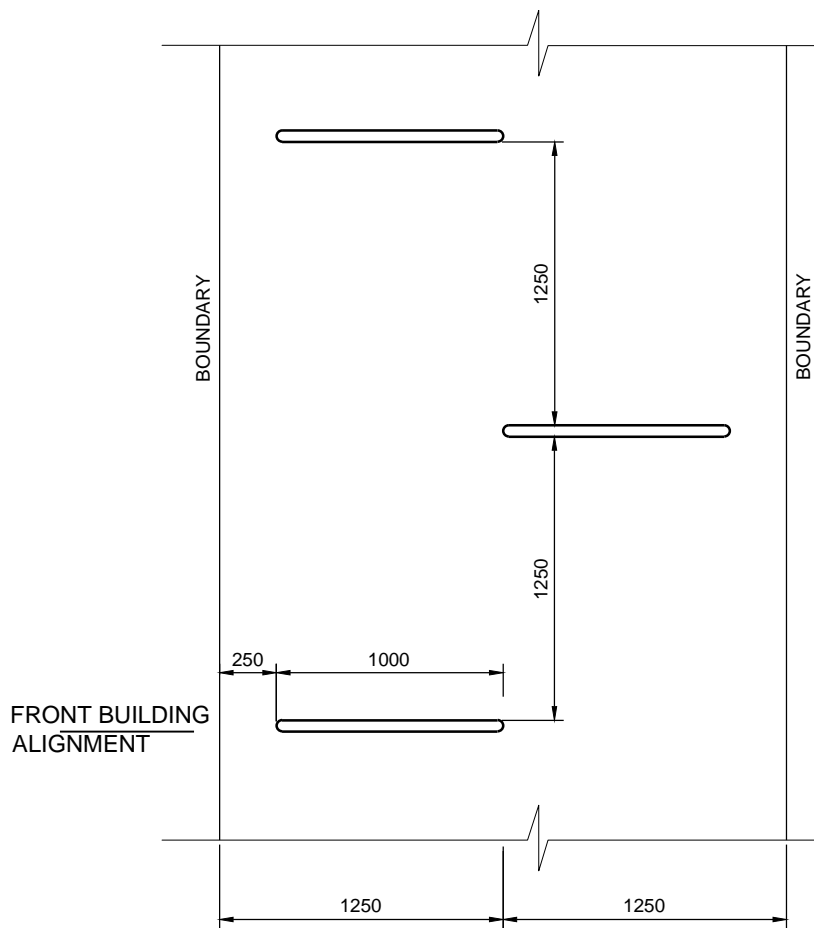
Notes:

1. Path width as shown
2. Path 75mm thick, min. 25 MPa concrete
3. Provide control joints at 1500 centres max. Isolation joints at 9000 centres max.
4. All dimensions are in millimetres

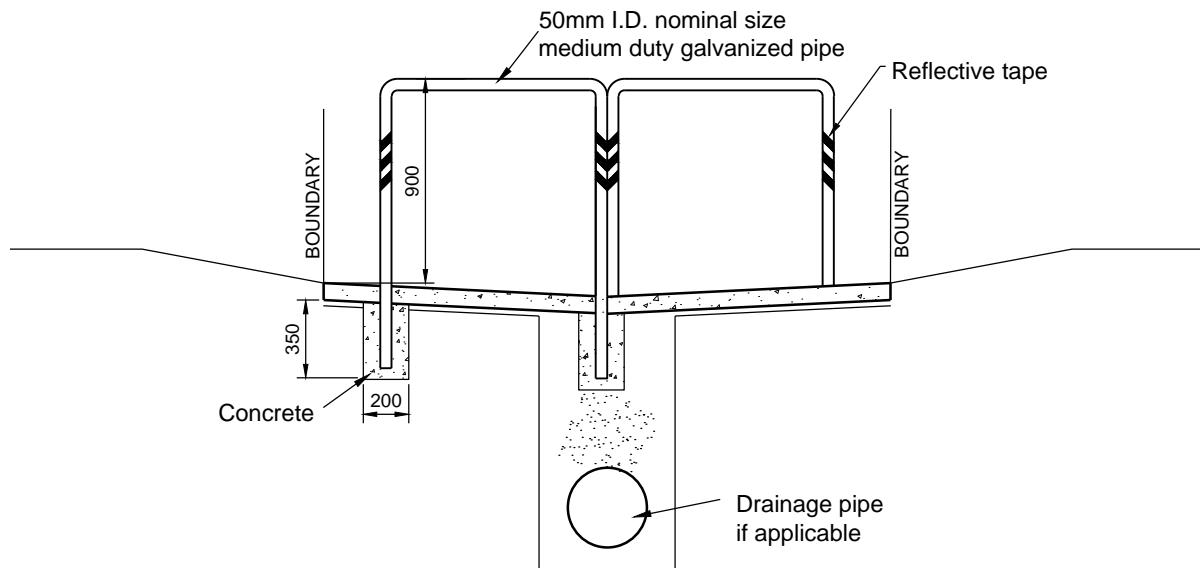


PATHWAY DETAILS (NON VEHICULAR TRAFFIC)

WWCC Engineering Development Standards Paragraph Reference: Part 2 - 2.26		Drawing No.
Scale: N.T.S.	A4	Date: 9.2013 Revised: 2.2017
		EDS 02.12



PLAN
N.T.S.



ELEVATION
N.T.S.

* All dimensions are in millimetres unless marked otherwise.



PATHWAY DETAILS - BARRIER DETAIL

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.25.3

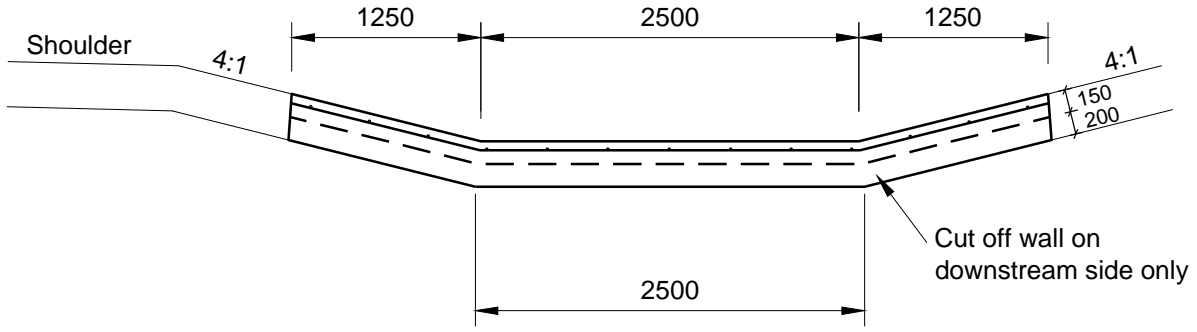
Drawing No.

Scale: Not to Scale

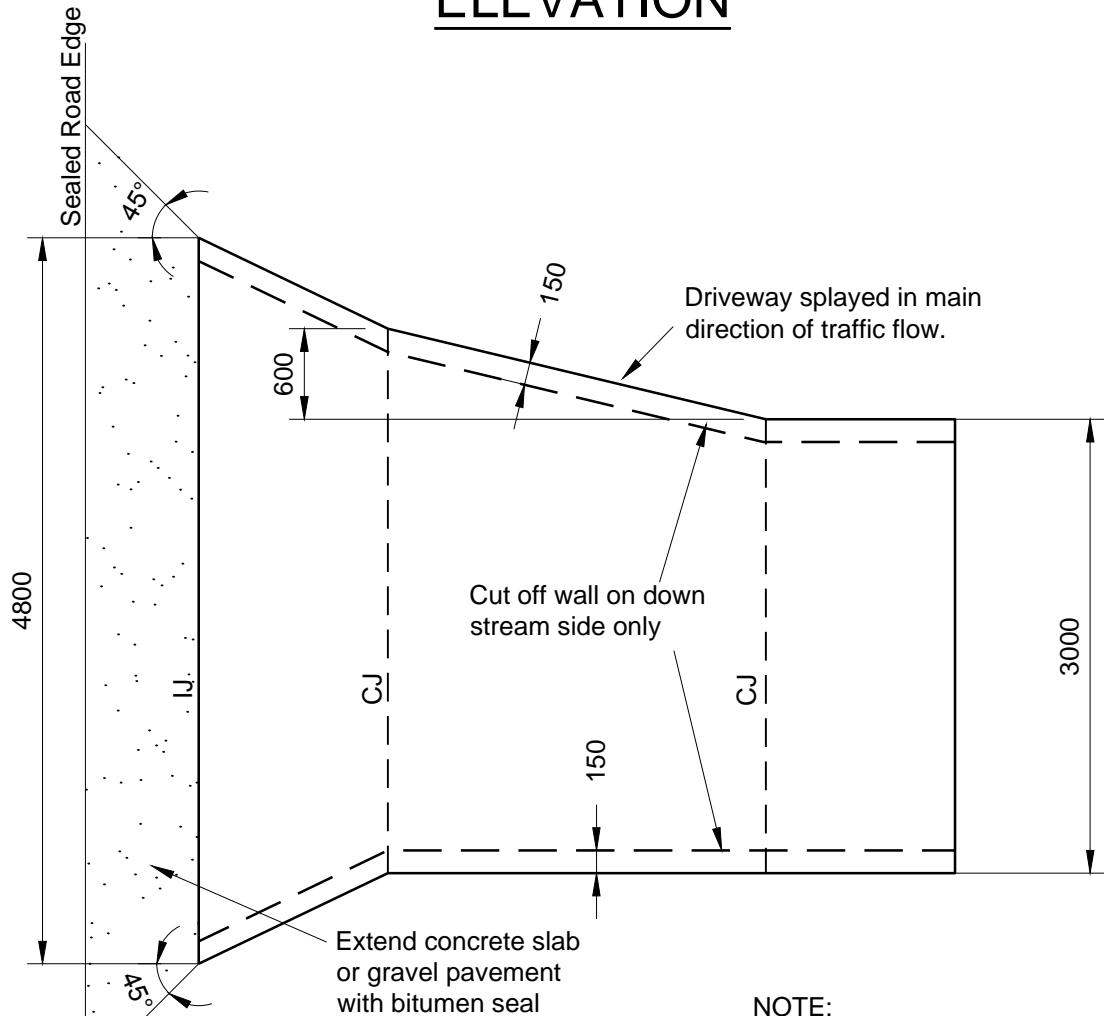
A4

Date: 9.2013
Revised: 2.2017

EDS 02.13



ELEVATION



LEGEND:

CJ - Control Joints

IJ - Isolation Joints

PLAN

NOTE:

1. Concrete slab 150mm thick 25MPa reinforced with SL72, 60mm top cover or fibrecrete 256EE steel fibre @ 50kg/m³
2. Construct invert slab 50mm above drain to allow for siltation/vegetation
3. All dimensions are in millimetres



**City of
Wagga Wagga**

VEHICULAR CROSSING - RURAL/RURAL RESIDENTIAL

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 3.11

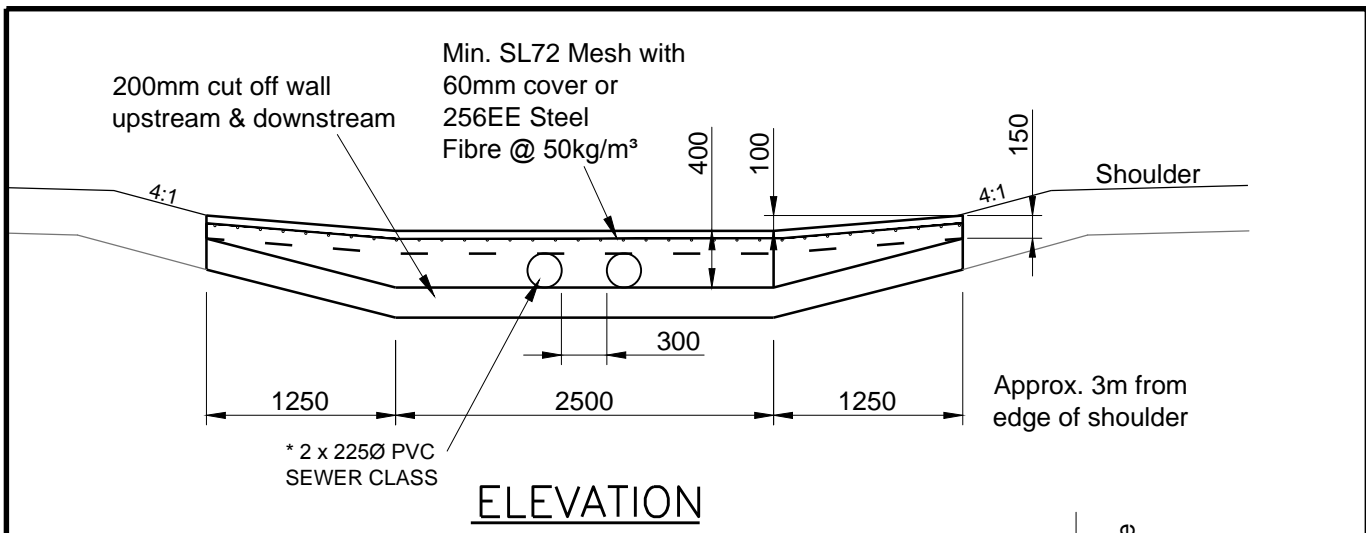
Drawing No.

Scale: 1:50

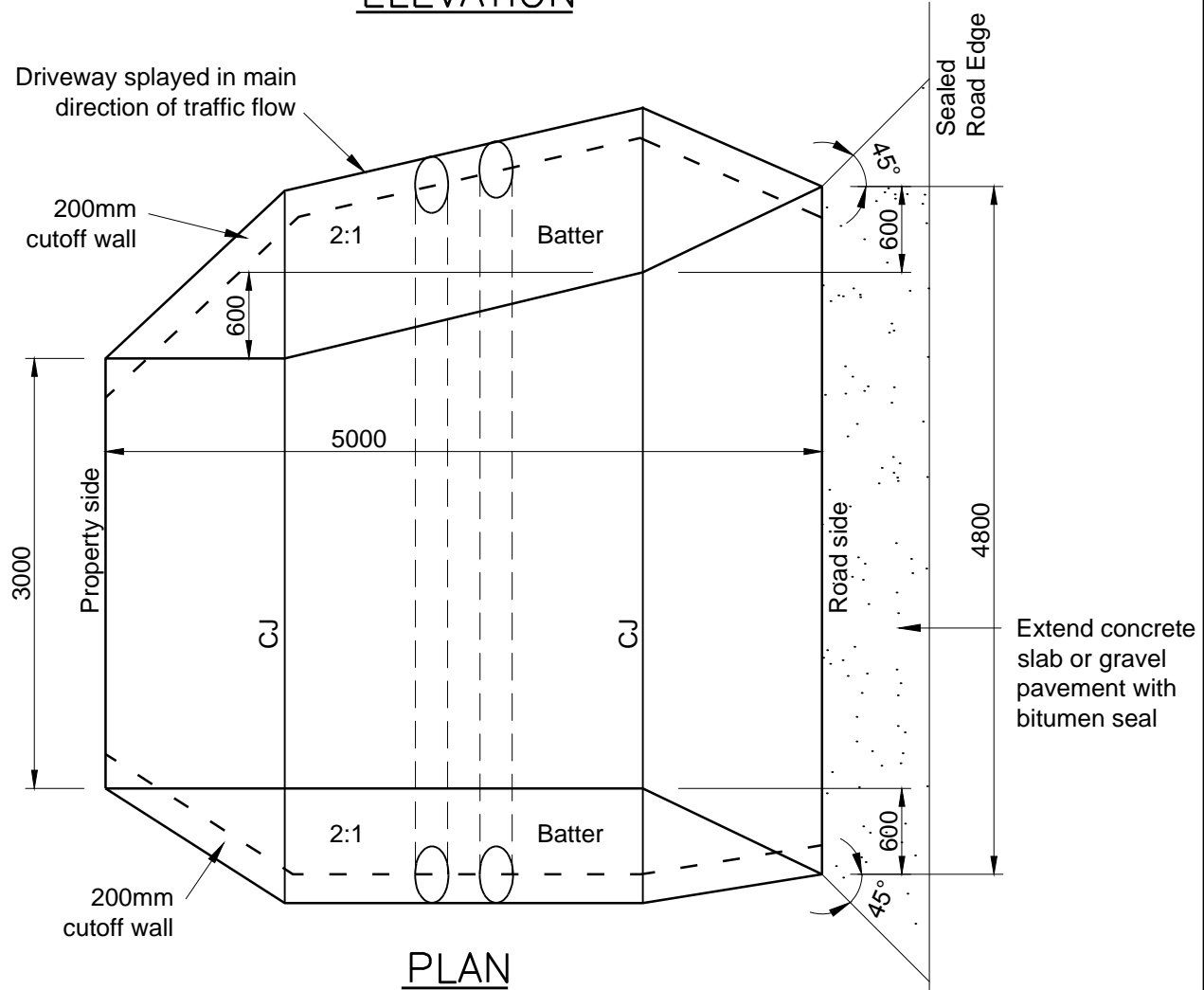
A4

Date: 9.2013
Revised: 2.2017

EDS 02.14



ELEVATION



PLAN

- NOTE:**
1. Concrete slab 150mm thick 25MPa reinforced with SL72, 60mm to cover or fibrecrete 256EE steel fibre@ 50kg/m³
 2. Provide 200 cut off wall upstream and downstream
 3. Slab invert level in the direction of travel for vehicle with 50mm min crossfall or to suit grade in the direction of the table drain.
 4. Provide 2x225 Ø PVC sewer grade drainage pipes as shown
 5. Chamfer pipes to suit batter
 6. Downstream provide approved scour protection
 7. All dimensions are in millimetres

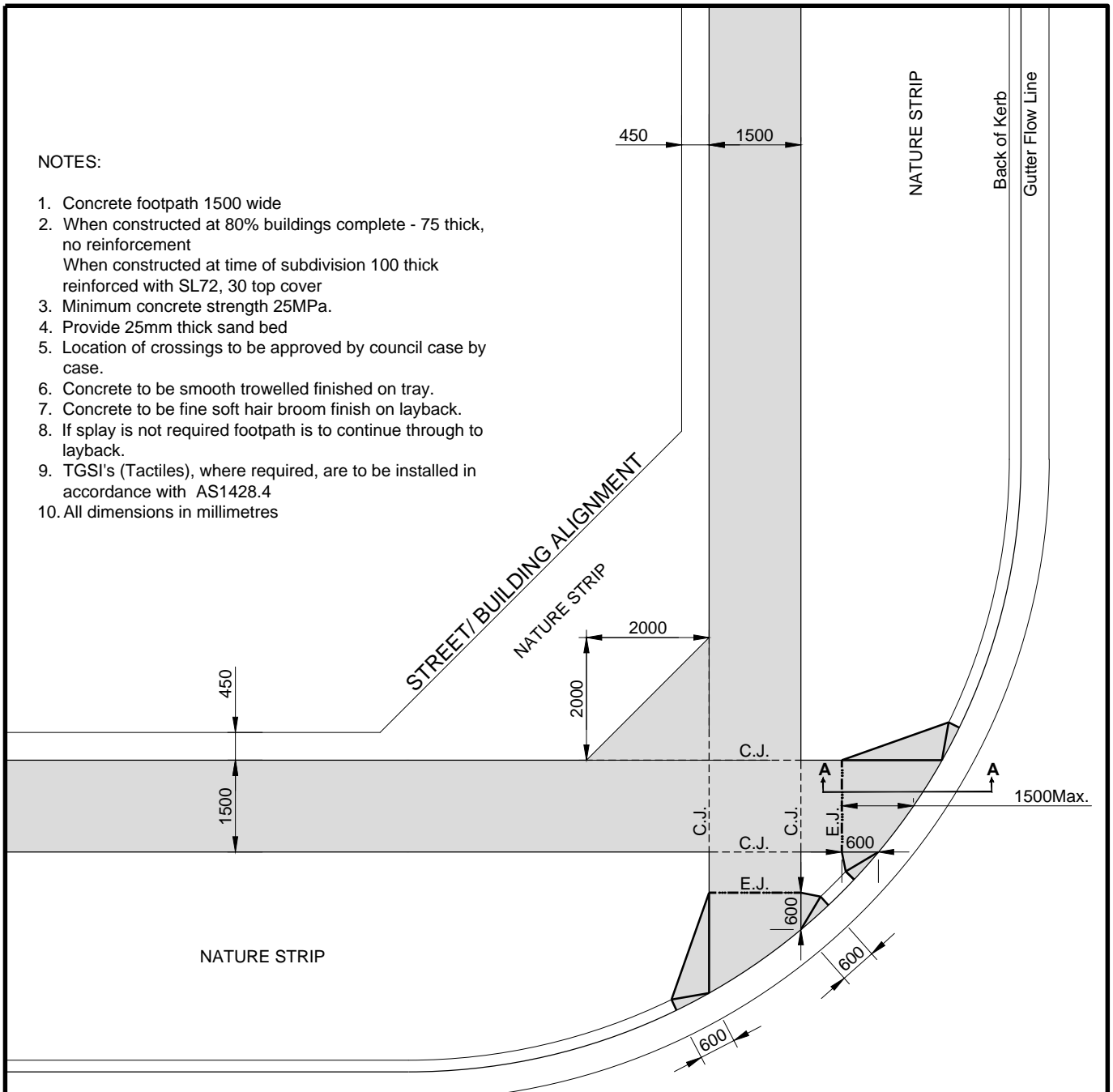


VEHICULAR CROSSING - STEEP TABLE DRAIN

WWCC Engineering Development Standards Paragraph Reference: Part 2 - 3.11		Drawing No.	
Scale: 1:50	A4	Date: 9.2013 Revised: 2.2017	EDS 02.15

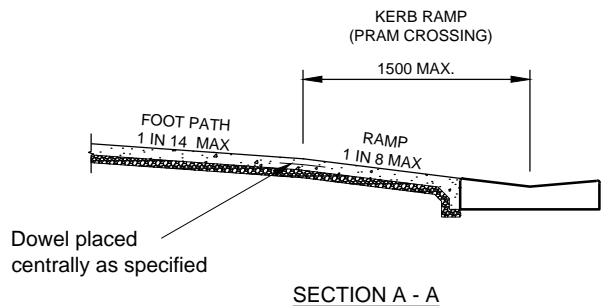
NOTES:

1. Concrete footpath 1500 wide
2. When constructed at 80% buildings complete - 75 thick, no reinforcement
When constructed at time of subdivision 100 thick reinforced with SL72, 30 top cover
3. Minimum concrete strength 25MPa.
4. Provide 25mm thick sand bed
5. Location of crossings to be approved by council case by case.
6. Concrete to be smooth trowelled finished on tray.
7. Concrete to be fine soft hair broom finish on layback.
8. If splay is not required footpath is to continue through to layback.
9. TGSi's (Tactiles), where required, are to be installed in accordance with AS1428.4
10. All dimensions in millimetres



LEGEND

- C.J. --- Control Joint
- E.J. --- Doweled Expansion Joint - 16Ø plan bar - 600 mm long @ 300 C/C



KERB RAMP DETAILS

WWCC Engineering Development Standards
Paragraph Reference: Part 2 - 2.25.4

Drawing No.

EDS 02.16A

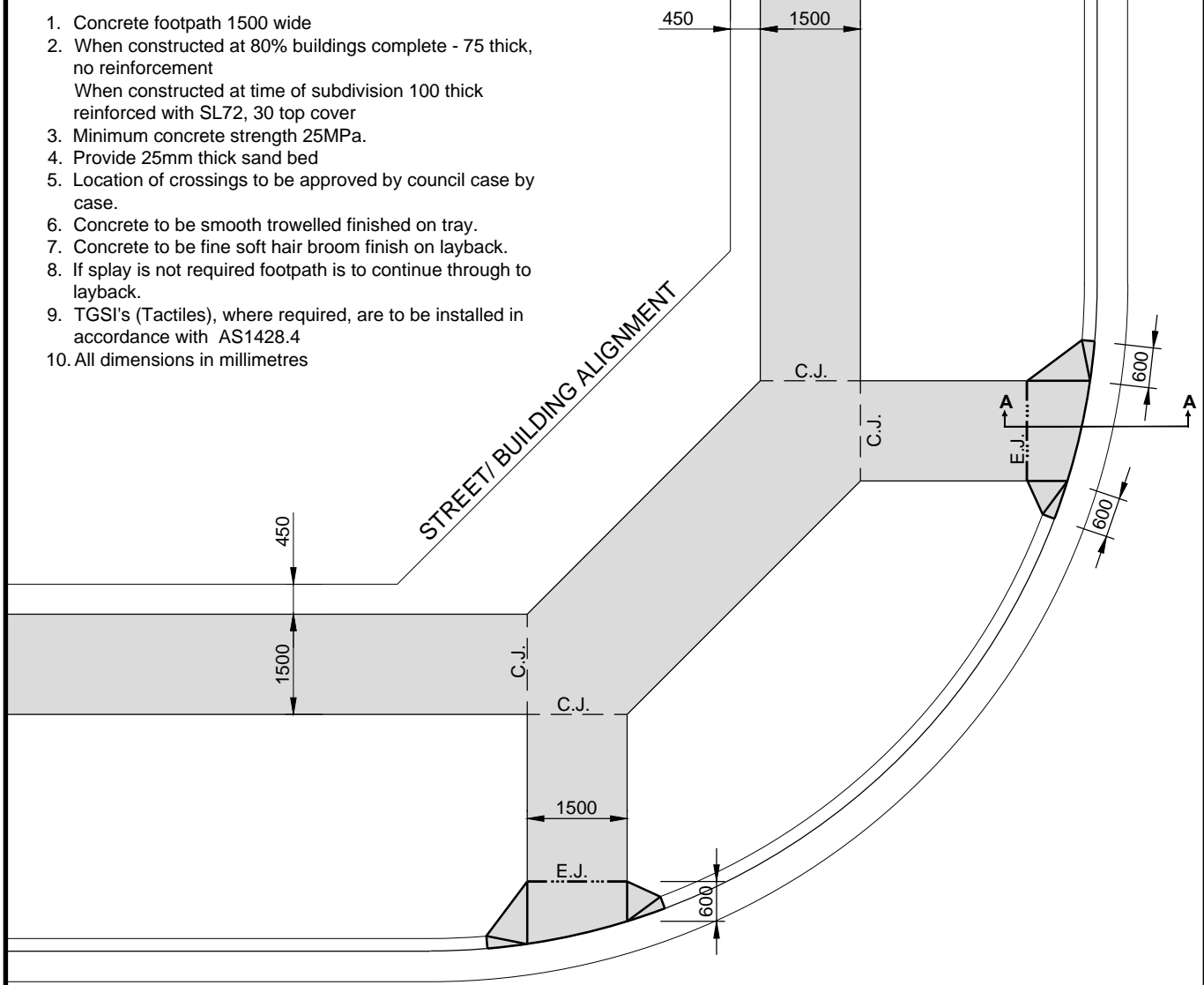
Scale: 1:100

A4

Date: 9.2013
Revised: 2.2017

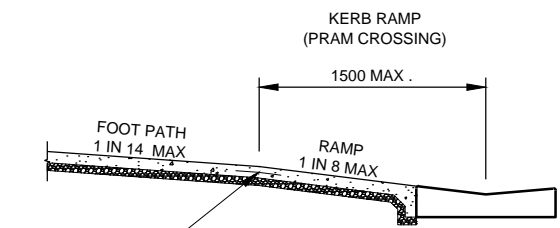
NOTES:

1. Concrete footpath 1500 wide
2. When constructed at 80% buildings complete - 75 thick, no reinforcement
When constructed at time of subdivision 100 thick reinforced with SL72, 30 top cover
3. Minimum concrete strength 25MPa.
4. Provide 25mm thick sand bed
5. Location of crossings to be approved by council case by case.
6. Concrete to be smooth trowelled finished on tray.
7. Concrete to be fine soft hair broom finish on layback.
8. If splay is not required footpath is to continue through to layback.
9. TGS's (Tactiles), where required, are to be installed in accordance with AS1428.4
10. All dimensions in millimetres



LEGEND

- C.J. — Control Joint
- E.J. — Doweled Expansion Joint - 16Ø plan bar - 600 mm long @ 300 C/C

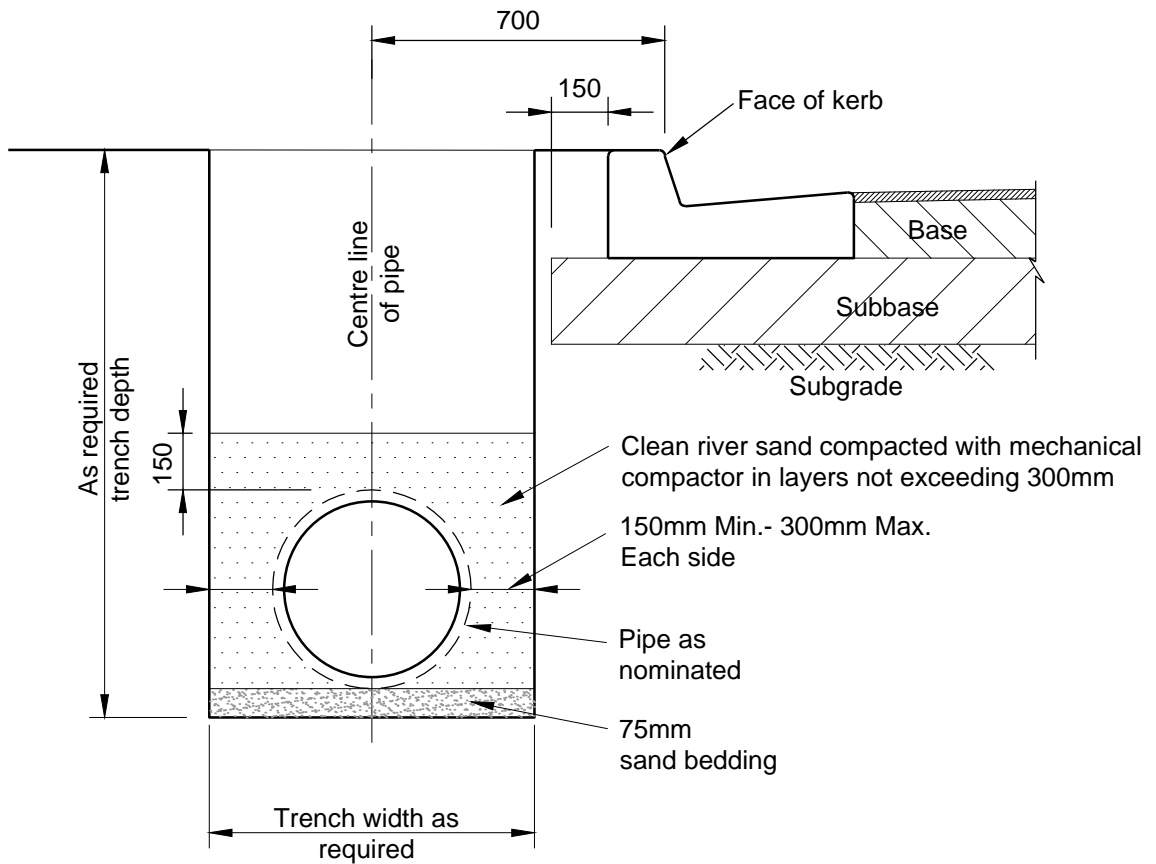


SECTION A - A



KERB RAMP DETAILS FOR ROUNDABOUTS

WWCC Engineering Development Standards Paragraph Reference: Part 2 - 2.25.4		Drawing No.
Scale: 1:100	A4	Date: 9.2013 Revised: 2.2017
		EDS 02.16B



PIPE LOCATION DETAIL

FOR PIPES 375mmØ - 525mmØ

NOTES:

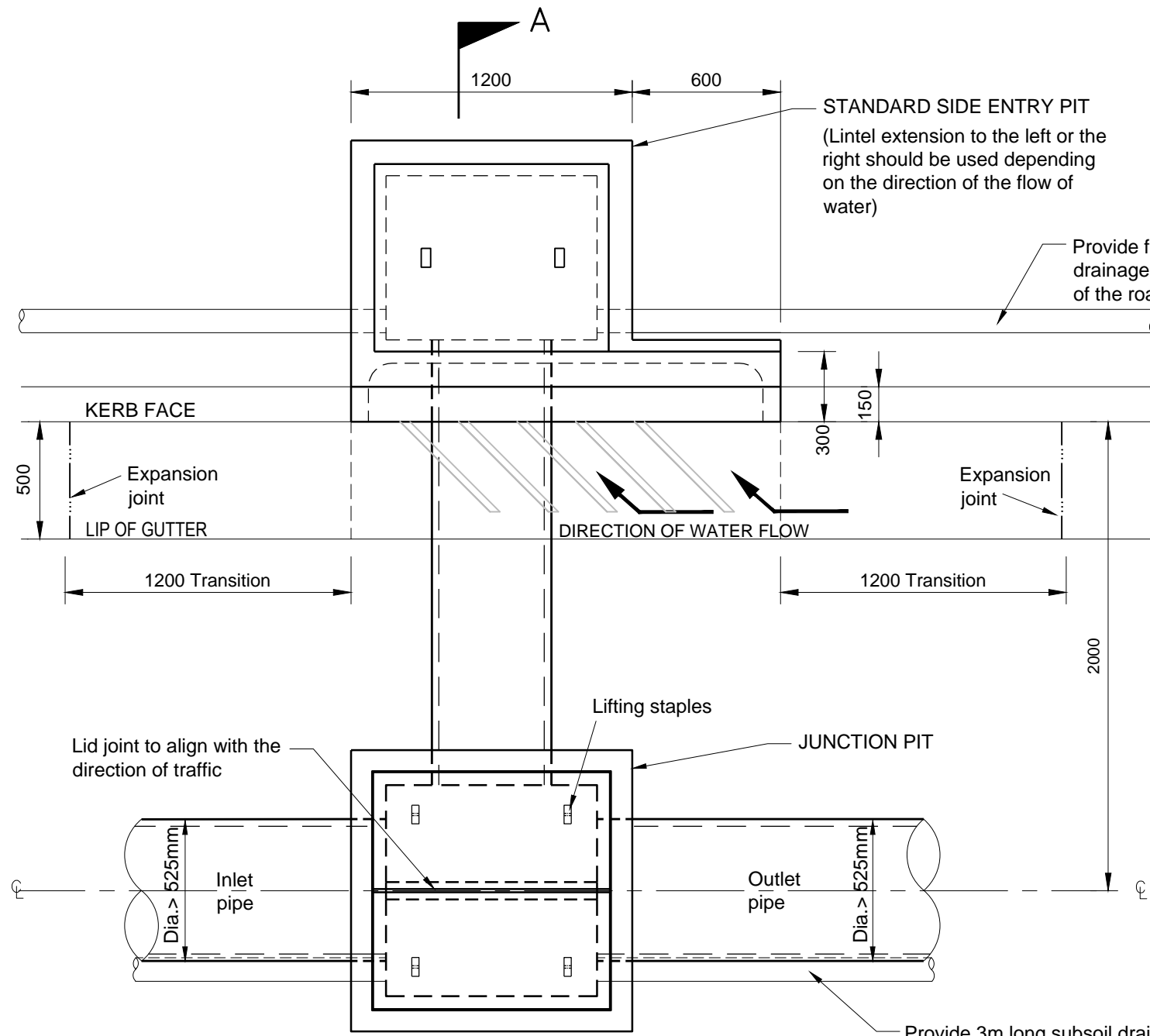
Backfill compaction to be in accordance with AS/NZS 3725 loads on buried concrete pipes.

* All dimensions are in millimetres



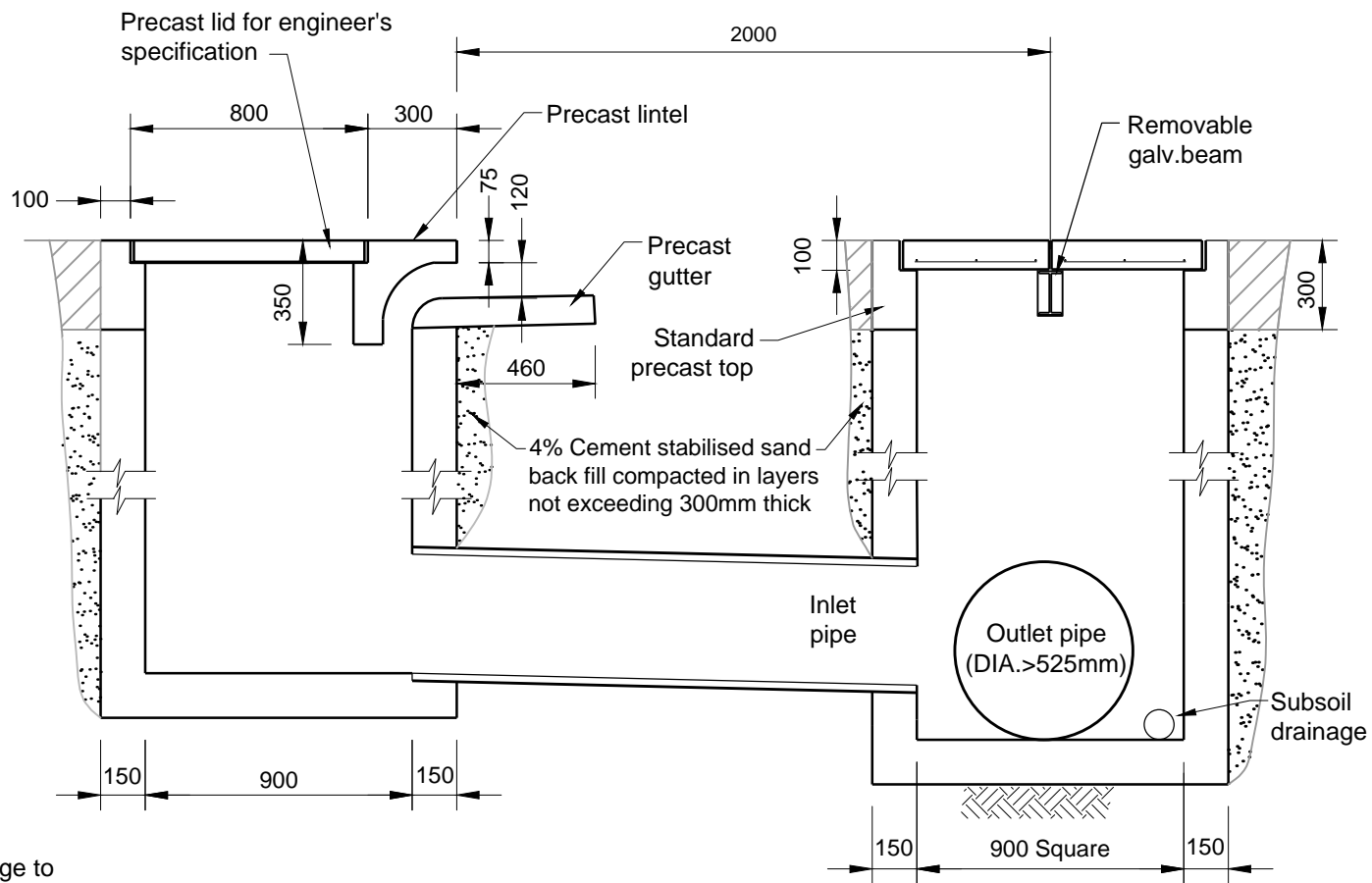
PIPE LOCATION BEHIND KERB

WWCC Engineering Development Standards Paragraph Reference: Part 3 - 4.6		Drawing No.	
Scale: Not to Scale	A4	Date: 9.2013 Revised: 2.2017	EDS 03.01



PLAN

SCALE 1:25



SECTION A-A

- * All dimensions are in millimetres unless marked otherwise
- * Min. 25MPa concrete strength if cast insitu etc.

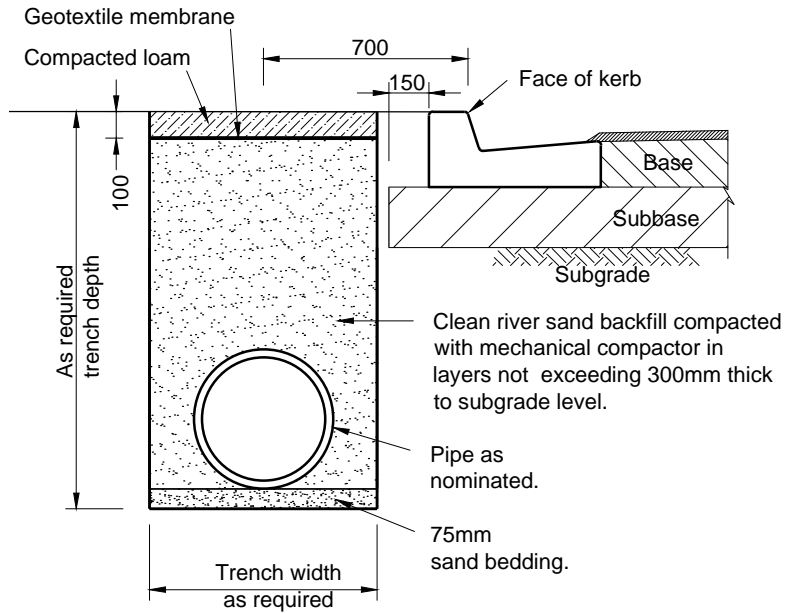


WWCC Engineering Development Standards	
Paragraph Reference: Part 3 - 4.6 & 4.7	
Scale: 1:25	A3 Date: 9.2013 Revised: 3.2015

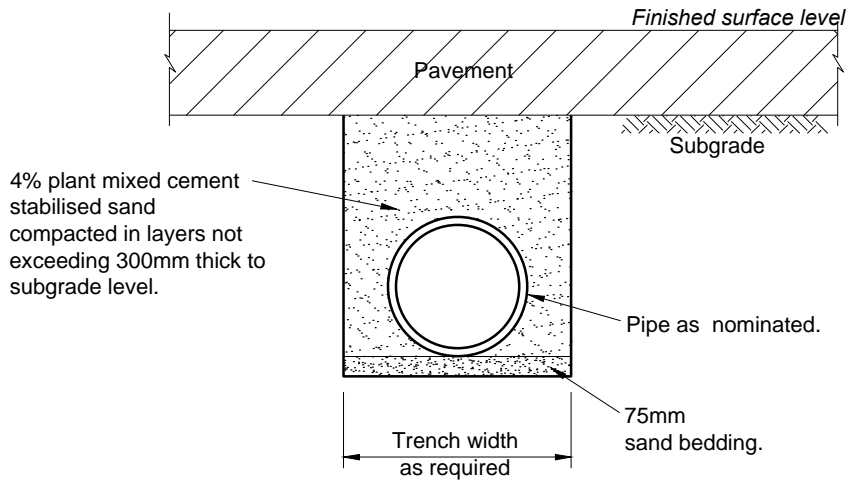
PIPE LOCATION IN FRONT OF KERB

FOR PIPES GREATER THAN 525mm DIAMETER

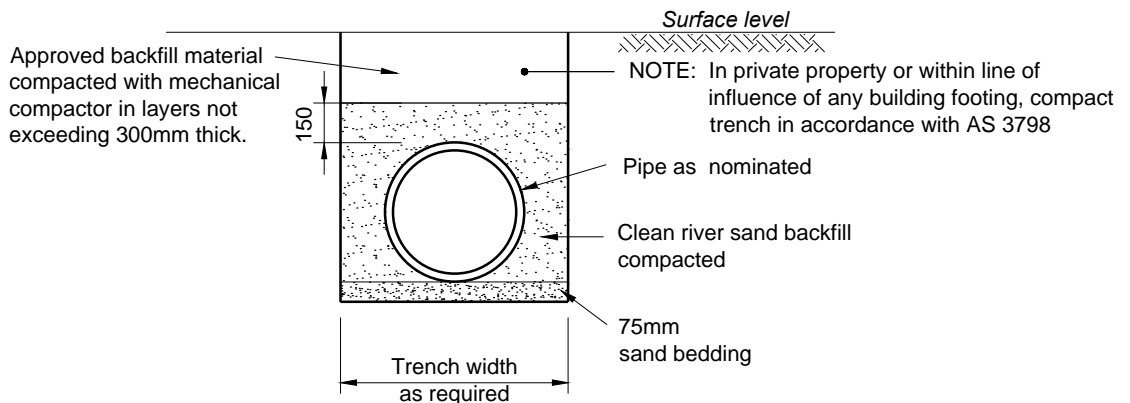
Drawing No.
EDS 03.02



PIPELINE BEHIND KERB



PIPELINE WITHIN ROAD PAVEMENT



PIPELINE OTHER AREAS



PIPELINE BACKFILL DETAILS

WWCC Engineering Development Standards
Paragraph Reference: Part 3 - 4.5 & 4.6

Drawing No.

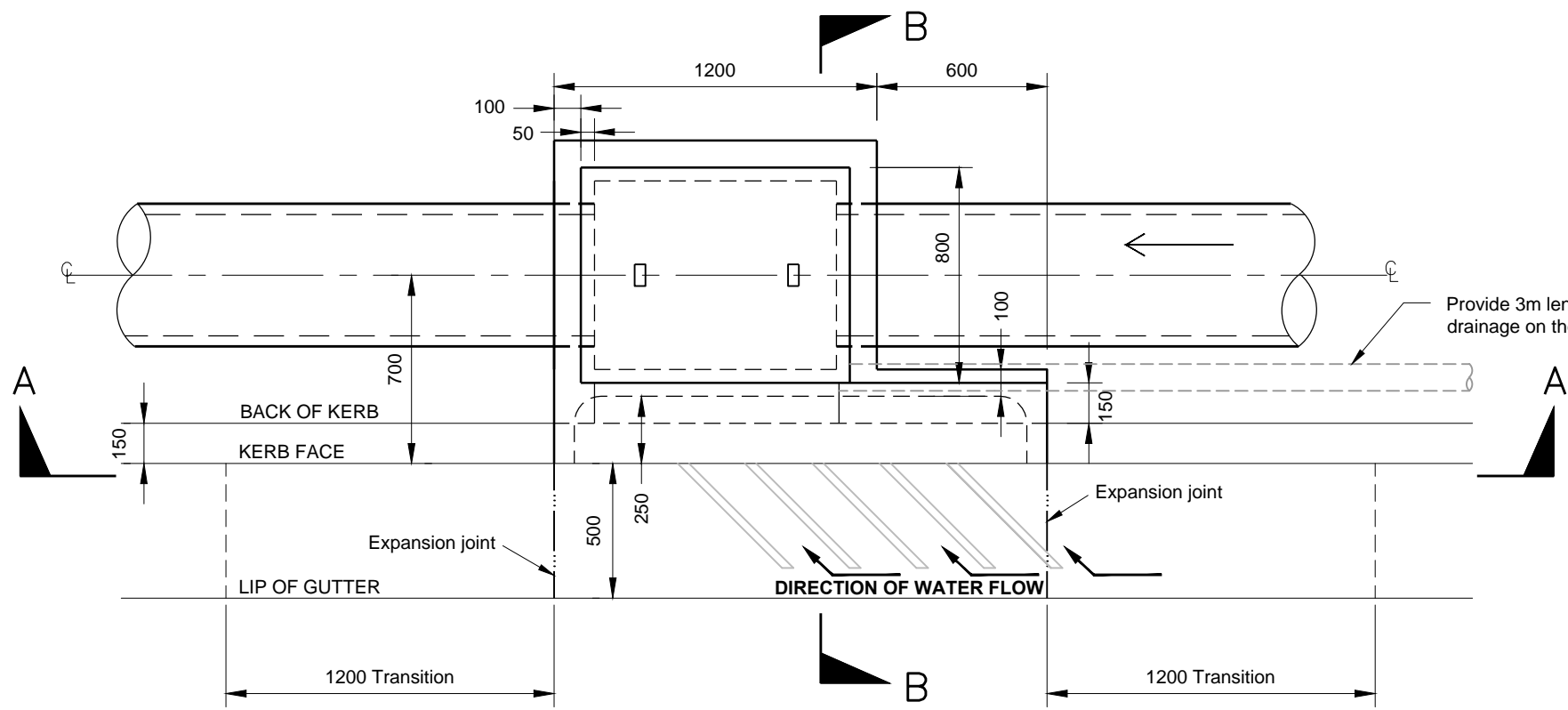
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A4

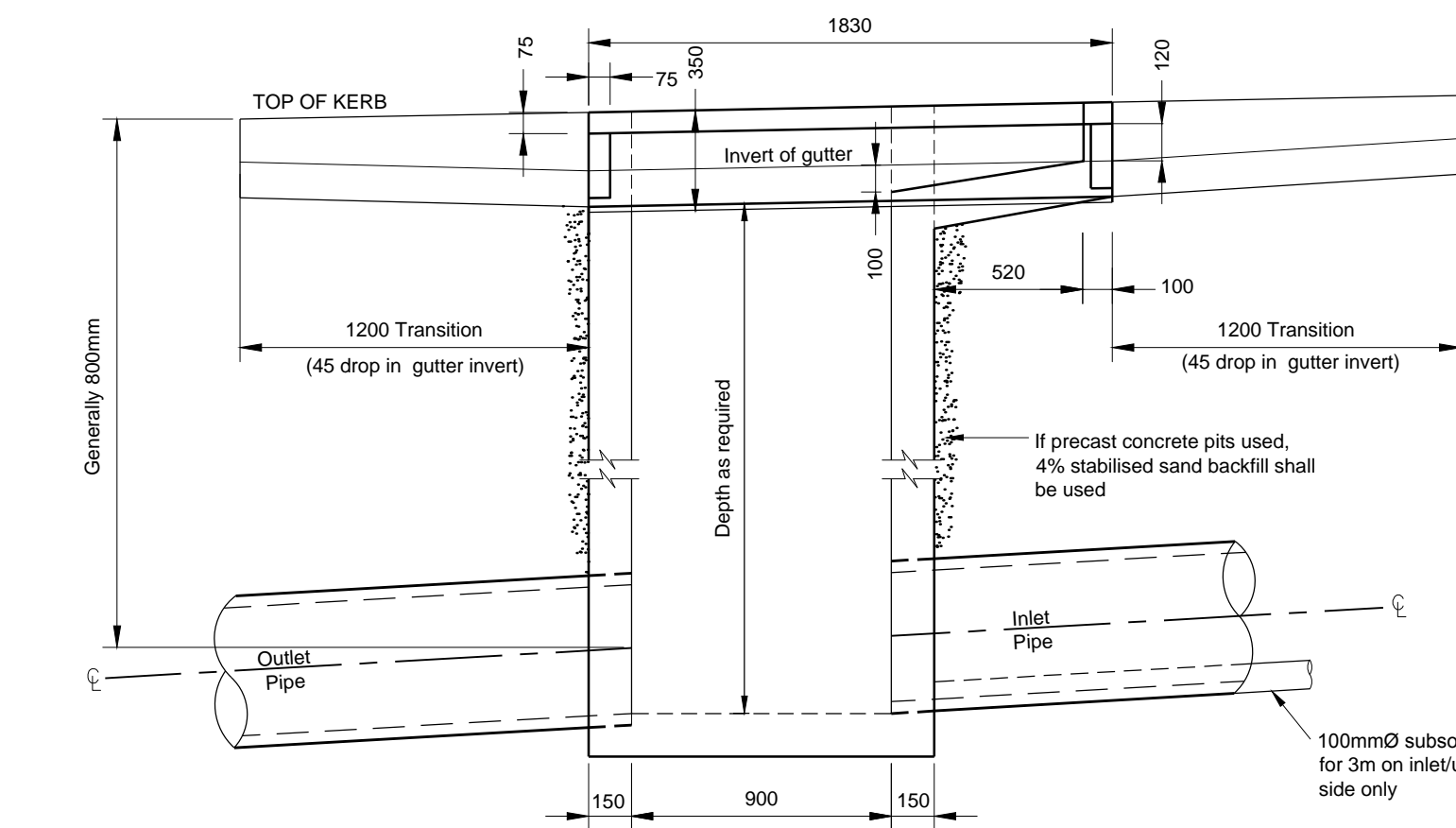
Date: 9.2013

Revised: 2.2017

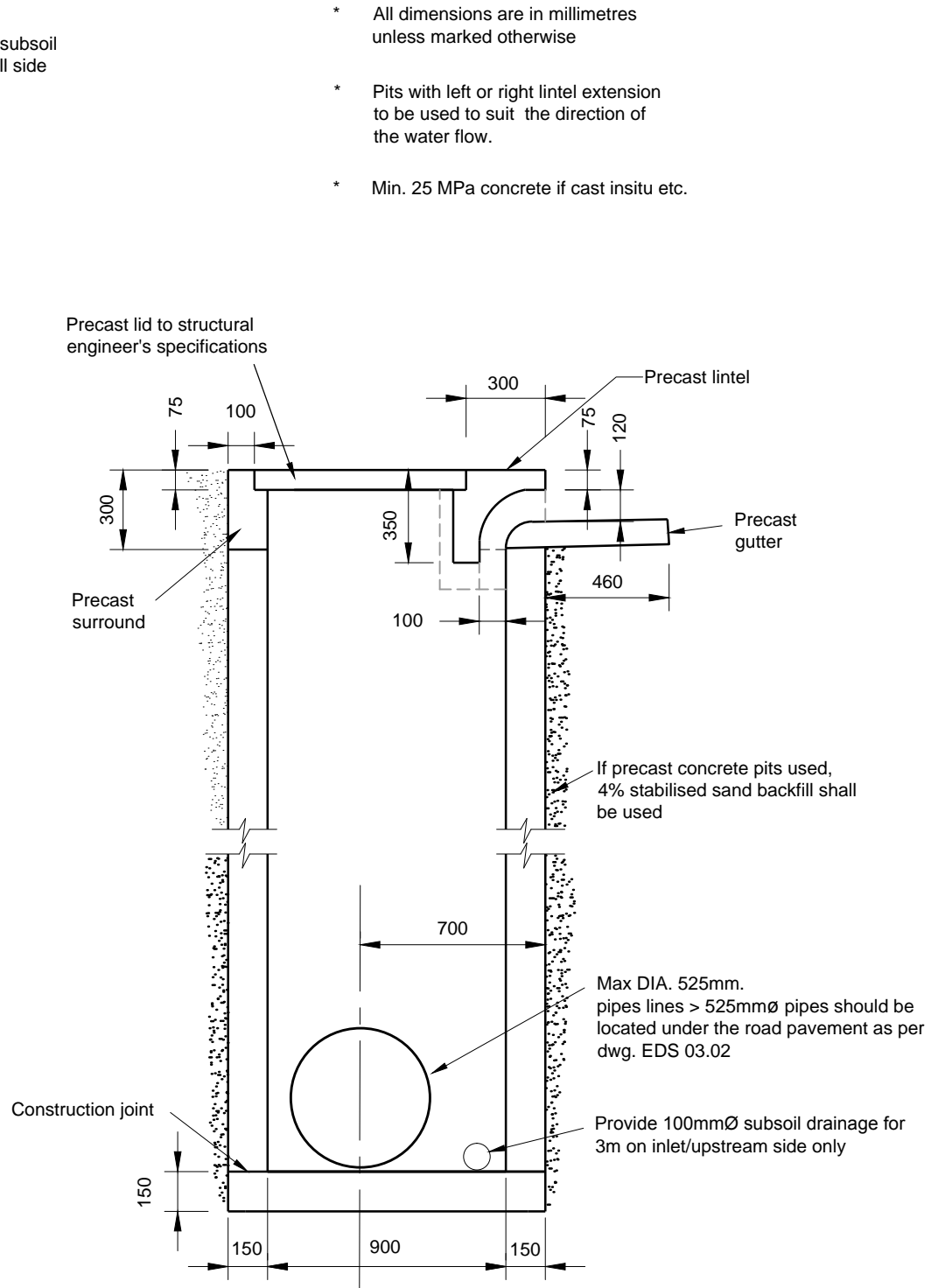
EDS 03.03



PLAN



SECTION A-A



SECTION B-B

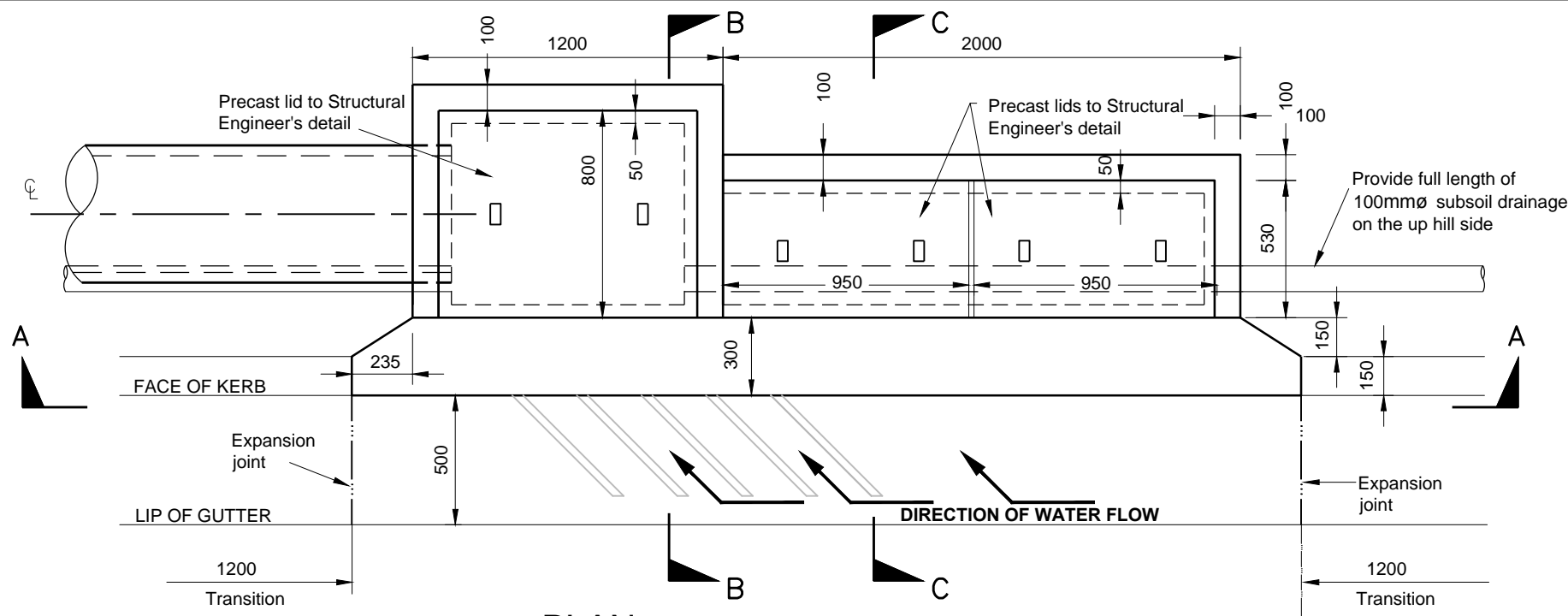
- * All dimensions are in millimetres unless marked otherwise
- * Pits with left or right lintel extension to be used to suit the direction of the water flow.
- * Min. 25 MPa concrete if cast insitu etc.



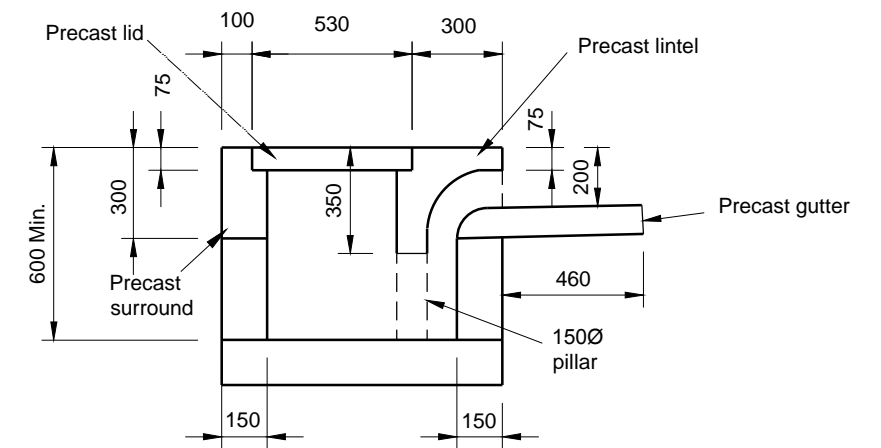
WWCC Engineering Development Standards Paragraph Reference: Part 3 - 4.7	
Scale: 1:25	A3 Date: 9.2013 Revised: 2.2017

SIDE ENTRY PIT
FOR PIPES UP TO 5252mm DIAMETER

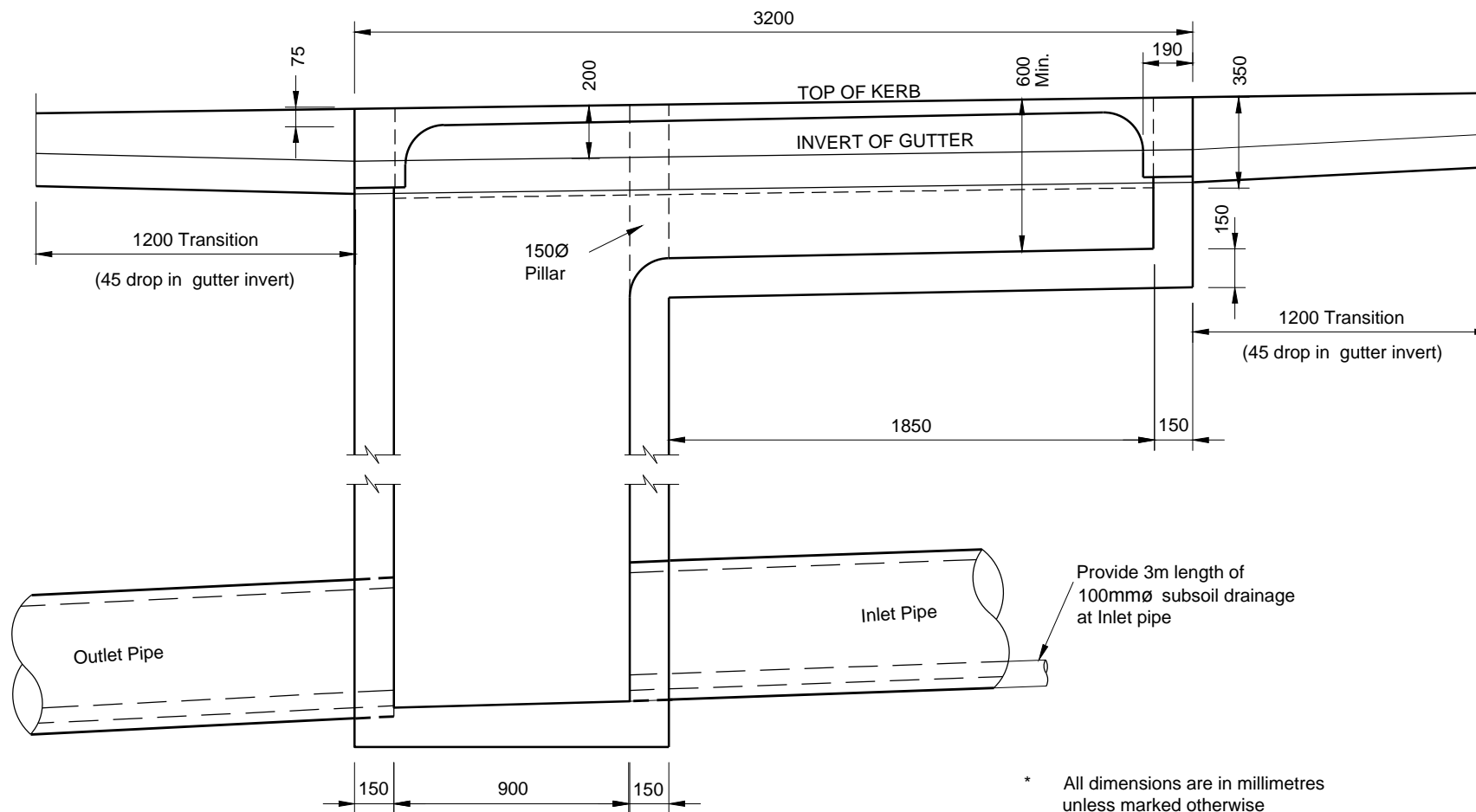
Drawing No.
EDS 03.04



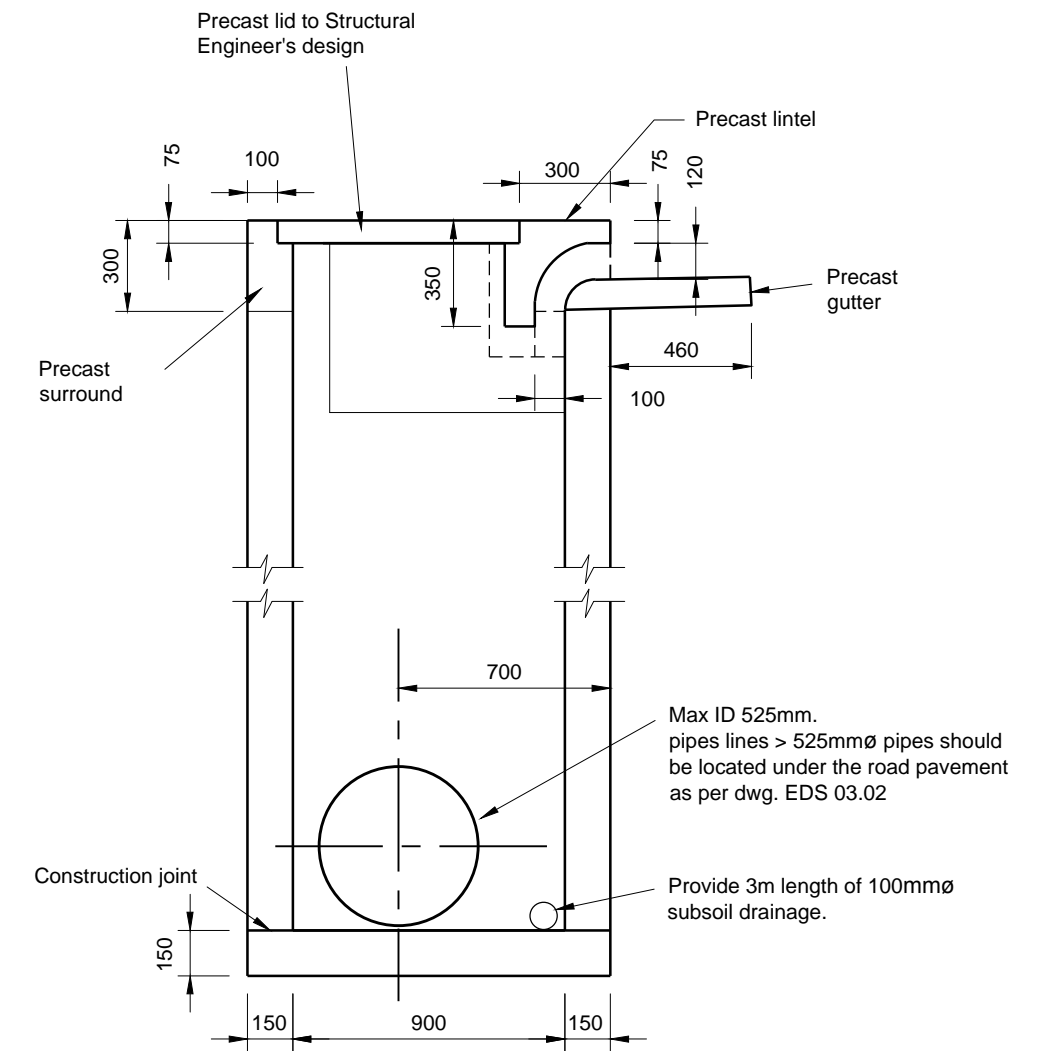
PLAN



SECTION C-C

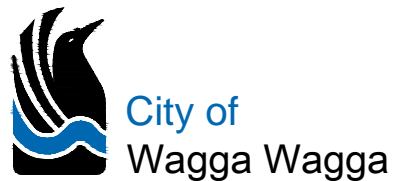


SECTION A-A



SECTION B-B

- * All dimensions are in millimetres unless marked otherwise
- * If not using precast concrete pits, cast insitu is acceptable with minimum 25MPa concrete.

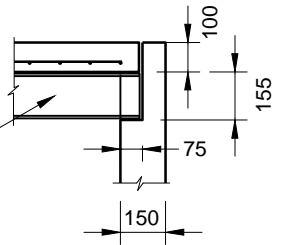


WWCC Engineering Development Standards	
Paragraph Reference: Part 3 - 4.7	
Scale: 1:25	A3 Date: 9.2013 Revised: 2.2017

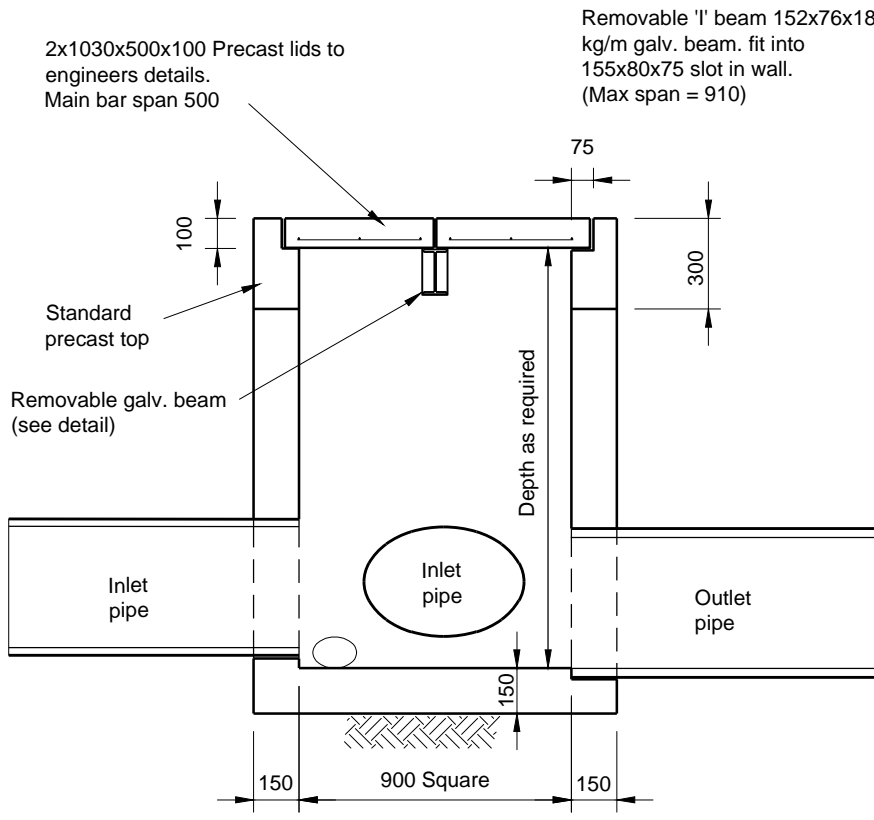
SIDE ENTRY PIT - EXTENDED LINTEL

FOER PIPES UP TO 525mm DIAMETER

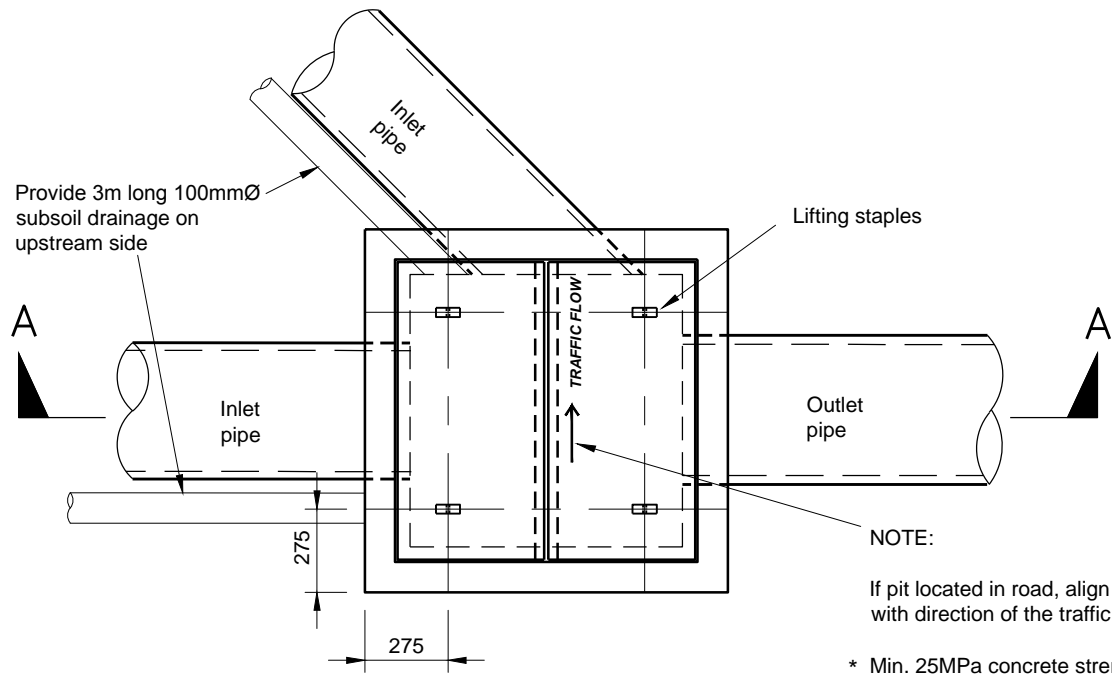
Drawing No.
EDS 03.05



BEAM DETAIL



SECTION A-A



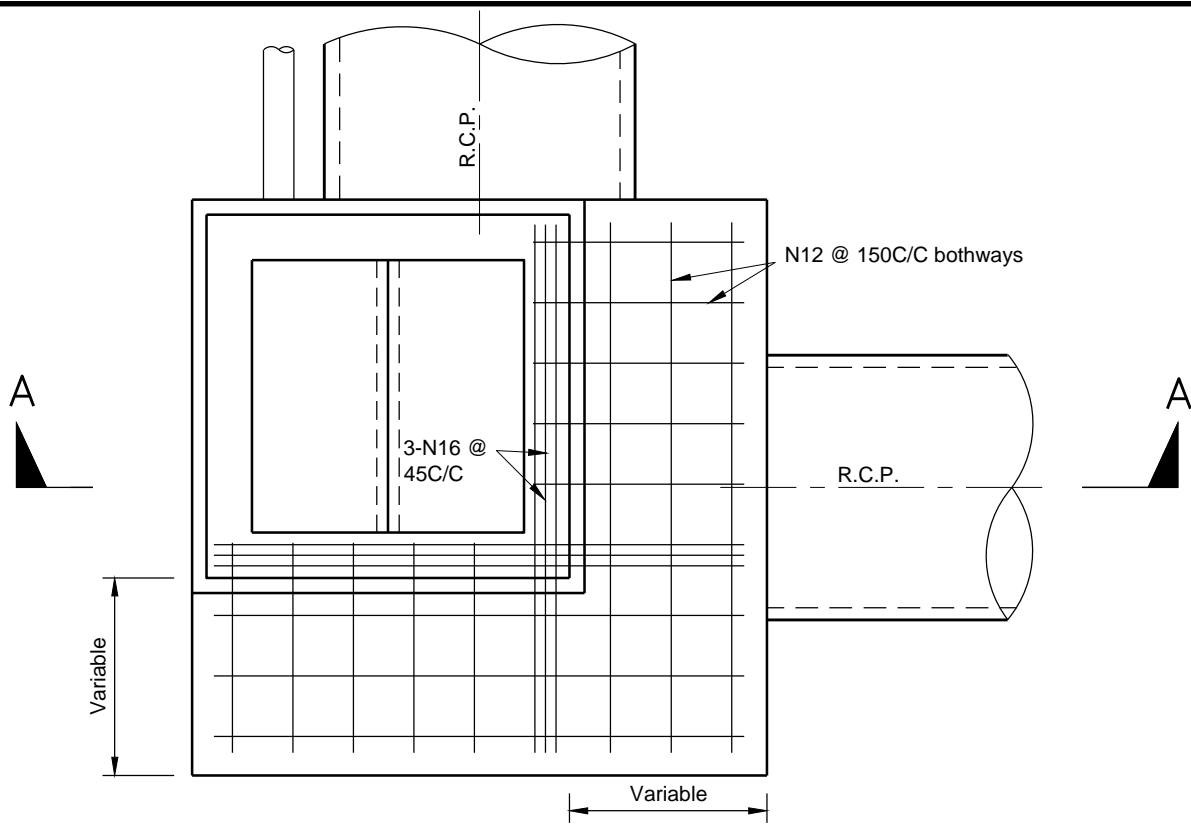
PLAN

NOTE:
 If pit located in road, align lids with direction of the traffic flow.
 * Min. 25MPa concrete strength
 * All dimensions are in millimetres

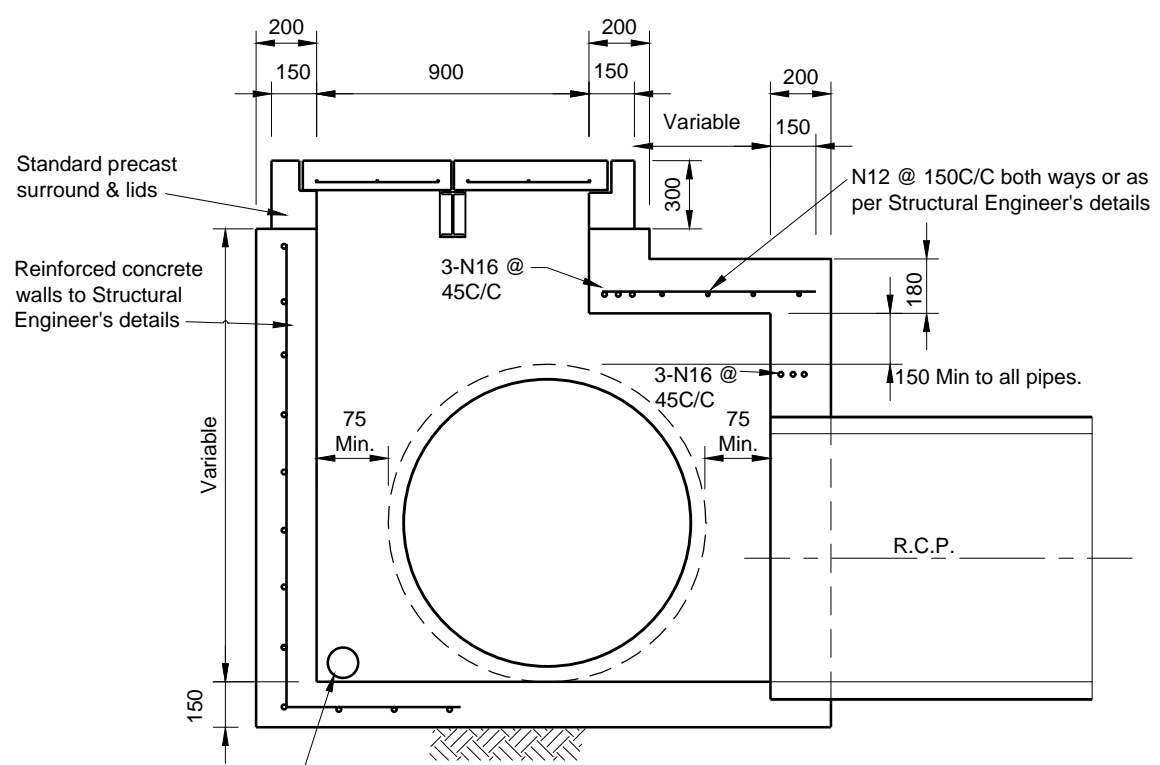


JUNCTION PIT

WWCC Engineering Development Standards Paragraph Reference: Part 3 - 4.7		Drawing No.	
Scale: 1:25	A4	Date: 9.2013 Revised: 2.2017	EDS 03.06



PLAN



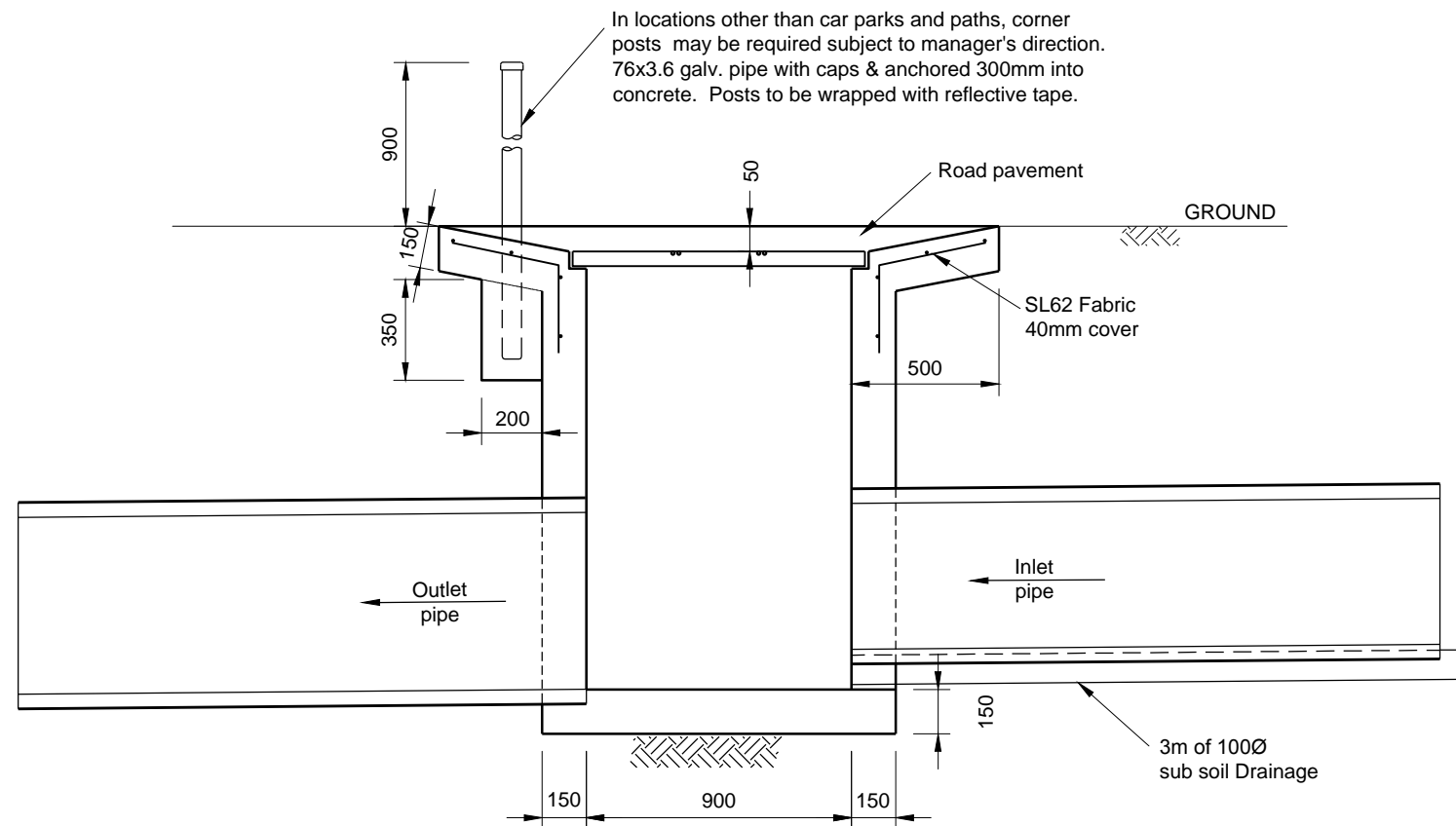
SECTION A-A

- * Min. 25MPa concrete
- * All dimensions are in millimetres unless marked otherwise

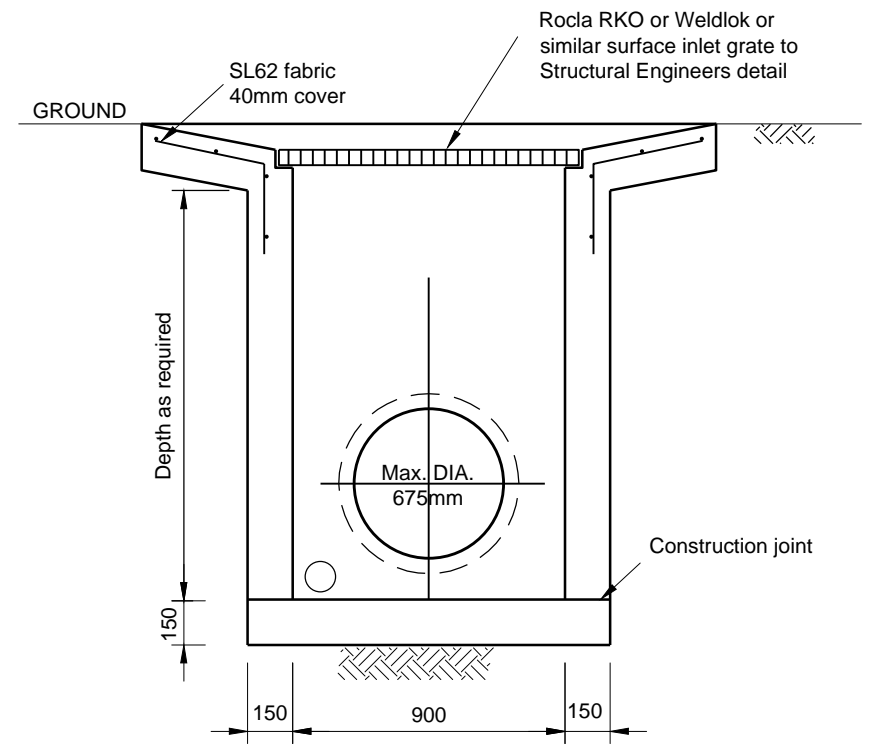


EXTENDED JUNCTION PIT

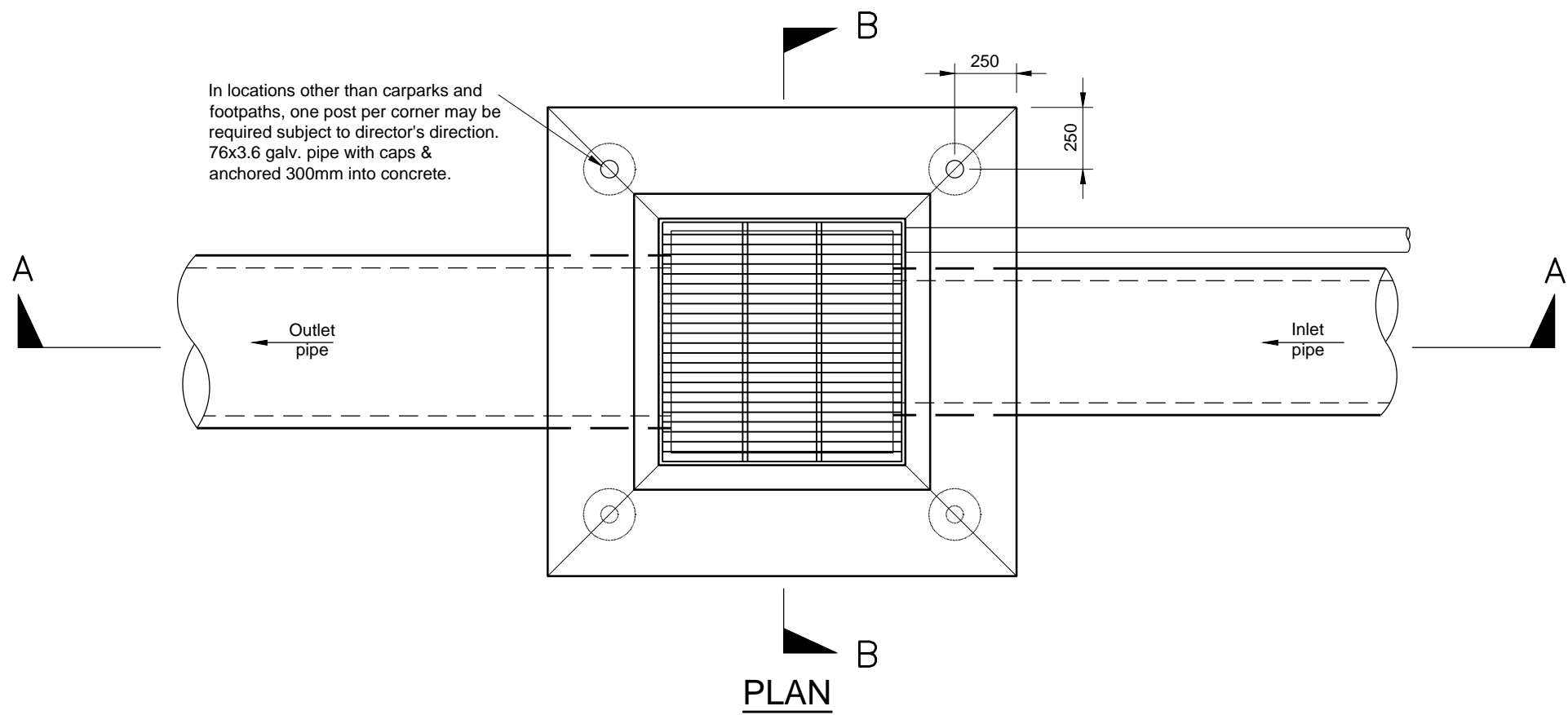
WWCC Engineering Development Standards Paragraph Reference: Part 3 - 4.7		Drawing No.	
Scale: 1:25	A4	Date: 9.2013 Revised: 2.2017	EDS 03.07



SECTION A-A



SECTION B-B



PLAN

In locations other than carparks and footpaths, one post per corner may be required subject to director's direction. 76x3.6 galv. pipe with caps & anchored 300mm into concrete.

In locations other than car parks and paths, corner posts may be required subject to manager's direction. 76x3.6 galv. pipe with caps & anchored 300mm into concrete. Posts to be wrapped with reflective tape.

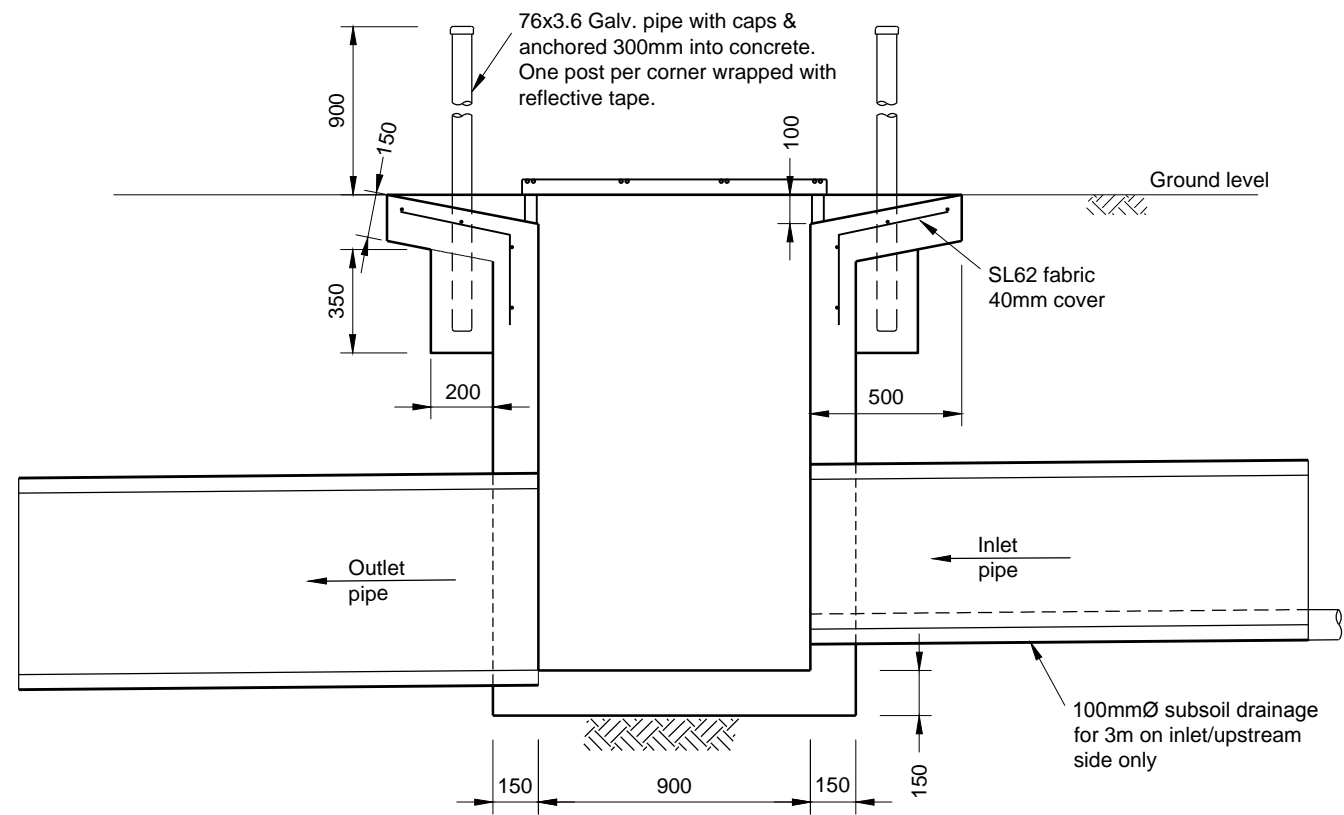
- GENERAL NOTES**
- * Minimum concrete strength 25Mpa
 - * Posts are to be included as per the direction of the director
 - * Surface inlet pits are generally to be used in carparks and footpaths
 - * All dimensions are in millimetres unless marked otherwise



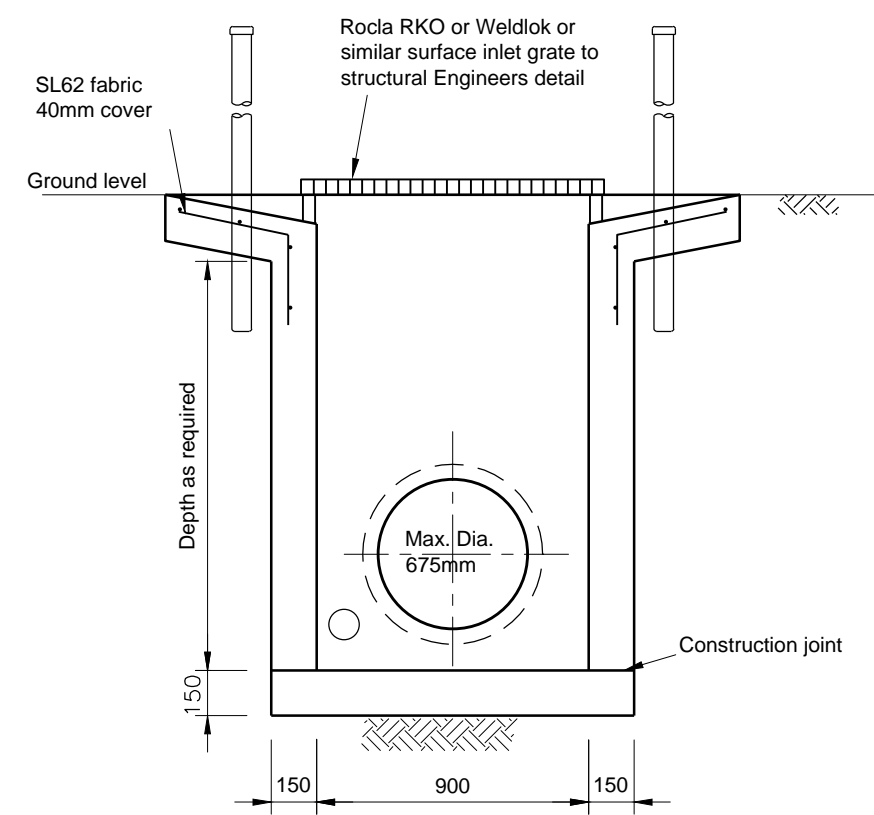
WWCC Engineering Development Standards	
Paragraph Reference: Part 3 - 4.7	
Scale: 1:25	A3 Date: 9.2013 Revised: 2.2017

SURFACE INLET PIT
PIPES UP TO 675mm DIAMETER
FOR PATHS AND CARPARKS

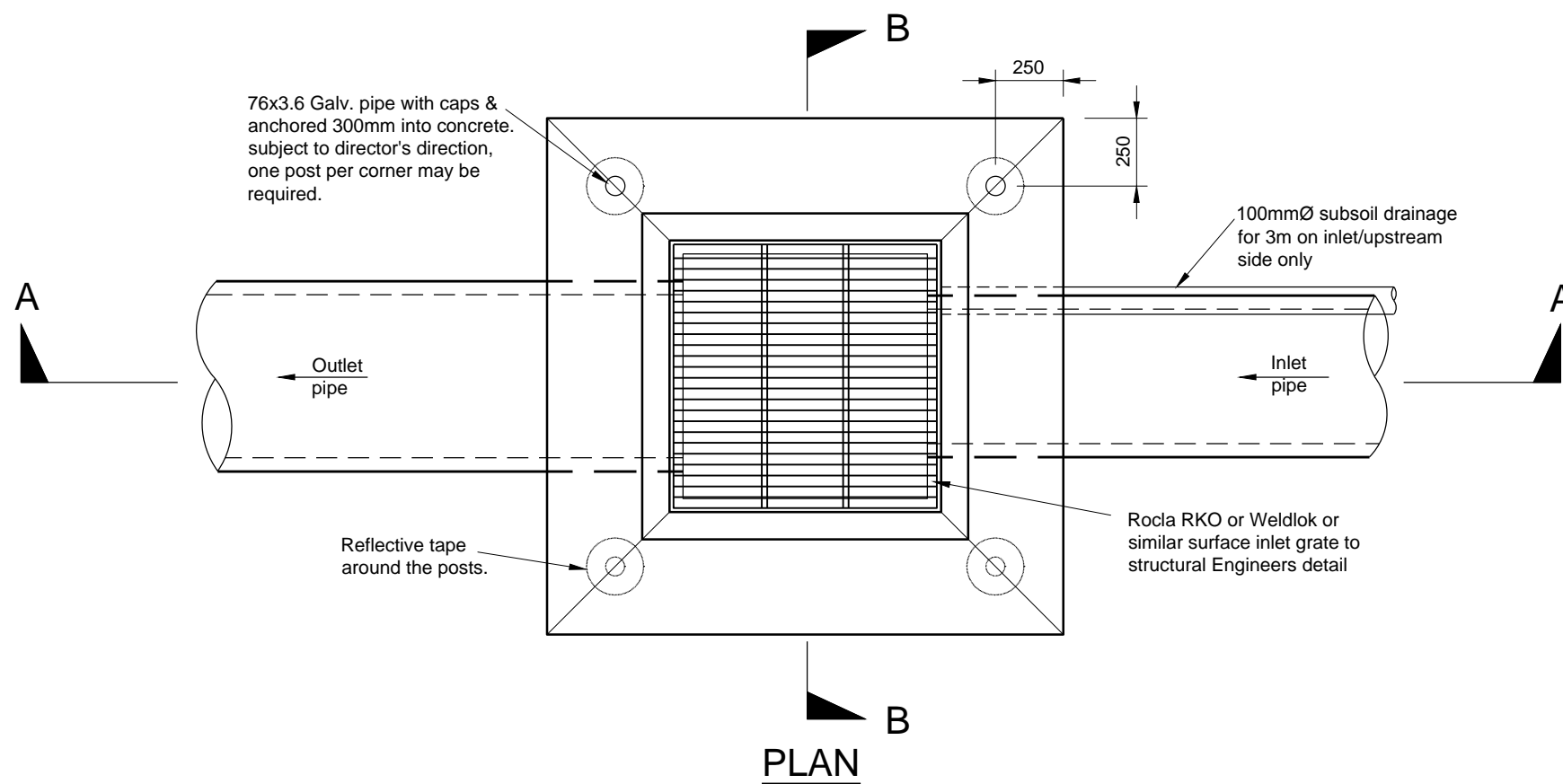
Drawing No.
EDS 03.08



SECTION A-A



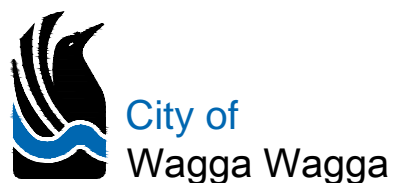
SECTION B-B



PLAN

GENERAL NOTES

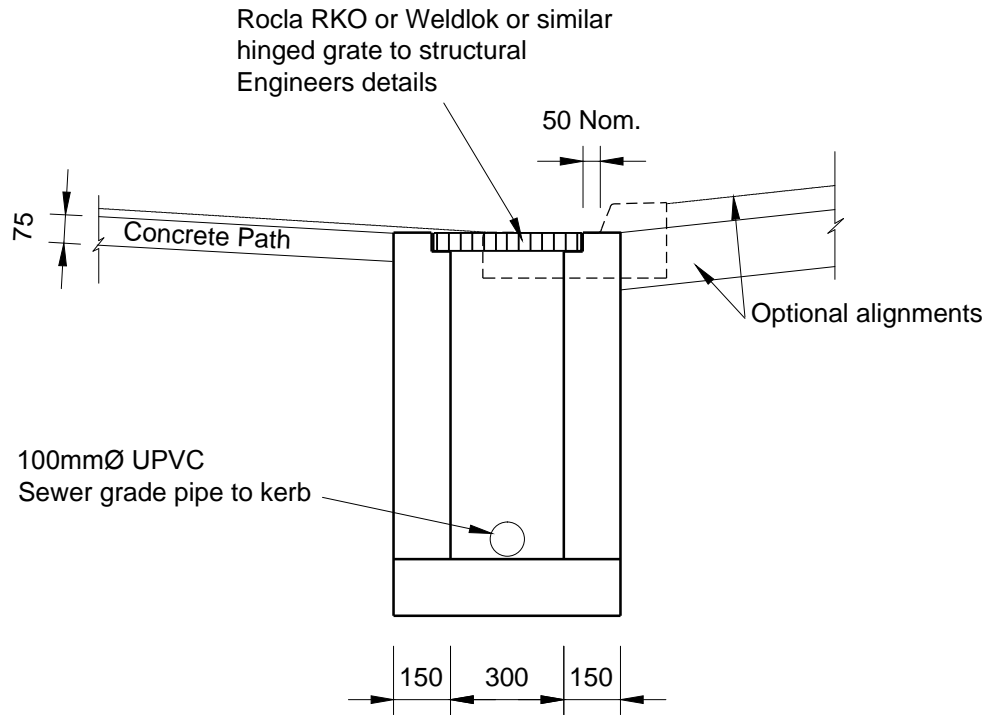
- * Minimum 25MPa concrete strength
- * Surcharge surface inlet pits are generally to be used in grassed areas and detention basins
- * Posts are to be included at the direction of the director
- * All dimensions are in millimetres unless marked otherwise



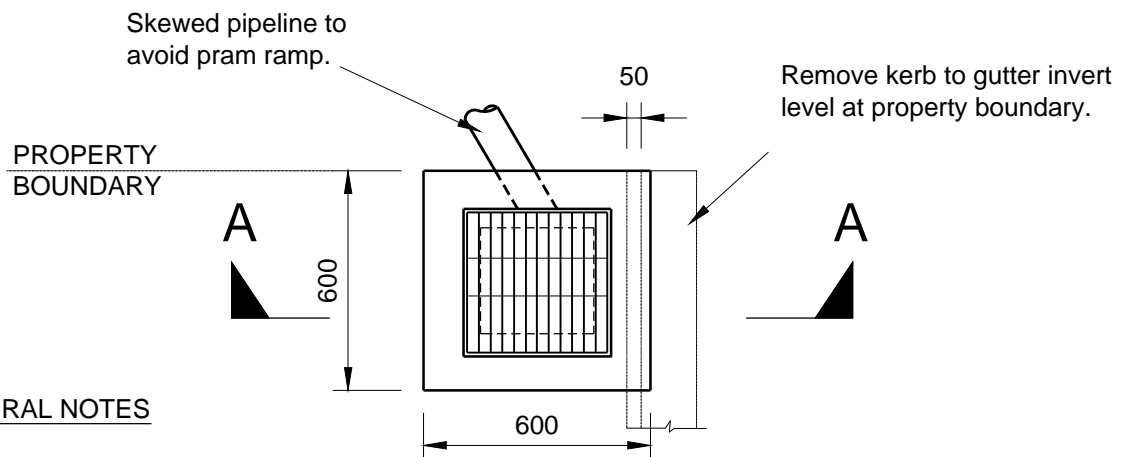
WWCC Engineering Development Standards	
Paragraph Reference: Part 3 - 4.6 & 4.7	
Scale: 1:25	Date: 9.2013
A3	Revised: 2.2017

SURCHARGE SURFACE INLET PIT
PIPES UP TO 675mm DIAMETER
FOR GRASSED AREAS AND DETENTION BASINS

Drawing No.
EDS 03.09



SECTION A-A



GENERAL NOTES

- * Minimum concrete strength 25MPa
- * All dimensions are in millimetres unless marked otherwise

PLAN

SCALE 1:20



**City of
Wagga Wagga**

MINOR INLET PIT

WWCC Engineering Development Standards
Paragraph Reference: Part 3 - 4.7

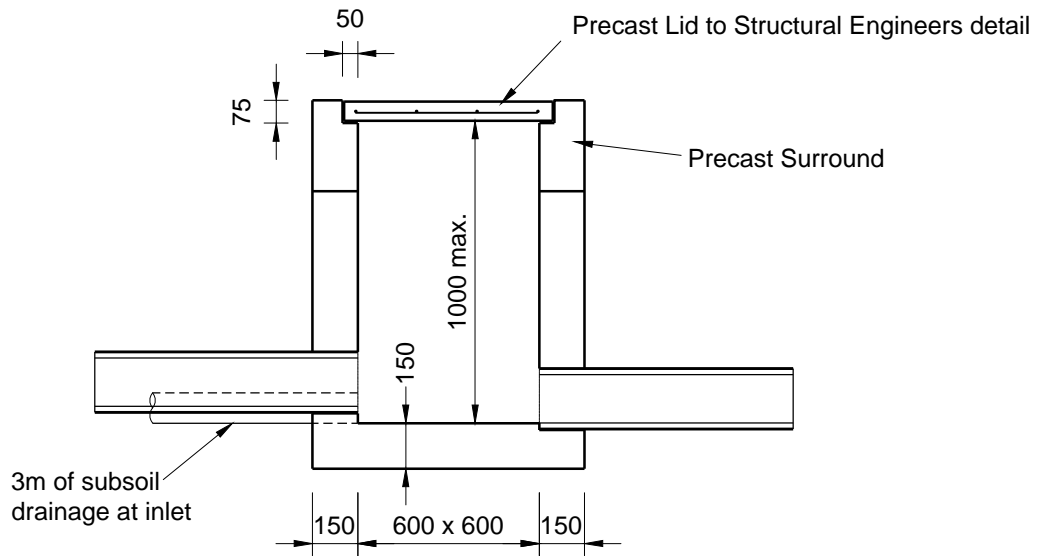
Drawing No.

Scale: 1:20

A4

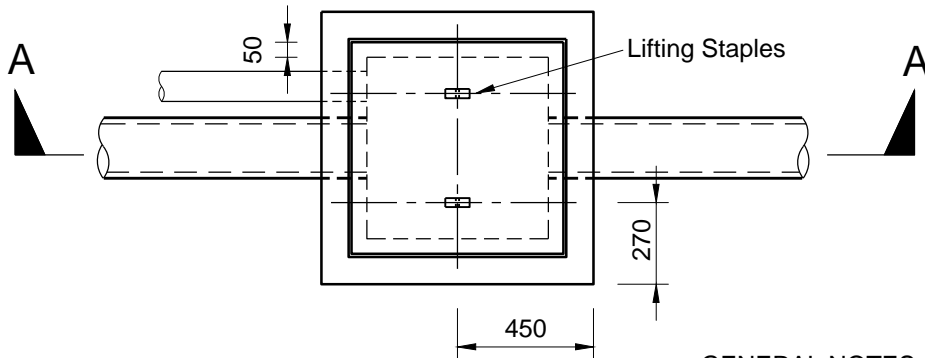
Date: 9.2013
Revised: 2.2017

EDS 03.10



SECTION A-A

NOTE - Where depth exceeds 1m,
use 900x900 Junction Pit.



PLAN

GENERAL NOTES

- * Minimum concrete strength 25MPa
- * All dimensions are in millimetres unless marked otherwise



REAR OF LOT INSPECTION/JUNCTION PIT

WWCC Engineering Development Standards
Paragraph Reference: Part 3 - 4.7

Drawing No.

Scale: 1:25

A4

Date: 9.2013
Revised: 2.2017

EDS 03.11

DRAINAGE CONNECTION TO KERB

WWCC Engineering Development Standards
Paragraph Reference: Part 3 - 4.5

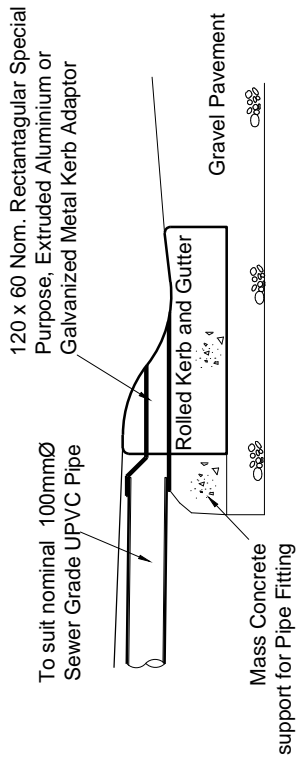
Drawing No.

Scale: As Shown

A4

Date: 9.2013
Revised: 2.2017

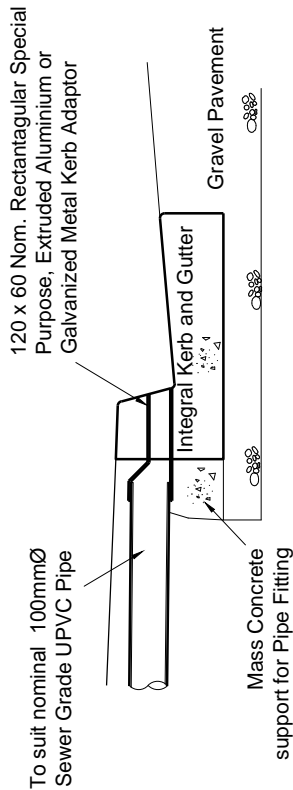
EDS 03.12



ROLLED KERB & GUTTER DRAINAGE CONNECTION

To be located on the downhill boundary
of each lot to be serviced

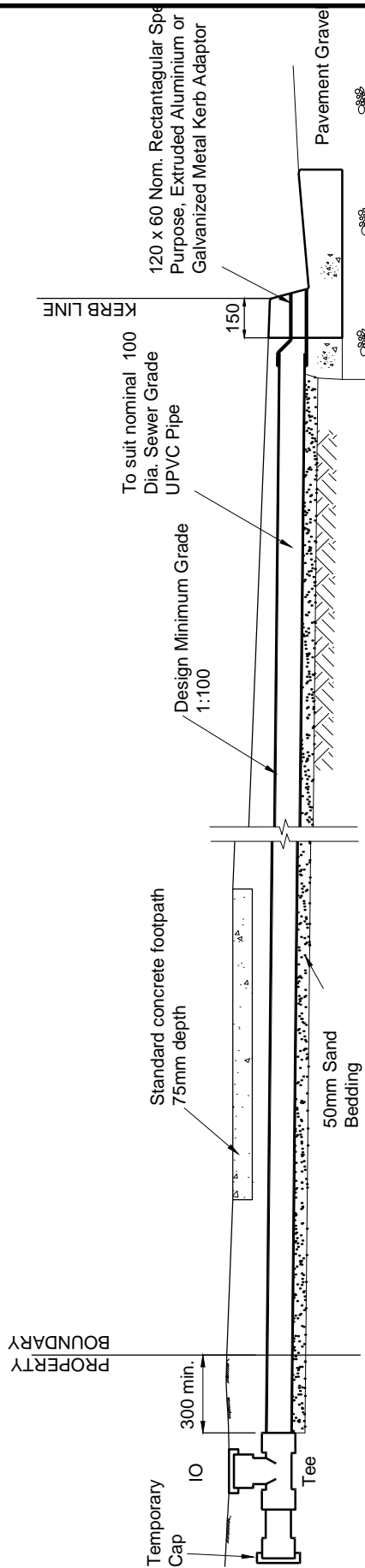
SCALE 1:20



INTEGRAL KERB & GUTTER DRAINAGE CONNECTION

To be located on the downhill boundary
of each lot to be serviced

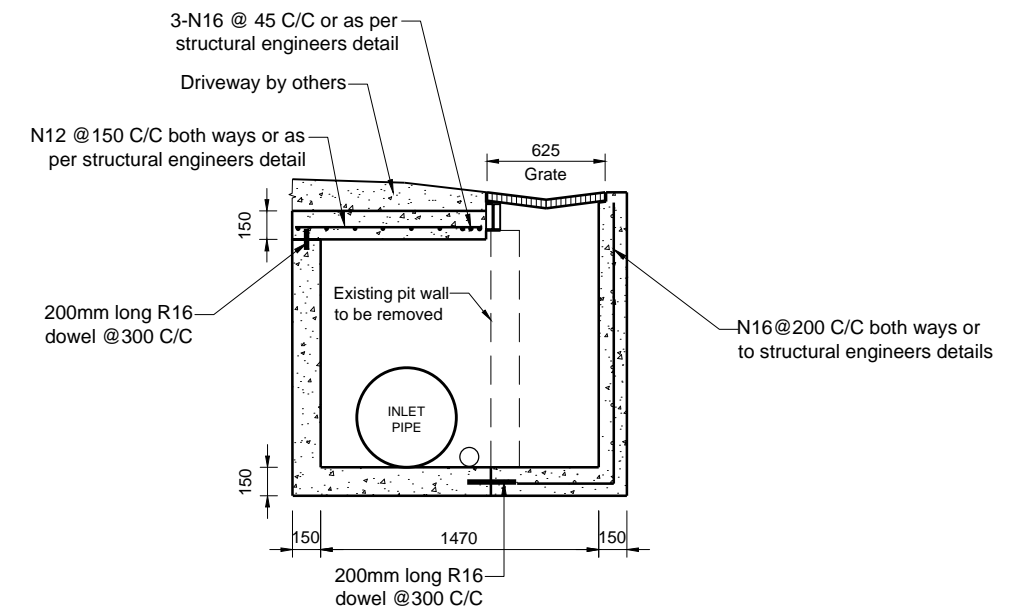
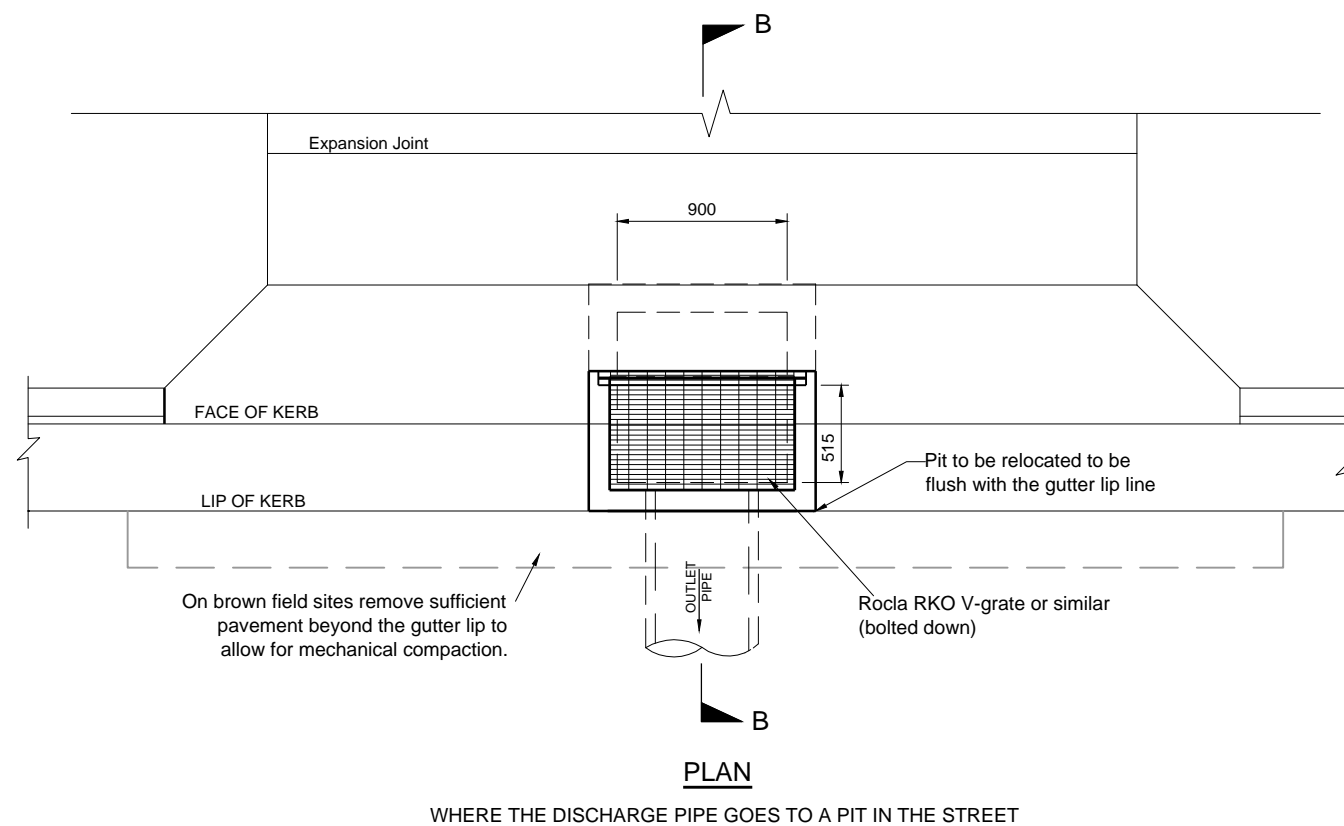
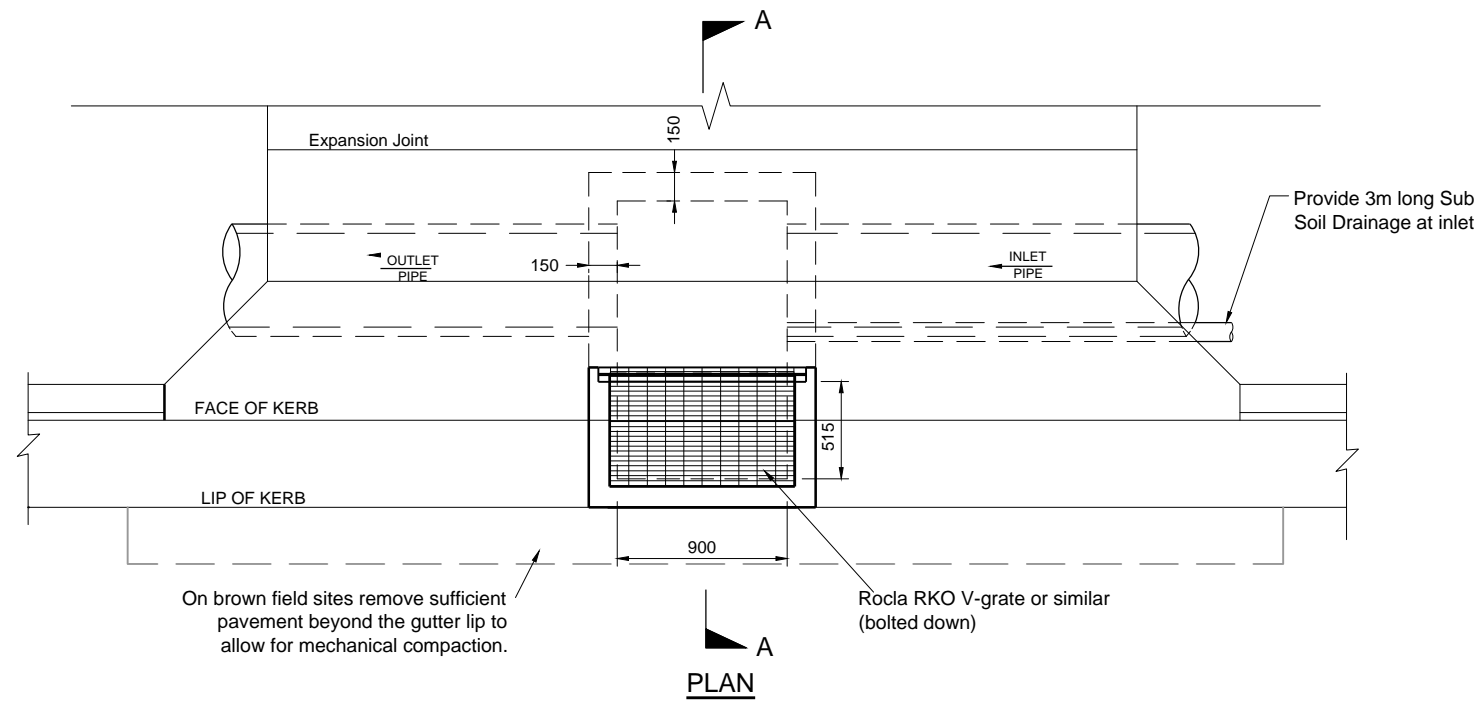
SCALE 1:20



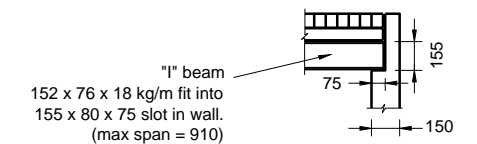
TYPICAL CROSS SECTION OF ROOF TO GUTTER DRAINAGE CONNECTION

SCALE 1:25

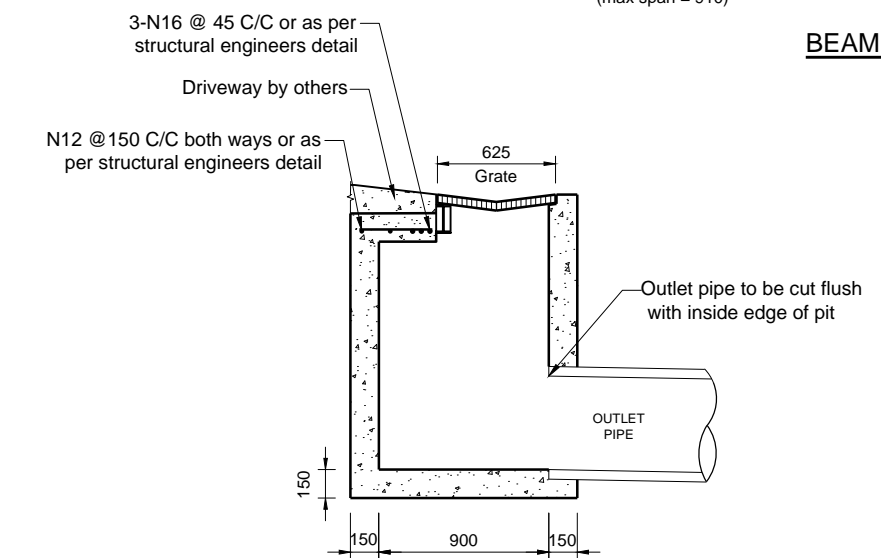
* As per AS 3500 Section 8.5, This arrangement required for commercial & industrial premises. Also recommend for residential use



SECTION A-A



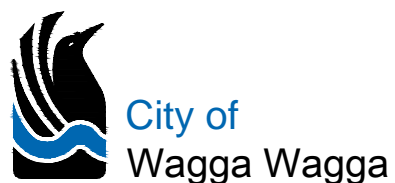
BEAM DETAIL



SECTION B-B

NOTES:

1. Last resort option, consult with council first. Approval from manager required
2. Pits deeper than 1.8m to be as per structural engineers detail
3. Min. 25MPa concrete
4. All dimensions are in millimetres



WWCC Engineering Development Standards
Paragraph Reference: Part 3 - 4.7

Scale: 1:40

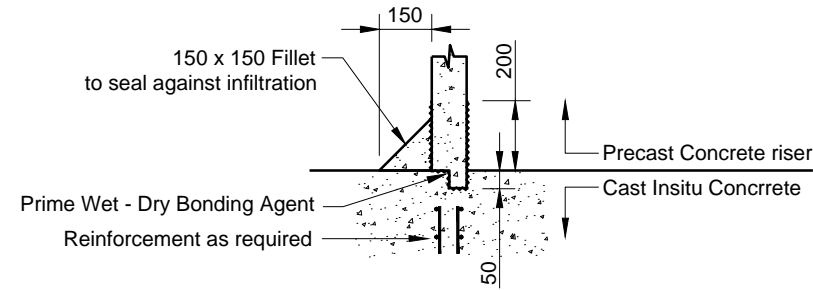
A3 Date: 9.2013
Revised: 2.2017

MODIFIED SIDE ENTRY PIT WITH A GRATE
TO LOCATE ON RESIDENTIAL VEHICULAR CROSSINGS

Drawing No.
EDS 03.13B

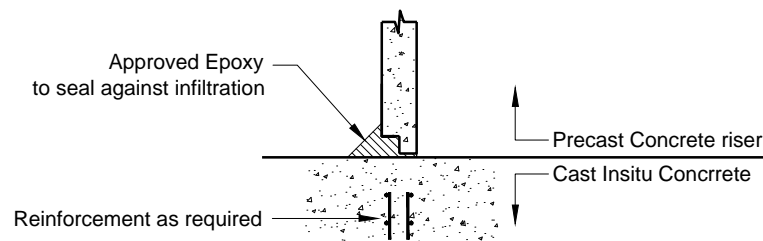
TYPICAL CONSTRUCTION JOINTS

(A) CONSTRUCTION JOINT PLACEMENT INTO WET BASE



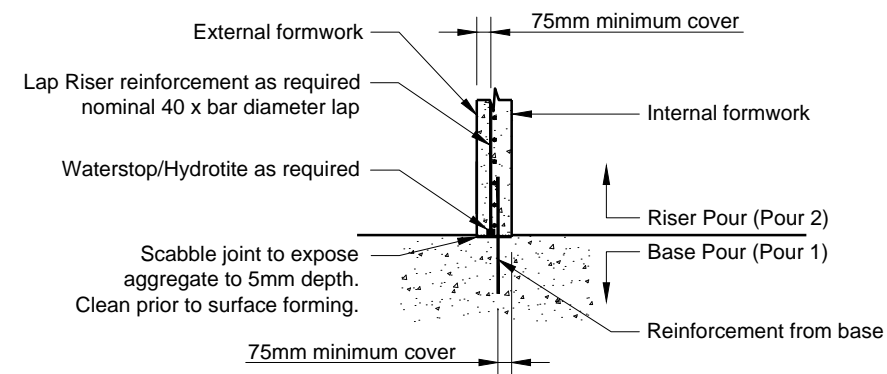
NOTE : Concrete allowed to set prior to placement of riser shape

(B) CONSTRUCTION JOINT PLACEMENT INTO DRY BASE

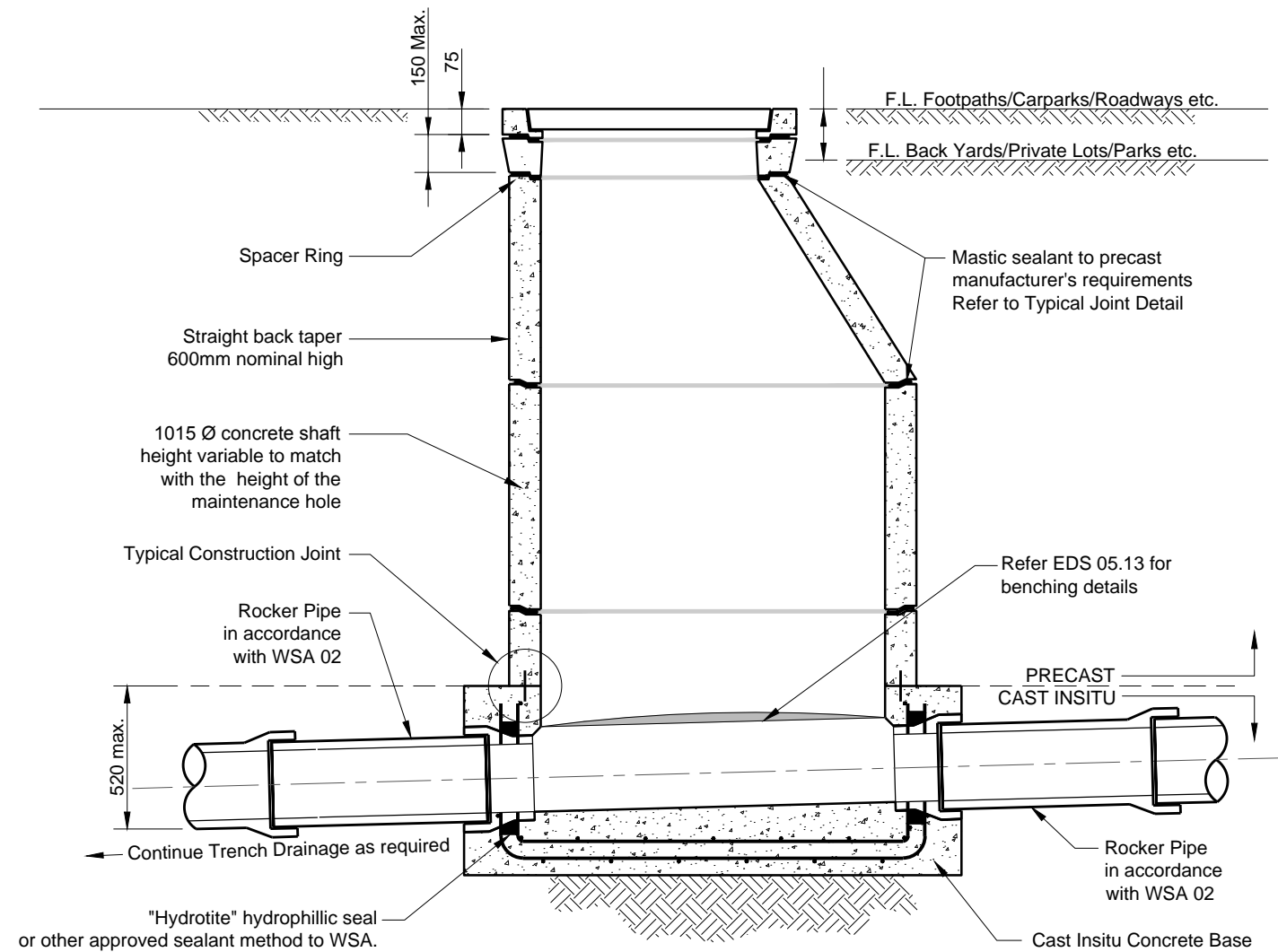


NOTE : Cast In situ (Allow 40MPa concrete, 7 days curing duration or 28MPa minimum strength) prior to placement of riser

(C) CONSTRUCTION JOINT - FULLY CAST IN SITU



NOTE : Full Cast In situ Manhole

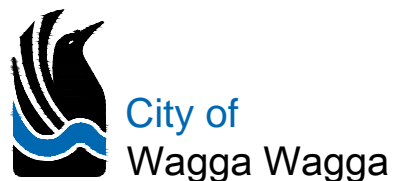


CROSS SECTION

STANDARD CAST IN SITU SEWER MAINTENANCE HOLE - TYPE A

PREFERRED TYPE TO USE IN NEW PROJECTS

- * Refer to EDS 05.01 for additional requirements
- * Refer WSA 02 Figure 7.7 to 7.12
- * 75mm minimum concrete cover to reinforcement
- * All concrete to be minimum 40MPa using "Sulphate Resistant" cement to Council approval
- * Socket cast into Maintenance Base as per requirement WSA 02 - 2014 - 3.1 Clause 7.6.4.2
- * All dimensions are in millimetres unless marked otherwise



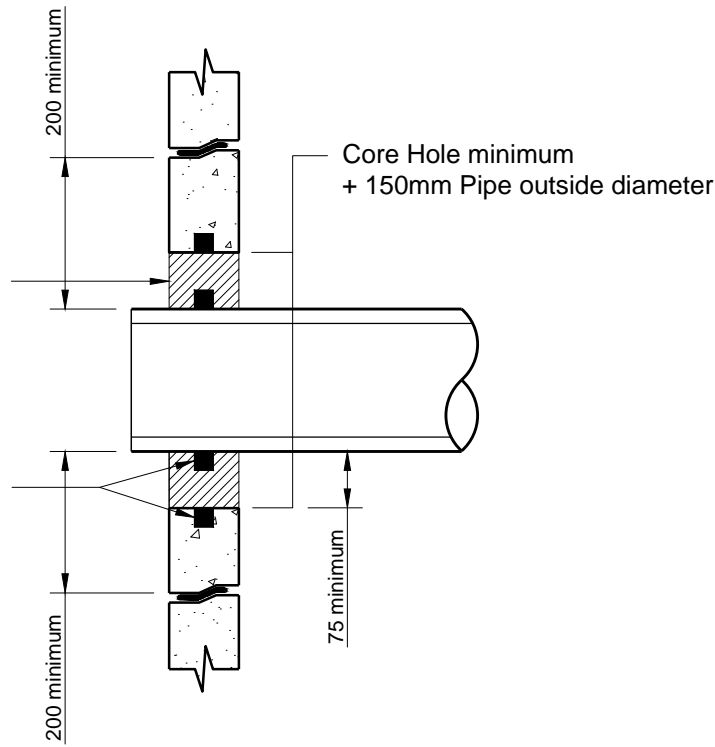
WWCC Engineering Development Standards	
Paragraph Reference: Part 5 - 7.2	
Scale: 1:20	A3 Date: 9.2013 Revised: 3.2015

CAST INSITU SEWER MAINTENANCE HOLE DETAIL

Drawing No.
EDS 05.01B

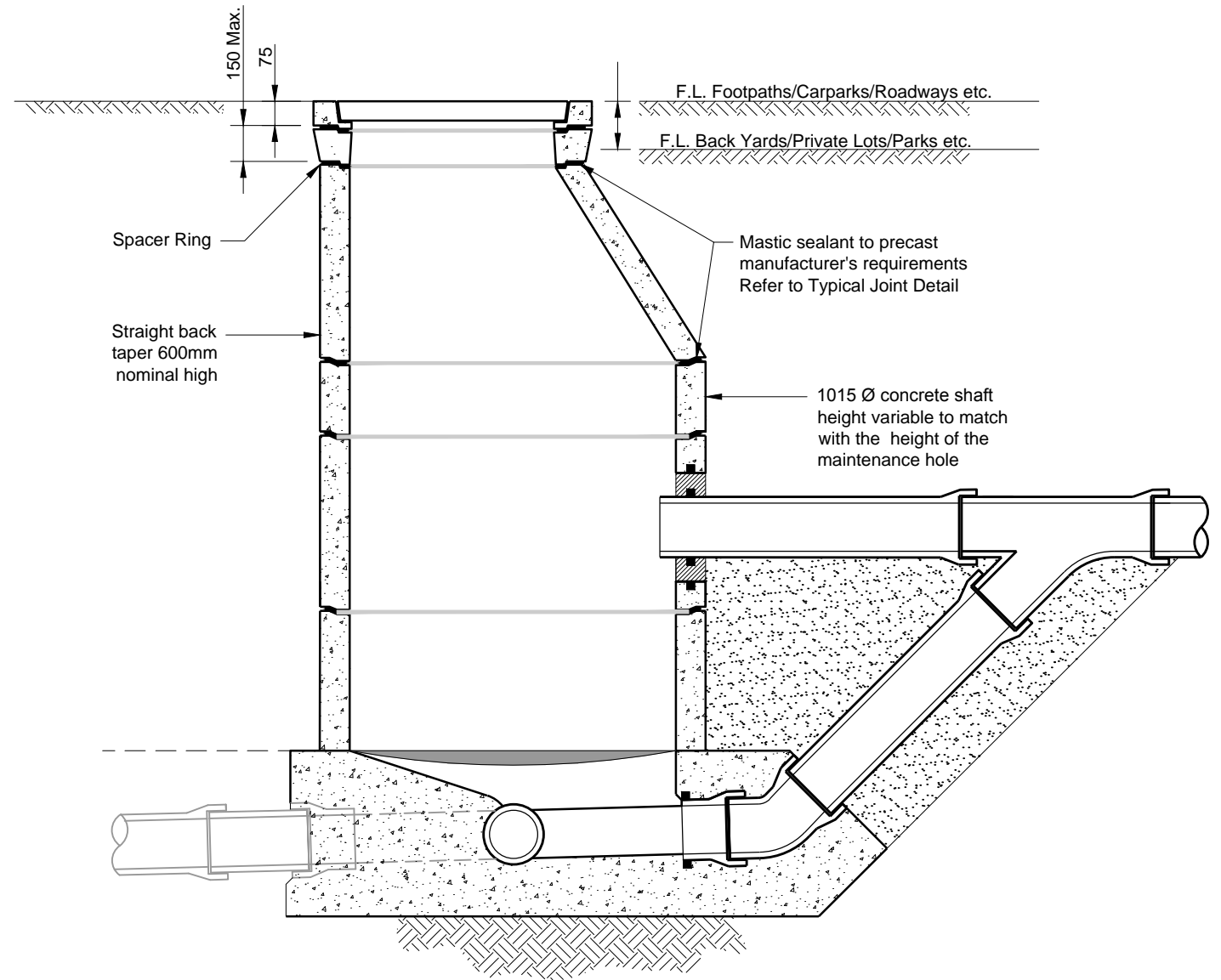
Approved flowing, self leveling Epoxy/Non Shrink grout equivalent to 40MPa, sulphate resistant applied in accordance with manufacturer's instructions

"Hydrotite" fixed to position, use "Sikaflex" to fix to concrete, self adhesive to pipe, joint sealant requirements as per Cast Insitu Maintenance Holes. Refer WSA 02 7.7 to 7.12



JOINT DETAILS

Scale - 1:10

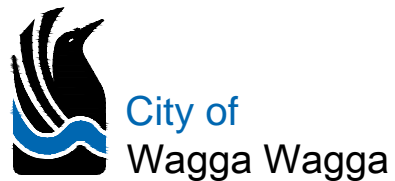


CROSS SECTION

SEWER DROP MAINTENANCE HOLE - TYPE A

NOT A PREFERRED METHOD.
REFER EDS. 05.04 FOR PREFERRED METHOD

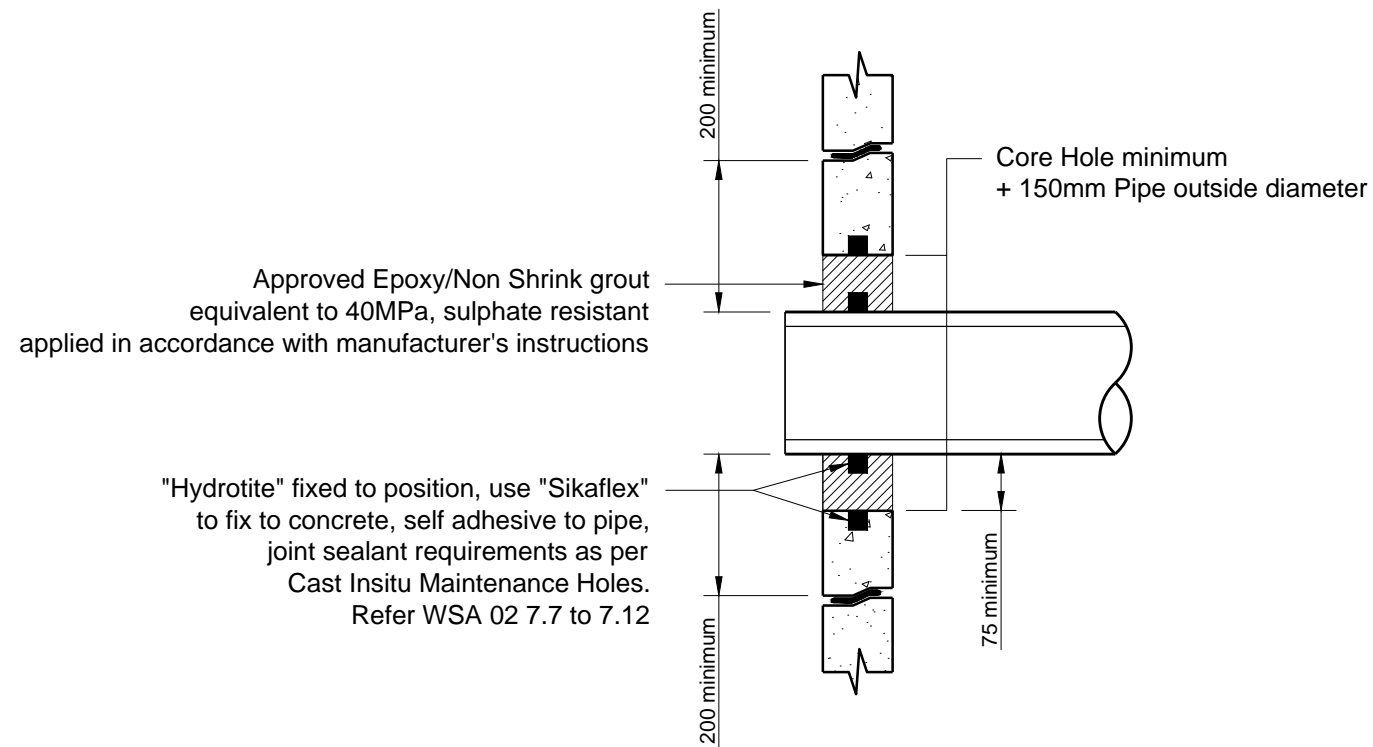
- * Refer WSA 02
- * Refer to EDS 05.01 for additional requirements
- * Base to meet either cast insitu or precast requirements
- * All dimensions are in millimetres unless marked otherwise



WWCC Engineering Development Standards	
Paragraph Reference: Part - 7.2	
Scale: 1:20	A3 Date: 10.2013 Revised: 3.2015

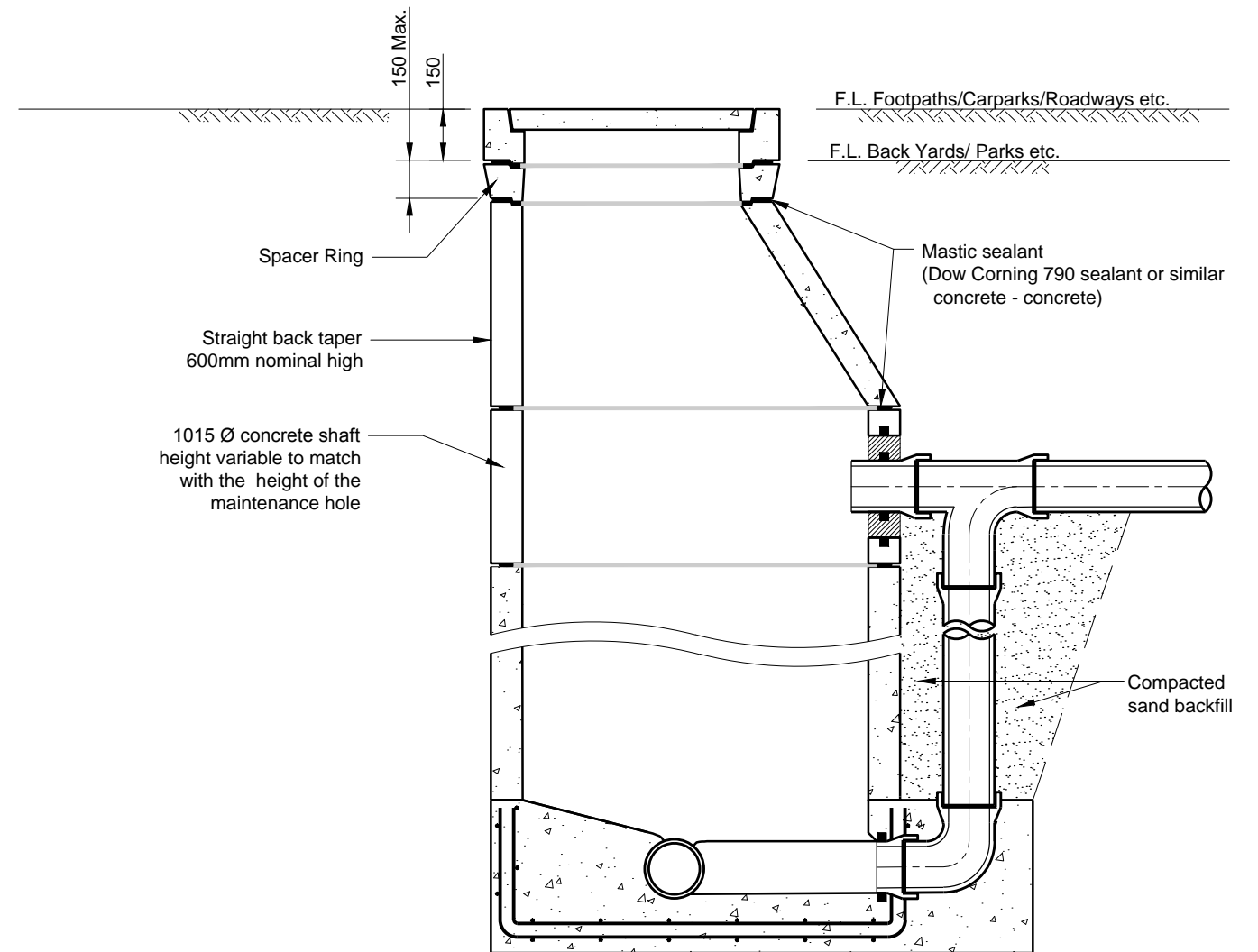
**SEWER DROP MAINTENANCE HOLE
TYPE "A"**

Drawing No.
EDS 05.03



JOINT DETAILS

Scale - 1:10



CROSS SECTION

SEWER DROP MAINTENANCE HOLE - TYPE B

PREFERRED METHOD

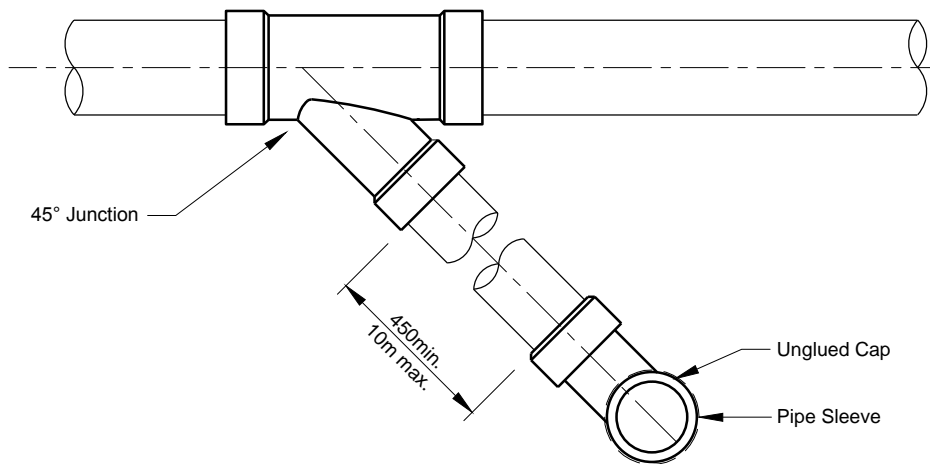
- * Refer WSA 02 Figure 7.13 to 7.14
- * Base to meet either Cast Insitu or Precast requirements
- * All dimensions are in millimetres unless marked otherwise



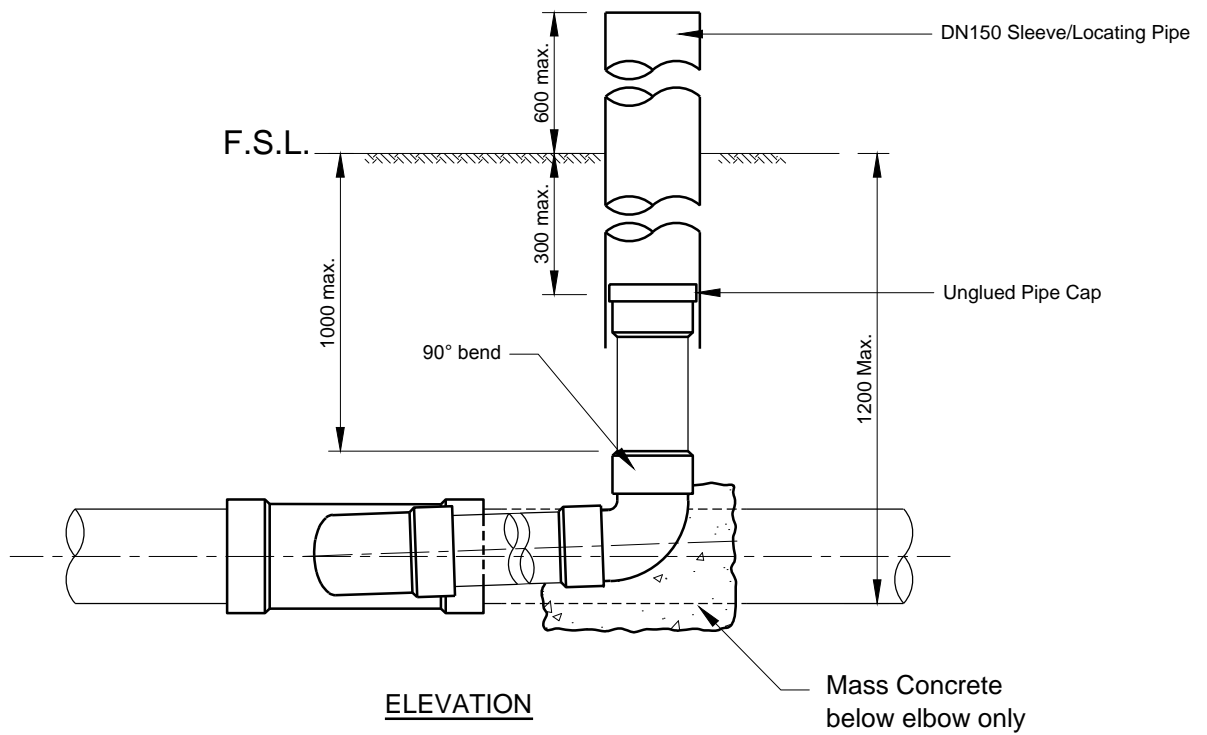
WWCC Engineering Development Standards	
Paragraph Reference: Part5 - 7.2	
Scale: 1:20	A3
Date: 10.2013	Revised: 7.2015

**SEWER DROP MAINTENANCE HOLE
TYPE "B"**

Drawing No.
EDS 05.04



PLAN



ELEVATION

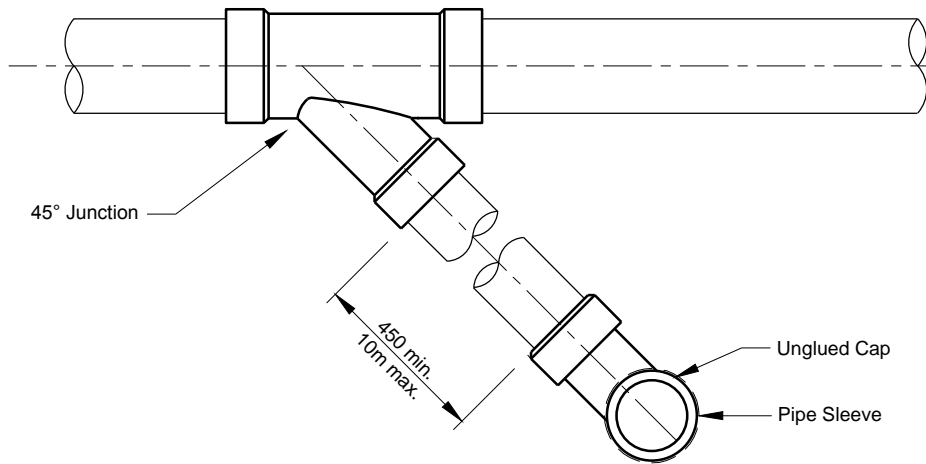
SHALLOW JUNCTION CONNECTION

- * Concrete : Minimum 25MPa
- * All dimensions are in millimetres unless marked otherwise

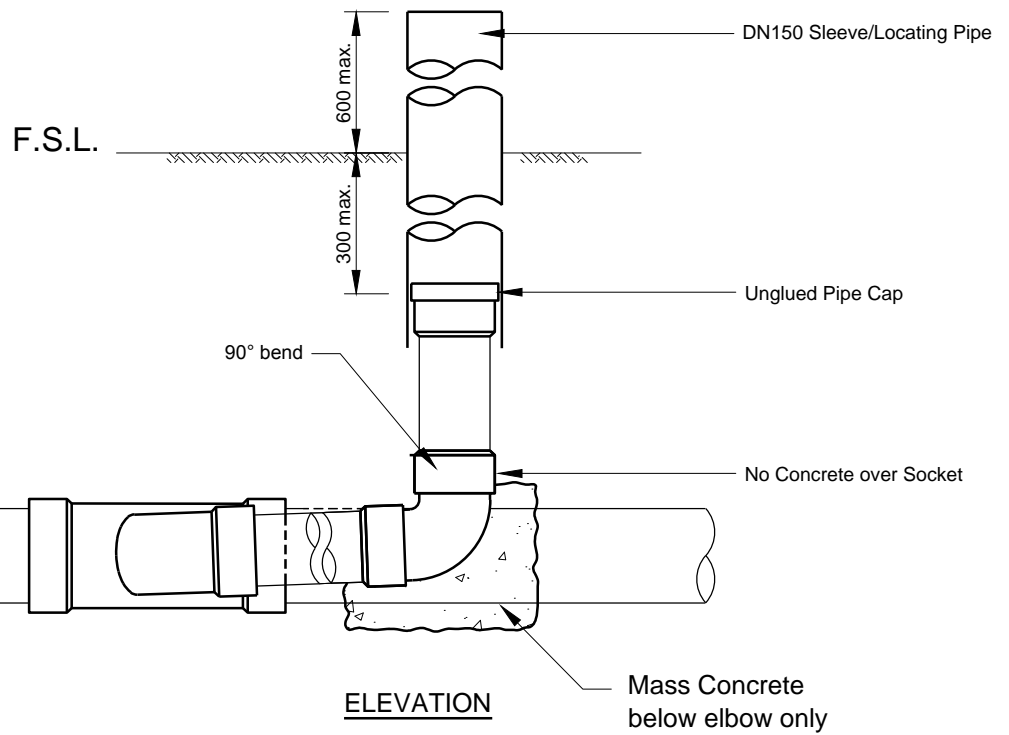


SEWER JUNCTION DETAIL - Shallow Connection

WWCC Engineering Development Standards Paragraph Reference: Part 5 - 5.4.7 & 6.1		Drawing No.
Scale: 1:15	A4	Date: 10.2013 Revised: 7.2015
		EDS 05.05A



PLAN



ELEVATION

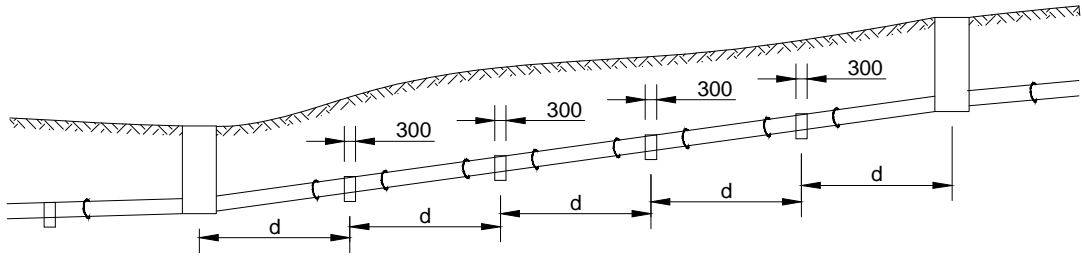
DEEP JUNCTION CONNECTION

- * Concrete : Minimum 25MPa
- * All dimensions are in millimetres unless marked otherwise



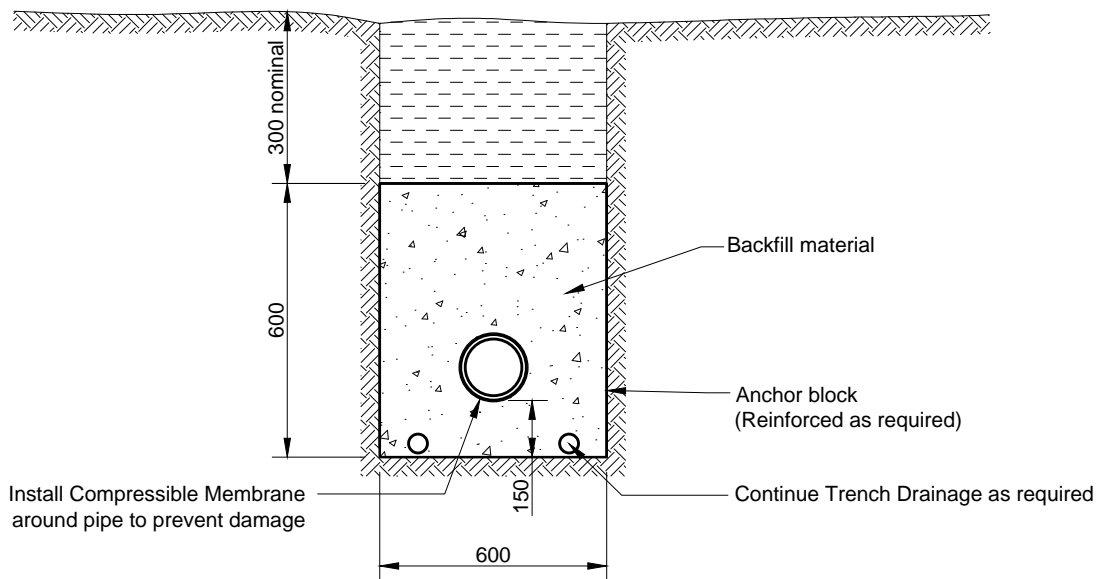
SEWER JUNCTION DETAIL - Deep Connection

WWCC Engineering Development Standards Paragraph Reference: Part 5 - 5.4.7 & 6.1		Drawing No.
Scale: 1:15	A4	Date: 10.2013 Revised: 7.2015
		EDS 05.05B



LONGITUDINAL SECTION

* Spacing 'd' to be as detailed on construction drawing



CROSS SECTION

NOTES:

- * Anchor blocks are to be used when grades are steeper than 1:15. Maximum allowable grade is 1:10. Blocks are to be evenly spaced between maintenance holes and should correspond to a fall 2m in height.
- * Concrete : Minimum 25MPa
- * All dimensions are in millimetres unless marked otherwise



SEWER ANCHOR BLOCKS

WWCC Engineering Development Standards
Paragraph Reference:

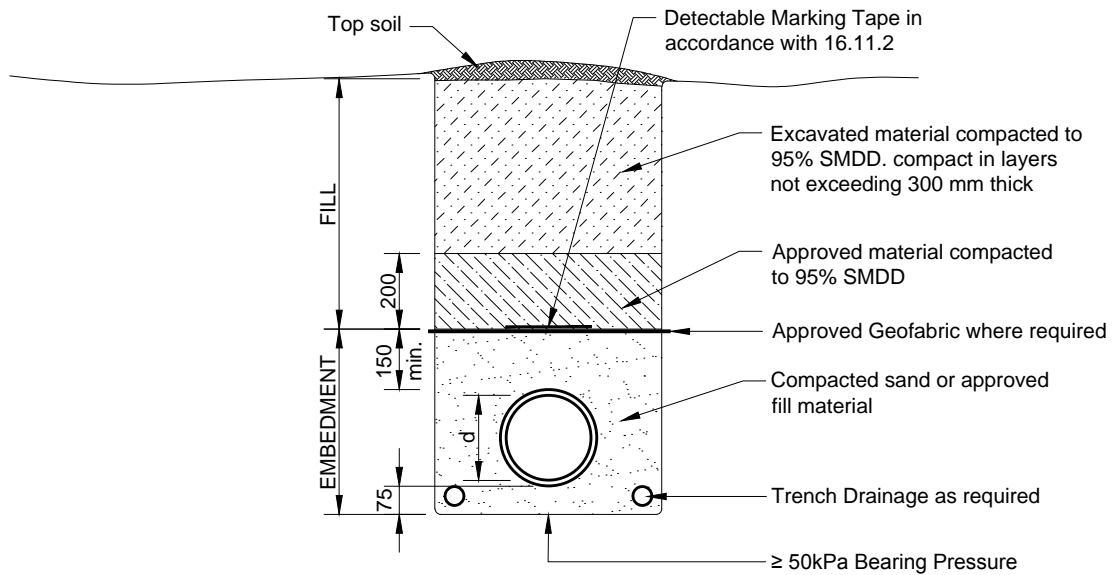
Drawing No.

Scale: Not to Scale

A4

Date: 10.2013
Revised: 7.2015

EDS 05.06



NOTES:

- * Backfilling of trenches to be in accordance with AS 3798 'Guidelines on earthworks for commercial and residential developments' and WSA 02 - 2014 - 3.1 Clause 19.0, 20.0 & 21.3
- * If benching is to be used, extent of excavation must not exceed the existing easement. if easement is not wide enough, it should be increased in size to encompass the full width of the excavation.
- * All dimensions are in millimetres unless marked otherwise
- * Seek WWCC Superintendents advice where Bearing Pressure is $\leq 50\text{kPa}$
- * Trench Compaction Test Frequency as per WSA 02 Clause 21.3 trench backfill may be subjected to random compaction testing at maximum of 2 test per house block, subject to Managers direction.
- * Alternate Trench Designs at the approval of Waste & Stormwater Manager. Minimum cover in accordance with WSA Table 5.11

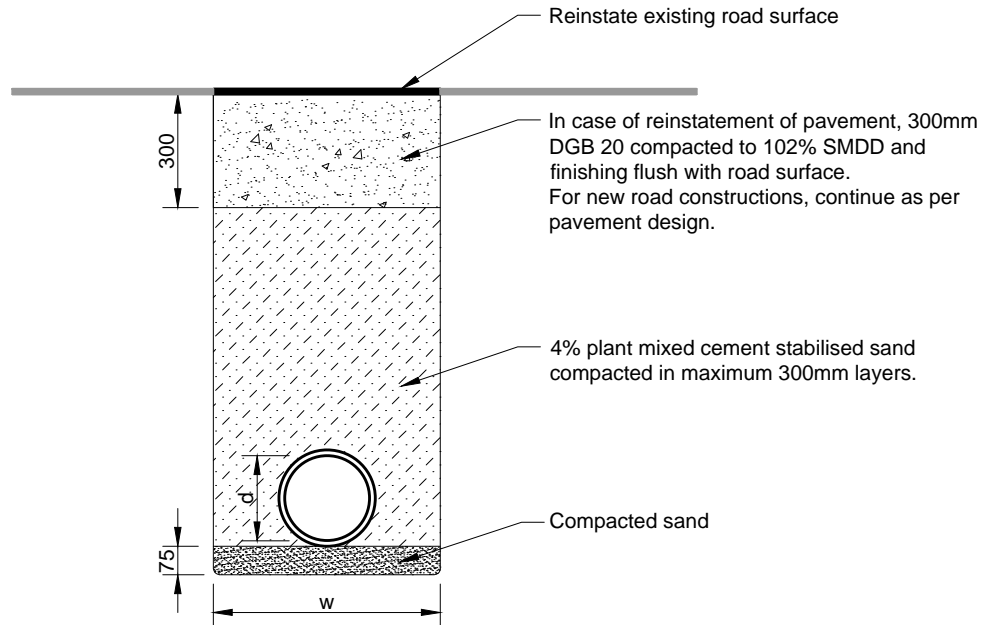
TRENCH DETAILS

d	w
100	450
150	450
225	600
300	750
375	750
450	900
525	900
600	1200



TYPICAL SEWER PIPE BACKFILLING ARRANGEMENT

WWCC Engineering Development Standards Paragraph Reference: Part 5 - 5.3.1		Drawing No.
Scale: 1:20	A4	Date: 10.2013 Revised: 7.2015
		EDS 05.07



- * All dimensions are in millimetres unless marked otherwise
- * Reinstatement backfill to extend 450mm beyond back of kerb or future kerb alignment
- * Refer EDS 05.07 for notes

TRENCH DETAILS

d	w
100	450
150	450
225	600
300	750
375	750
450	900
525	900
600	1200



TYPICAL SEWER BACKFILLING ARRANGEMENT UNDER ROAD PAVEMENT

WWCC Engineering Development Standards
Paragraph Reference: Part 5 - 5.1.3

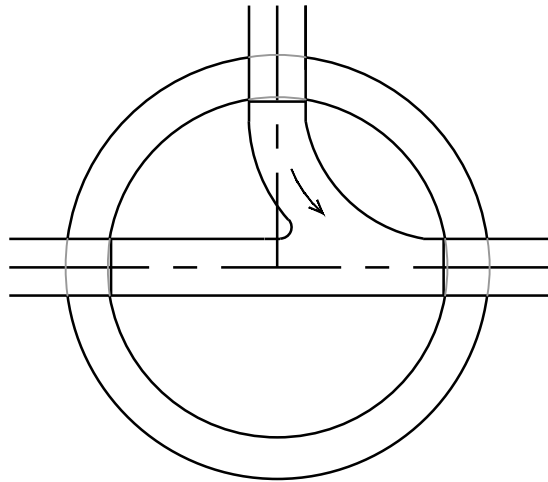
Drawing No.

Scale: 1:20

A4

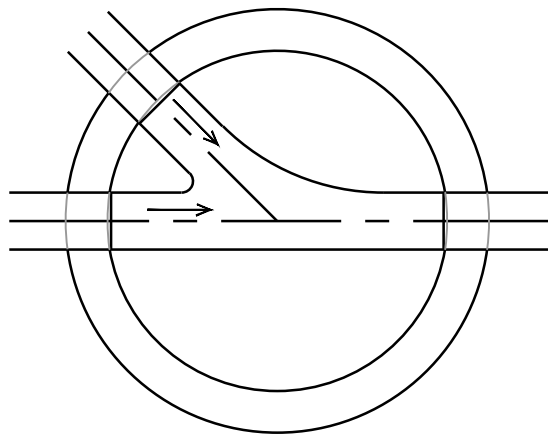
Date: 10.2013
Revised: 3.2015

EDS 05.08



3 - WAY MAINTENANCE HOLE/ TEE JUNCTION

2 x 150Ø - 150Ø



3 - WAY MAINTENANCE HOLE/ 45° BEND

2 x 150Ø - 150Ø

- * Maximum radii to be used for all bends in maintenance holes.
- * Tapers to have a minimum radius of 30mm.
- * Sewer pipes to protrude into maintenance hole no more than 100mm and no less than 50mm, when casting insitu.



CHANNELING OF SEWER MAINTENANCE HOLE BENCH - 1

WWCC Engineering Development Standards
Paragraph Reference: Part 5 - 5.2

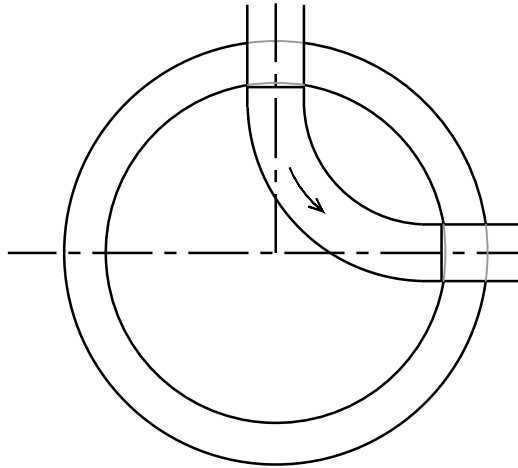
Drawing No.

Scale: 1:20

A4

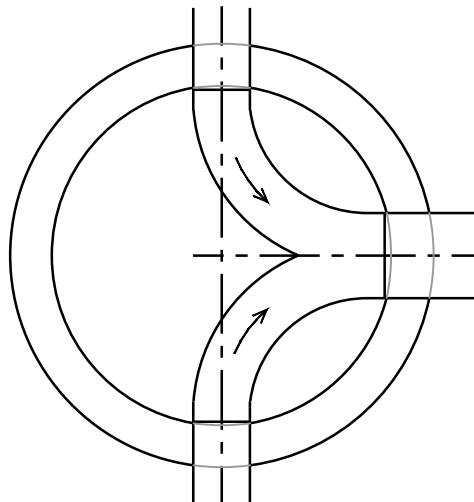
Date: 10.2013
Revised: 7.2015

EDS 05.10



MAINTENANCE HOLE - 90° BEND

150Ø - 150Ø



3 - WAY MAINTENANCE HOLE/ Y JUNCTION

2 x 150Ø - 225Ø

- * Maximum radii to be used for all bends in maintenance holes.
- * Tapers to have a minimum radius of 30mm.
- * Sewer pipes to protrude into maintenance hole no more than 100mm and no less than 50mm, when casting insitu.



CHANNELING OF SEWER MAINTENANCE HOLE BENCH - 2

WWCC Engineering Development Standards
Paragraph Reference: Part 5 - 5.2

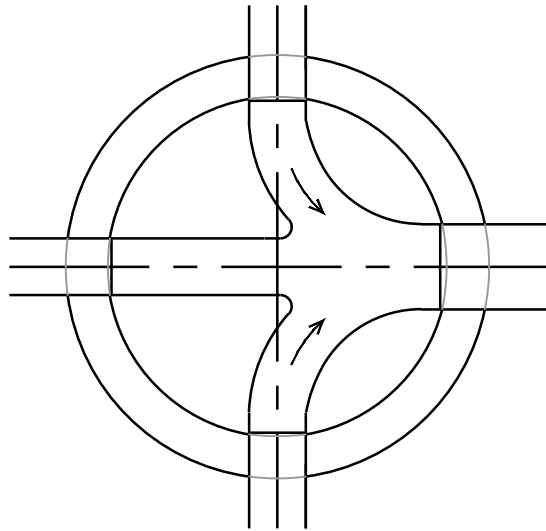
Drawing No.

Scale: 1:20

A4

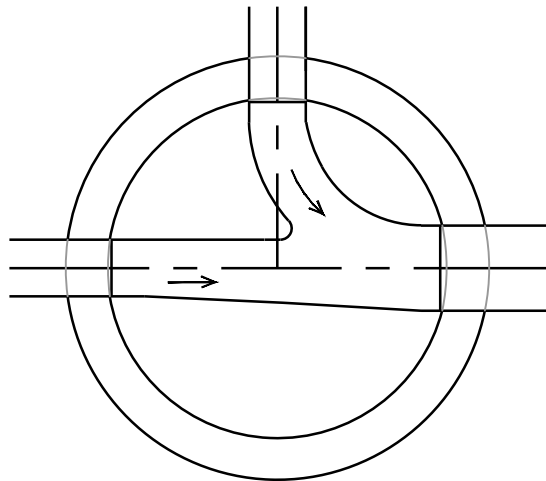
Date: 10.2013
Revised: 7.2015

EDS 05.11



4 - WAY MAINTENANCE HOLE

3 x 150Ø - 225Ø



3 - WAY MAINTENANCE HOLE/ TEE JUNCTION

2 x 150Ø - 225Ø

- * Maximum radii to be used for all bends in maintenance holes.
- * Tapers to have a minimum radius of 30mm.
- * Sewer pipes to protrude into maintenance hole no more than 100mm and no less than 50mm.
- * All dimensions are in millimetres unless marked otherwise



CHANNELING OF SEWER MAINTENANCE HOLE BENCH - 3

WWCC Engineering Development Standards
Paragraph Reference: Part 5 - 5.2

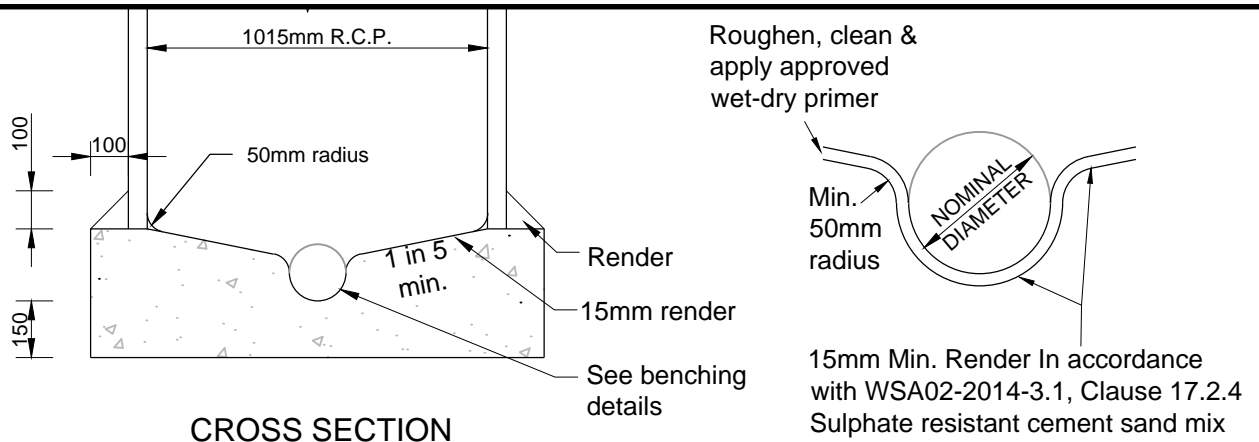
Drawing No.

Scale: 1:20

A4

Date: 10.2013
Revised: 7.2015

EDS 05.12

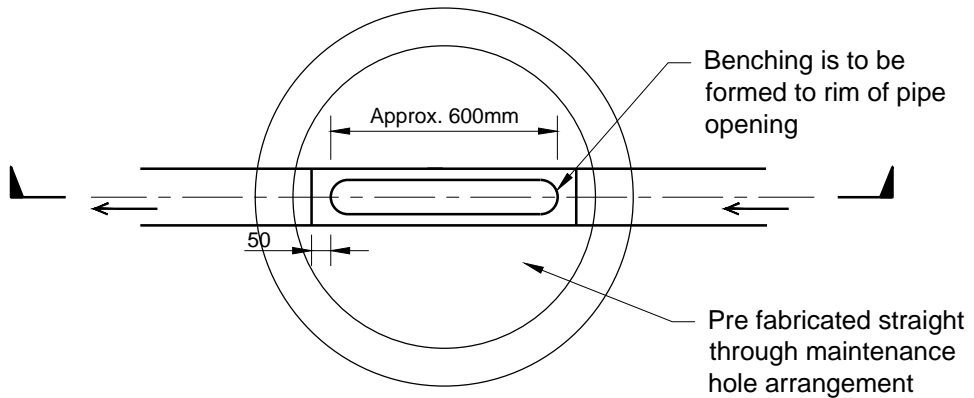


CROSS SECTION

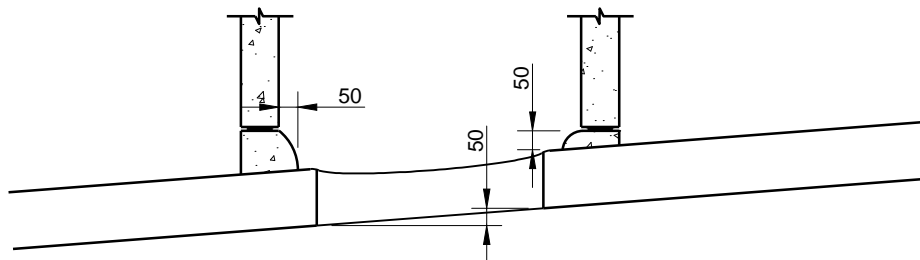
BENCHING ARRANGEMENT

BENCHING DETAIL

- NOTE: *
- * Minimum invert drop through maintenance hole is 50mm unless specified otherwise.
 - * Obvert of property spur into maintenance hole is to correspond with obvert of inlet pipe.



PLAN



SECTION A - A

STRAIGHT THROUGH MAINTENANCE HOLE

- NOTE: *
- * Straight through arrangement is only to be used when consecutive lines have the same grade
 - * Refer drawing EDS 05.01 for other maintenance hole details
 - * All dimensions are in millimetres unless marked otherwise



**BENCHING ARRANGEMENT
STRAIGHT THROUGH MAINTENANCE HOLE**

WWCC Engineering Development Standards
Paragraph Reference: Part 5 - 5.2

Drawing No.

Scale: 1:20

A4

Date: 10.2013
Revised: 7.2015

EDS 05.13