Engineering Design Guidelines

Authorisation Details

Container No:	01/0278/01		
Service Unit:	Infrastructure Services		
Officer:	Sam Masoomi		
Consultation:	Internal and External		
Review Timeframe:	5 years	**Next Review:**	23/12/2029
Authorisation:	Singleton Council		
Authorisation Date:	23/12/2024		

Printing Disclaimer

If you are viewing a printed copy of this document it may not be current. Printed copies of this document are not controlled.

Before using a printed copy, verify that it is the most current version.

REVISION HISTORY

Edition / Revision Number	Description of Revision	Authorised By	Date
Ed 1 / Rev 1	Engineering Design Guidelines	Infrastructure Services	March 2023
Ed 1 / Rev 2	Engineering Design Guidelines	Infrastructure Services	December 2024
Ed 1 / Rev 3	Engineering Design Guidelines	Infrastructure Services	December 2025

Table of Contents

1 Application of Engineering Design Guideline

1.1 General

The *Engineering Design Guidelines* has been compiled to outline Council's requirements for the planning, survey, design, construction and maintenance of public infrastructure assets, subdivisions and various private site works within the Singleton Local Government Area.

The *Engineering Design Guideline* is referenced in the Singleton *Development Control Plan* and consists of the following volumes, which shall be read in conjunction with one another as required and not in isolation. These documents are available on Council's website:

1. Design Guideline
2. Construction Specification
3. Standard Drawings

This *Engineering Design Guideline* and referenced documents provide minimum requirements and references for the design of civil works within the Singleton Local Government Area. Works may include, but are not limited to the following:

- Roads
- Intersections
- Paths
- Cycleways
- Traffic facilities
- Earthworks
- Water quality facilities
- Parks and reserves
- Development and subdivision of land
- Site regrading
- Control of erosion and sedimentation
- Geometric road layout
- Pavements design
- Subsurface drainage
- Pathways and cycleways
- Bridges and other structures.
- Stormwater drainage

Referenced Documents

Reference documents include but are not limited to:

- Austroads publications for which there is a specific Glossary of Terms publication and also incorporate some definitions in individual documents.
- Transport for NSW (TfNSW) or documents which incorporate definitions.
- Australian Standards documents for which there is a specific Glossary of Terms, such as AS 1348 *Road and traffic engineering* and incorporated definitions in individual documents.
- Engineers Australia publications.
- Water Services Association of Australia documents relating to supply of water and sewerage services and their respective Supplements.
- *Queensland Road Drainage Design Manual* (Department of Transport and Main Roads 2013) and the *Queensland Urban Drainage Manual*.
- Other Singleton Council documents.

1.2 Disclaimer

This document is intended to be a technical guide and should not be used as a works specification. It does not remove the need for compliance with all relevant statutory requirements.
Whilst this manual is a policy document of Singleton Council, the information contained herein at the date of publication, is subject to revision by Council due to changing standards over time. Therefore, no warranty can be given that this document represents current standards and practices at the time of their application in design and construction. The responsibility is on the user of this manual to verify the currency of information contained and referenced herein, prior to implementation.

Subsequently, certified/approved designs for works that are either on existing public lands or on land intended for dedication to the public, and that are older than two years, must be reviewed and rendered acceptable to Council, prior to construction.

1.3 Departure from the Guideline

Consideration may be given for products or work methods which do not strictly comply with Singleton Council's *Engineering Design Guideline*. Details of the proposed departure from the Guideline need to be submitted to Council's Representative for approval.

1.4 Council's Standard Drawings

Standard Drawings referred to in this *Engineering Design Guideline* can be found in Council's *Standard Drawings* and are available to download from Singleton Council's website.

1.5 Constructability, Health and Safety in Design

Designers shall comply with the *SafeWork NSW requirements for Health and Safety in Design - CHAIR - Safety in Design Tool.*
CHAIR (Construction Hazard Assessment Implication Review) is a tool to assist designers, constructors, clients and other key stakeholders to come together to reduce construction, ongoing operation, maintenance, repair and demolition safety risks associated with design.

The Australian Council of Building Design Professions (BDP) and the Royal Australian Institute of Architects (RAIA) support the use of CHAIR. The BDP believes that along with the quality and amenity of the built environment, its safety is also determined at the design stage. "CHAIR is a tool that will enable better safety awareness and solutions for improving safety and construction through identifying potential hazards by a co-ordinated approach by all stakeholders.
g

2 Quality Management System for Design

2.1 General Requirements

Design organisation's quality plan

Requirements: Provide a Quality Plan in conformance with AS/NZS ISO 9001, to include the following:

- Quality manual including the organisation's Quality Policy.
- Responsibilities for the implementation of the Quality Policy for the project.
- A commitment from top management to the development and implementation of the QMS.
- Evidence of the resources, infrastructure and work environment for the project.
- Policy for evaluating and selecting Sub-consultants.

2.2 Design Planning

General

Collaboration: Coordinate the different groups involved in the development of the design to ensure effective communication and clear assignment of responsibility.

Integrated planning with Sub-consultants: Verify and incorporate inputs into the design process.

Design quality plan

Requirement: Provide a design Quality Plan, to include the following:

- Design stages.
- Review, verification and validation for each stage (Design program and procedures).
- Responsibilities and authorities for design.
- Define the design team, including Sub-consultants, names of team members, roles and technical interfaces.
- Details of the resources assigned to the project.
- Organisation chart including communication paths with the Superintendent, the Principal, other Consultants and Contractors.
- For the construction phase, reference the Contractor's program for review and verification such as site inspections.
- Design inputs such as requirements and acceptable criteria.
- Any Witness Points or Hold Points for the design.
- Programmed approvals/consultations with regulatory authorities.
- Any third party review/verification/validation required by the Principal or regulating authority.
- Proposed design documentation.
- Procedure for managing design changes of project audits.
- Sign off activities and record using the checklists in the **Annexures**.

2.3 Design Input and Output

Design input

Input to AS/NZS ISO 9001 clause 7.3.2: All designs shall Identify, document and review for adequacy the following:

- Principal's brief:
- Site information:
- Codes of practice:
- Regulatory and statutory requirements:
- Performance criteria:
- Design criteria:
- Materials:
- Requirement: Give notice if the design inputs do not provide sufficient information for verification.

- Review: Submit design proposals for approval by the Principal at appropriate stages.

Design output

Output to AS/NZS ISO 9001 clause 7.3.3: To include the following, produced at various stages:

- Advice.
- Calculations.
- Drawings.
- Models.
- Other contract documents.
- Reports.
- Schedules of quantities.
- Sketches for shop drawings.
- Specifications.

Design checklist: Provide a quality record of the design processes and integrate additional criteria, as required, in the design checklists in **Annexure A**.

Acceptance criteria: Define on drawings or in the specification the acceptance criteria for standards of workmanship and other design requirements.

Define: Key characteristics e.g. safety signs.

2.4 Review, Verification and Validation

Design review

Design meetings: Minute design meetings with all relevant parties in attendance and make sure the following considerations are included in the agenda:

- Principal's requirements.
- Sequence of design activities.
- Conformance with the design brief.
- Identification and control of design interfaces.
- Construction processes.
- Safety methods.
- Methods of verification.
- Consultation including Council or authority approvals, public input and existing utilities.
- Completion of Road Safety Audit

Method of quality recording: Provide and maintain quality records by notation on documents, minutes and checklists signed off by the review leader.

Design verification

Verification: At the end of each design stage examine the result of a given activity for conformance with the specified input requirements for that activity, include the following:

- Document the process.
- Identify responsibilities.
- Maintain adequate records of the verification.
- Site investigation and reporting.

Design validation

Validation: Following completion of design, validation shall be performed to make sure the design has met the specified requirements, include the following:

- Document the process.
- Identify responsibilities.
- Maintain adequate records of the validation.

Audit

Notice: Provide all reasonable assistance for the inspection of records of designs submitted to Council for acceptance. Provide access to the designer's premises on a 24 hour notice basis.

2.5 Control of Design Changes

Design changes

Requirement: Review and amend the design quality plan as necessary during the course of the design, include the following:

- Manage, identify, record any design changes.
- Identify who can make and approve changes.
- Procedure for review of wider implications of design changes.

Process for changing documents after issue for construction: Once documents are issued for construction, any changes must go through the review, verification and approval process prior to re-release for construction.
Principal approval required for design changes to documents after issued for construction: Required

Record: Maintain a register of design changes.

2.6 Control of Documentation

Documentation

Distribution control: Maintain a master list of controlled documents, to include the following information:

- The source of data used in calculations and on drawings.
- Record of the personnel authorised to review, approve and change documents.

Design documentation and data: Provide calculations, sketches, drawings (including those retained for reference or circulated outside the design team), data sheets and specifications.

Requirement: Control and retain documents and data relating to the project e.g. from the Principal, other Consultants or Sub-consultants and suppliers.

Design change register: Record changes made to any documents after they have been issued for construction.

Certification

Certification Report: Submit for approval a Certification Report signed by the designer accompanied by drawings and specifications. Conform with the design certificate and checklists included in **Annexure A**

Certification of preliminary drawings: Submit a Certification Report with all preliminary drawings. Submit an updated Certification Report with the submission of final drawings. A Certification Report is not required when submitting sketch plans or concept plans.

Drawing requirements

Drawings: Define and set out the design concepts on design drawings in conformance with the following:

- Prepare all design drawings on a Council approved standard sheet and clearly number with each sheet numbered as part of a set. **Annexure B** provides guidelines for grouping information in design drawings.
- Refer to design work-sections for documentation requirements.
- Provide a space in the bottom right hand corner of each drawing for an assigned number provided by Council, include a title of each page, drawing number, revision and date.
- Do not overcrowd the drawings with information.
- If colour is used to distinguish information, ensure submitted copies are in colour.
- Use A1, A2 size and/or A3 sheets, suitable for black and white copying and reduction to A4 paper size without loss of clarity
- DWG copy of the design to be submitted as part of WAE

2.7 Control of Records

Records

Requirement: Retain appropriate design records in a format which can be understood readily with no prior knowledge of the particular design.

Copies of records: Make copies of records available to Council upon request without charge.

Design file: Maintain a design file containing records of calculations, approvals and decisions, geotechnical data and other design data that could be relevant in reviewing aspects of the design or planning future maintenance responsibilities.

Calculation record retention: Keep all calculations for the duration of the construction maintenance period.

Hydrologic and hydraulic design records: To *0074 Stormwater drainage (Design)*.

2.8 Control of Non-Conformance

Design variations

Record: Identify on the Certification Report checklists any aspects of the design which do not meet the requirements or tolerances set out in this work-section and other applicable Council design and construction specifications.

3 Annexure A

3.1 Certification Report

Design Certificate

Project Title: _____

Documentation No: _____

Designer: _____

I certify that the documentation noted above represents a design for which the attached design check lists provide a valid record.

I certify that this design conforms to current Australian or International standards, industry guidelines, Council's design specifications, Council's current DCP and specific instructions received with the exception of departures cited in the attached design checklists.

I certify that this design will not significantly impact on the environmental factors of the area as interpreted under Part IV of the NSW Environmental Planning and Assessment Act.

I certify that this design is in strict compliance with the development consent conditions and where a variance to the consent is found, written confirmation has been received from Council approving of the variance prior to the lodgement of Design Drawings (this includes designs for staged construction).

I certify that all structural/civil/hydraulic elements have been designed by an engineer suitably experienced in the relevant field and who has or is eligible for NER registration with Engineers Australia.

Contact Phone: _____ _____ _____

Design Engineer/Surveyor Date

Contact Postal Address:

_____ _____

Qualifications

_____

_____

A.B.N.

_____

3.2 Design Checklist 1 – Documentation of Existing Site Features

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
1.1	Check detail survey by site inspection for existing drainage.	……	...../...../.....	☐
1.2	Check detail survey by site inspection for existing property descriptions, boundaries and accesses.	……	...../...../.....	☐
1.3	Check detail survey of contours as representative of site terrain.	……	...../...../.....	☐
1.4	Document trees and significant environmental features affected by the works.	……	...../...../.....	☐
1.5	Document significant features to heritage within the Works boundaries.	……	...../...../.....	☐
1.6	Document existing public and private property likely to be affected by the design.	……	...../...../.....	☐
1.7	Document survey and benchmarks.	……	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

3.3 Design Checklist 2 – Horizontal Road Alignment

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
2.1	Check that alignment is compatible with design speeds.	……	...../...../.....	☐
2.2	Check that alignment is adequate in relation to clearance of roadside hazards.	……	...../...../.....	☐
2.3	Check that there is adequate horizontal sight distance for drivers and pedestrians.	……	...../...../.....	☐
2.4	Check that there is minimum conflict with existing services.	……	...../...../.....	☐
2.5	Check that road widths and lanes conform to Council and traffic design requirements.	……	...../...../.....	☐
2.6	Check that bridge alignment is compatible with the road alignment.	……	...../...../.....	☐
2.7	Check for adequate pedestrian, pram, bicycle and parking provisions.	……	...../...../.....	☐
2.8	Check for adequate provision for large vehicles such as buses, garbage trucks and emergency vehicles.	……	...../...../.....	☐
2.9	Check that intersections conform to the turning requirements of design traffic, including emergency vehicles.	……	...../...../.....	☐
2.10	Check adequate pavement width tapers and merges.	……	...../...../.....	☐
2.11	Identify and resolve any conflict with existing public utility services.	……	...../...../.....	☐
2.12	Document horizontal road alignment set out data.	……	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

3.4 Design Checklist 3 – Vertical Road Alignment

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
3.1	Check that grades conform to maximum and minimum requirements.	……	...../...../.....	☐
3.2	Check that vertical clearances to bridges and services conform to standards.	……	...../...../.....	☐
3.3	Check that there is adequate vertical sight distance for drivers and pedestrians.	……	...../...../.....	☐
3.4	Check that there is adequate cover to drainage structures or services.	……	...../...../.....	☐
3.5	Check that there is adequate vertical alignment for disposal of surface drainage from properties and road.	……	...../...../.....	☐
3.6	Check that grades conform to 1:100 year flood levels.	……	...../...../.....	☐
3.7	Check that vertical alignment is compatible with property access.	……	...../...../.....	☐
3.8	Check that gradients on intersecting roads do not exceed the cross slope of the through pavement and no greater than 3% at give way and stop signs.	……	...../...../.....	☐
3.9	Check that there is acceptable sight distance for all accesses to roundabouts.	……	...../...../.....	☐
3.10	Check that alignment coordination with horizontal alignment is in conformance with the Austroads design guides referenced in the AUS-SPEC specifications.	……	...../...../.....	☐
3.11	Identify and resolve conflict with existing public utility services.	……	...../...../.....	☐
3.12	Document vertical road alignment set out data on the longitudinal sections.	……	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

Design Checklist 4 – Road Cross-Section

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
4.1	Document complete dimensions on typical cross-sections have.	……	...../...../.....	☐
4.2	Document kerb & gutter, road safety barrier and surface drainage on typical cross-sections.	……	...../...../.....	☐
4.3	Document batter slopes and batter treatment where appropriate.	……	...../...../.....	☐
4.4	Document pavement description and surface treatment.	……	...../...../.....	☐
4.5	Document property boundaries, service allocations and location of known existing underground services and pathway treatments.	……	...../...../.....	☐
4.6	Document cross-sections to define all variations and width transitions.	……	...../...../.....	☐
4.7	Document cross-sections allowing for assessment of impact of road level on adjoining property.	……	...../...../.....	☐
4.8	Verify the stability of embankment slopes, batters and retaining walls as satisfactory.	……	...../...../.....	☐
4.9	Check that cross section reference level conforms with vertical road alignment.	……	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

3.5 Design Checklist 5 – Road and Interallotment Drainage

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
5.1	Document existing surface drainage.	……	...../...../.....	☐
5.2	Check that hydrological data is current.	……	...../...../.....	☐
5.3	Make hydrologic and hydraulic design calculations available for audit.	……	...../...../.....	☐
5.4	Check that underground drainage and structures do not conflict with public utility services.	……	...../...../.....	☐
5.5	Check that the designed drainage lines are compatible with existing incoming lines and outgoing lines.	……	...../...../.....	☐
5.6	Document pipeline length, type, size, class and bedding requirements for each drainage line.	……	...../...../.....	☐
5.7	Check that height of fill over drainage lines is within allowable limits.	……	...../...../.....	☐
5.8	Document drainage provisions for local depressions, e.g. median areas or areas adjacent to fills.	……	...../...../.....	☐
5.9	Check that the effect of headwater and back-up water on private property is satisfactory.	……	...../...../.....	☐
5.10	Document subsurface drainage by line and level if required.	……	...../...../.....	☐
5.11	Document batter drains for fills and cuttings if required.	……	...../...../.....	☐
5.12	Consider the height and energy level of downstream drainage.	……	...../...../.....	☐
5.13	Locate drainage structures and flowpaths to ensure safe vehicular and pedestrian transit.	……	...../...../.....	☐
5.14	Document drainage structure number, set out, type and pipe on the drainage plans and schedule of drainage elements.	……	...../...../.....	☐
5.15	Locate emergency flowpaths to minimise impact on private property.	……	...../...../.....	☐
5.16	Check that road drainage conforms with Council's drainage design criteria.	……	...../...../.....	☐
5.17	Check that interallotment drains conform with Council's Specification and Australian Rainfall and Runoff (AR&R) rainfall data.	……	...../...../.....	☐
5.18	Document appropriate land stabilisation and velocity controls to pipe systems, open channels and embankments.	……	...../...../.....	☐
5.19	For flood controlled allotments ensure, the floor height controls are compatible with road and drainage levels.	……	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

3.6 Design Checklist 6 – Signs and Markings

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
6.1	Conform to the documented Traffic Management Plan.	…….	...../...../.....	☐
6.2	Document sign types, sizes, locations and support structure details to conform with AS 1742 (All parts) and RMS Supplements and RMS Signs Register.	…….	...../...../.....	☐
6.3	Document pavement linemarking, pavement marking type and set out to conform to AS 1742.2. and RMS Supplements and RMS delineation guidelines	…….	...../...../.....	☐
6.4	Document signs and linemarking to conform to Council's policies.	…….	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

3.7 Design Checklist 7 – Pavement Design

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
7.1	Document pavement design and surface treatment on the typical road and/or pathways and cycleways cross-sections. Document any variations on the specific cross-sections.	…….	...../...../.....	☐
7.2	Check that the pavement design conforms to *0042 Pavement design* and/or *0044 Pathways and cycleways* for adequacy.	…….	...../...../.....	☐
7.3	Assess geotechnical data and keep records of design calculations.	…….	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

3.8 Design Checklist 8 – Bridge/ Major Culvert Design

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
8.1	Check that the design engineer is suitably experienced in the relevant field and who has or is eligible for NPER registration with Engineers Australia.	…….	...../...../.....	☐
8.2	Assess geotechnical data for adequacy and keep records.	…….	...../...../.....	☐
8.3	Check that the type and functional dimensions of the bridges conform to AS 5100, AS 4100, AS 3600, AS 1684, AS/NZS 1170.	…….	...../...../.....	☐
8.4	Document the type and class of all materials.	…….	...../...../.....	☐
8.5	Keep records of all significant design calculations and make available for audit.	…….	...../...../.....	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

3.9 Design Checklist 9 – Erosion and Sedimentation Control Plans

Checkpoints

Initial and date the following checkpoints or tick box if not applicable.

		By	Date	NA
9.1	Check that the concept erosion control plan conforms to *0022 Control of erosion and sedimentation (Design).*	…….	……/……/……	☐
9.2	Check that the erosion and sedimentation control conforms to development consent conditions and environmental legislations.	…….	……/……/……	☐
9.3	Check that the erosion and sedimentation control plan conforms to *0022 Control of erosion and sedimentation (Design).*			
9.3	Check that the soil and water management plan conforms to *1102 Control of erosion and sedimentation (Construction)*.	…….	……/……/……	☐

Certified documents

Include the following certified documents:

List additional certified documents provided.

Non-conformance

Describe any special features of the project and document any variations from Council or State Road Authority requirements.

4 Annexure B

4.1 Example Compilation of Drawings

Sequence of drawing sheets: The following sequence is acceptable to Council in the compilation of a full set of roadworks drawings.

Sheet No	Topic
1.	Development consent number (if applicable), project title, locality drawing and index of sheets.
2.	General layout plan with contour details and extent of work.
3.	Typical road cross-sections showing road widths, pavement (design) configuration, batter slopes, kerb and gutter types.
4.	Plan and longitudinal section of each road showing set out data, road safety barrier locations, guide posts and services.
5.	Drainage plan and schedule of drainage elements (pipe lines and structures).
6.	Drainage profiles.
7.	Drainage structure details.
8.	Road cross-sections.
9.	Intersection layout details.
10.	Pavement marking and signposting.
11.	Erosion and sedimentation control concept plans (short term and long term treatment).
12.	Structure details - bridges, retaining walls, etc.

Multiple sheets: A set of roadworks plans may require more than 1 sheet for each of the topics listed and may also require supplementary sheets for site specific details.

Scale: Nominate scales on all drawings.

North point: Show on all plan views.

5 Development and Subdivision of Land

5.1 General

5.1.1 Introduction

Work-section

General: This work-section provides guidance on the design requirements and planning permission process for development and subdivision of land within Council area.

Structure: This work-section is divided into five subsections:

1. Lodgement
2. Review
3. A – Notification/advertising

   B – Referrals
4. Assessment
5. Determination

Other documentation: This work-section also provides an introduction to other documentation affecting development and subdivision including:

- State planning legislation.
- As specific in DA consent conditions

Council planning instruments.

- LEP.
- DCP.
- Asset Management Plans.
- Council standard drawings.
- AUS-SPEC *Design* work-sections (Workgroup 00 *Planning and Design*).
- AUS-SPEC *Construction* work-sections (Workgroup *02 Site, Urban and open spaces, 03 Structure* and 11 *Construction – Roadways* and 13 *Construction – Public Utilities*).

5.1.2 Council's Objectives

Planning

Objectives: Council's objectives for land development and subdivision are as follows:

- To provide a functional, attractive and safe environment for residents that is consistent with community standards and needs.
- To minimise adverse effects on the natural environment.
- To provide for the needs of future users of the land with respect to building requirements, vehicular and pedestrian access, provision of services and an amenity appropriate to the zoning of the land.
- To economically utilise the land resource of the area.
- To achieve a balance between the development/subdivision of residential, commercial and industrial land and the amenity of existing occupants/residents.
- To provide for an equitable and efficient distribution of public amenities and services.
- To minimise Council's future maintenance costs for roads, services and open spaces.

5.1.3 Cross References

General

Requirement: Conform to the following work-section:

- *0010 Quality requirements for design.*

5.1.4 Referenced Documents

General: The following documents are incorporated into this work-section by reference:
AS/NZS ISO 9001-2008 Quality management systems – Requirements

5.1.5 Interpretation

Abbreviations

General: For the purposes of this work-section the following abbreviations apply:

- ARI: Average recurrence interval.
- DA: Development assessment.
- WAE: Work-as-executed.
- DCP – Development Control Plan
- LEP – Local Environmental Plan

Definitions

General: For the purposes of this work-section the following definitions apply:

- Development Application: to be submitted to Council for the development or subdivision of land.
- Development assessment: The process for ensuring that a proposed development on land is consistent with the plans, zones and other instruments determining how the land is to be used.
- Hold point: A defined position in the different stages of the Contract beyond which work can not proceed without mandatory verification and acceptance by the Superintendent.
- Planning: The process of making decisions to guide future allocation and development of land.
- Qualified surveyor: A surveyor who is eligible for membership of the Spatial Sciences Institute as a certified engineering surveyor.
- Registered Surveyor: A surveyor accredited by the Institution of Surveyors for civil design in the appropriate area.
- Rural land: Land, other than urban and rural residential, comprising larger holdings.
- Rural residential land: Rural home site and hobby farm land.
- Urban residential land: Land within areas zoned residential, village or township.
- Witness point: A nominated position in the different stages of the Contract where the option of attendance may be exercised by the Superintendent, after notification of the requirement.
- Zones: A smaller area within the larger Council area which is identified in a development plan. A zone groups together areas with similar characteristics to integrate mutually beneficial uses and separate incompatible uses. Zones are typically based on land uses.

5.2 Pre-Submission Planning

5.2.1 Preparing an Application

Requirements

Consent: Refer to the planning and development instrument(s) applying to the land to determine if the proposed development is permitted and, if so, whether an application for consent is required. Minor development and subdivisions may not require consent. Refer to exempt or complying development standards. Refer Singleton Council Website (http://www.singleton.nsw.gov.au/index.aspx?nid=97)

Application form: Submit an application on Council's standard application form and provide supporting information compiled following consultation with Council and to **APPLICATION REQUIREMENTS**.

Site Information

Compilation: Before submitting an application, compile the following site information and include on the plans for submission:

- Land title.
- Existing easements.
- Items of heritage significance.
- Topography, slope and aspect.
- Stormwater and overland flows.
- Surrounding development.
- Existing trees and vegetation.
- Existing and proposed local road and traffic situations.
- Other physical characteristics pertinent to the design or any other information specified in Part 1 of Schedule 1 of the Environmental Planning and Assessment Regulation 2000.

Fees/contributions

Schedule: Fees for applications are prescribed by state legislation and regulations and Council. Obtain a fee schedule from Council which includes non-prescribed fees/contributions that may be required as a condition of consent. Refer Fees & Charges link: http://www.singleton.nsw.gov.au/index.aspx?NID=820

5.2.2 Consultation

Council and other authorities

Purpose: To determine the planning, zoning, legislative and regulatory requirements and the extent of professional assistance required. The consultation process will identify the following:

- Any non-compliance.
- Council's specific requirements.
- Financial contributions for services and amenities.

Modifications to application required before submission.

Standards of construction acceptable to Council.

Requirement: Consultation with Council before submission of an application is not mandatory. However, consultation with Council is recommended for the following reasons:

- Reduction of costs in preparation of application
- Reduction of the time Council needs to consider the application.
- Increased likelihood of consent. The form to apply for a Development Advisory Panel (DAP) Meeting is as follows: http://portal.singleton.nsw.gov.au/eplanning/Temp/ViewedDocs/TrimDocumentViewer_ssvMapsyNi.PDF

Sketch plan: Prepare a sketch plan for the consultation indicating the location, aspect and size of the various elements of the development including subdivision patterns surrounding the site. Provide enough information on the sketch plan so that Council is able to undertake an initial assessment of the proposal and provide appropriate advice on the application.

Utilities services

General: Consult public utility authorities to obtain their requirements.

Public consultation

All DA applications will require public consultation.

5.3 Application Process

5.3.1 Consent and Exemptions

Consent

Requirement: Submit an application for proposed development and/or subdivision in conformance with state planning legislation and regulations and Council's requirements.

Exemptions
For applications deemed to comply or exempt refer to: http://www.singleton.nsw.gov.au/Index.aspx?NID=355

5.3.2 Government Authority

Council's authority
Authority responsible for approving applications: Singleton Council

Provisions for development and subdivision are included in the following:

- Council planning instruments.
- Local Government Act.
- Land title registration authority: Department of Lands and Industry (DLI).

Approval criteria: Conformance with the provisions of the state Acts or Regulations does not imply that Council is required to consent to, or approve, an application.

Restrictions: Council's authority to approve the development and subdivision of land is set out in the state Acts and Regulations.

Responsibility: The Developer (or its consultants) is responsible for making sure that all works are designed and constructed in conformance with Council requirements. Obtain advice from Council's planning/engineering/environmental/services sections on any restrictions that apply to the land.

Conditions of contribution: Council's authority to impose conditions for contributions are set out in the state Acts and Regulations.

5.3.3 Submitting Application

Preparation

General: Prepare the application in conformance with **APPLICATION REQUIREMENTS** refer to: http://www.singleton.nsw.gov.au/index.aspx?NID=859 and submit to Council.
Development application form: Available from:

http://portal.singleton.nsw.gov.au/eplanning/Temp/ViewedDocs/TrimDocumentViewer_qbuHGPhcZO.PDF

Fees schedule: Available from:

http://www.singleton.nsw.gov.au/index.aspx?NID=820

Contributions schedule: Available from:

http://www.singleton.nsw.gov.au/index.aspx?NID=970

Submission: Submit application to:

http://www.singleton.nsw.gov.au/Index.aspx?NID=941

Owner's approval: If the applicant is not the owner of the land to be developed, written authority from the owner must be submitted with the application form.

5.3.4 Assessment by Council

Assessment Criteria

General: Council will assess each application based on its merits in conformance with the state Planning Acts and Regulations and the following assessment criteria:

- Natural and built environmental impacts.
- Social and economic impacts.
- Suitability of the site.
- Public interest.
- Conformance with the provisions of any planning instruments, development control plans and regulations applying to the land.

Design standards: Minimum design standards do not relieve the applicant of the responsibility to properly address all assessment criteria. Council will consider alternative approaches to development and subdivision design if the applicant satisfies the Council that objectives of Council have been achieved.

Staged development: If staged development is proposed, prepare a plan showing the complete concept with the various stages and conformance with the standard requirements.

5.3.5 Determination and Appeal

Determination

Notification: Council will notify the applicant in writing stating that consent has been granted subject to conditions, or that consent has been refused (with reasons).
Determination period (days): Generally between 60 to 90 days depending on size and scale of development

Determination period where referral to other authorities is required (days): Generally between 90 to 150 days depending on size and scale of development.

Appeal

Reconsideration: Submit a request for reconsideration within the required time frame from determination. Include the reconsideration fee and list the reasons for reconsideration.
Timeframe for reconsideration (days): Generally between 60 to 90 days depending on size and scale of development.

Appeal to court: Submit an appeal with the appropriate court within the required time frame from determination.
Timeframe for appeal (months): 4 months

Appeal by third party: Any third party may submit an appeal to the court if they believe a breach of the Act has occurred.

5.3.6 Application Approval

General

Revocation of consent: Council may revoke or modify consent in circumstances of fraud, failure to conform with legislation or non-conformance with conditions of consent.

Commencement: The consent will lapse if the works have not been commenced within the consent period from determination or such other shorter period stipulated by the consent.
Typical consent period (years): 5 years

Private certification: Obtain confirmation from Council that a private certifying authority (PCA) can issue subdivision certificates.

5.4 Application Requirements

5.4.1 Accompanying Information

Plans

Details: Provide the following information on the plans accompanying the application:

- Title description of land.
- Scale (preferably 1:500 for subdivisions, 1:100 for developments).
- Location, boundary dimensions, site area and north point of the land.
- Existing vegetation and trees on the land. Refer to Council's tree preservation order.
- Location and use of existing buildings on the land and adjoining properties. Include measured floor
- plans of existing buildings for calculation of floor space ratios.
- Contours to Australian height datum at 1 m intervals based on existing levels of the site.
- Natural features of the site, including rock formations or cliffs, watercourses, flood levels, wetlands, forest areas and slip areas.
- Existing drains, easements or rights-of-way affecting the site.
- Details of existing and proposed subdivision pattern, including the number of lots and location of roads.
- Designated fire prone areas.
- Heritage items (buildings and sites), or relics defined by a heritage Act or considered of local significance.
- Details of proposed access to the site and the legal status of that access.

- Other details relevant to consideration of the application.

Record of consultation

Details: Provide details of consultation with Council, the public, public utility authorities and/or other authorities.

Additional Information

Requirements: Provide the following additional information:

- Principles, assumptions and calculations behind stormwater drainage and on-site detention (OSD) proposals.
- Rationale for the design of utilities, roads, open space, bicycle and pedestrian ways, bus routes, etc.
- A contamination assessment.
- Evaluation of housing types, house type distribution, building lines, fencing, building materials etc.
- Existing site stormwater flows.
- Existing traffic situation.
- Existing utilities service plans.

5.4.2 Environmental Considerations

Environmental input

General: Provide an environmental impact assessment (EIA) to address the following matters:

- Suitability of the land.
- Access.
- Traffic generation.
- Risk of flooding or other natural hazards.
- Flora and fauna.
- Local amenity.
- Waste management.
- Threatened species.
- Filling/earthworks.
- Erosion and sediment control/soil and water management.
- Coastal development/reclamation of coastal areas.
- Sacred sites, heritage, conservation.
- Fire management.
- General pollution.
- Acid sulphate soils.
- Air quality.
- Water quality.
- Biting insects.
- Buffer area management.

Tree protection

Tree preservation: Identify vegetation that is significant to the overall landscape of the area and proposed removal of trees.

Tree preservation officer: Do not prune, damage or remove trees without the consent of Council's tree preservation officer. Contact Council's tree preservation officer before clearing or under-scrubbing is carried out.

Native vegetation: Submit a management plan for the protection of native vegetation in rural areas.

Covenant on land clearing: If required by Council, place a covenant on land clearing prohibiting the following acts to any tree without consent of the Council:

- Ringbarking.
- Cutting down.
- Topping, pruning.
- Removal.

- Endangering.
- Wilful destruction.

Heritage sites

Heritage, Aboriginal and other relics: Identify sites of Aboriginal or heritage significance. Maintain adequate curtilage around any significant item to protect its setting.

Contact for heritage/Aboriginal/other sites: Contact the following services:

- The National Parks and Wildlife Service for details and verification.
- The Heritage Council for details and verification.

Natural Hazard areas

Coastal flooding/erosion: Submit an environmental impact statement for development and subdivisions of land susceptible to tidal inundation or coastal erosion.

Flood prone land: Submit details for the subdivision of flood prone land in conformance with Council requirements.

Bushfire: Provide protection zones and access for fire fighting vehicles and maintenance vehicles to minimise the risk of bushfire damage.

Sensitive Environments

Environmentally sensitive sites: Development and subdivision will not be considered for the following environmentally sensitive sites:

- Estuarine wetlands.
- Rainforests.
- Dune areas.
- Steep slopes.
- Flood prone lands.

5.4.3 Urban Residential Areas

Roads

Access: Provide access in conformance with the following Council objectives:

- To provide for flow of through traffic, at the intended speed limit, giving regard to pedestrian priorities.
- To establish a road hierarchy in conformance with function and usage.
- To provide variation in alignment, allowing for existing natural features and creating interest in the streetscape.
- To provide traffic facilities and parking controls to suit the intended speed limit and streetscape.
- To provide safe pedestrian and cycle routes to each allotment and through the street network, including ramps, public transport infrastructure and environmentally sensitive illumination.

Requirement: Provide a fully serviced subdivision including a sealed road system with drainage, and kerb and channel (gutter), allowing functional and safe vehicular and pedestrian access to each allotment.

Costs: The applicant will be required to meet the full cost of kerb and channel (gutter) across all existing road frontages of any development and subdivision in urban areas, except where direct vehicular access is restricted.

Adjoining roads: Provide kerb and channel (gutter) to provide safe vehicular and pedestrian access. Provide footpaths if required by Council.

Lot size

Requirements: Conform to state legislation and regulations and Council requirements for lot sizes, lot widths, building line setbacks and the supply of services to allotments.

Legal easements width: Provide over stormwater drains and watercourses in conformance with state legislation and regulations and Council requirements.

Services

Water and sewerage: Provide reticulation of water and sewerage services and connections to existing services in conformance with the relevant water and sewerage authority requirements.

Electricity: Provide reticulation of underground electricity services in conformance with the relevant electricity authority requirements. If underground services are not appropriate seek approval from Council and the relevant electricity authority.

Gas: Provide reticulation of gas services in conformance with the relevant gas authority requirements.

Telephone and data services: Provide underground telephone services. If underground services are not appropriate seek approval from Council.

Stormwater runoff: Provide for urban stormwater runoff in conformance with Council's requirements, both within the development and to an external point of discharge.

Flooding

Consideration: The development/subdivision of urban land, other than boundary adjustments, will only be considered if it can be clearly demonstrated that flood free building sites/allotments can be provided and that the creation of these developments/allotments will not adversely affect flood patterns or levels in the area.

Requirement: For development and subdivision on urban land to be considered, demonstrate the following:

- The provision of flood free building sites/allotments to the designated ARI.
- No adverse effect on flood patterns or levels from the provision of allotments.

5.4.4 Rural Residential Areas

Roads

Requirement: Provide kerb and channel (gutter) and underground stormwater drainage in conformance with Council's requirements. Provide concrete lined table drains where scour velocities are excessive and/or the soils are susceptible to erosion from stormwater. For rural subdivisions, provide open drains where specified.

Lot size

Requirements: Conform to state legislation and regulations and Council requirements for lot sizes, lot widths, building line setbacks and the supply of services to allotments.

Services

Sewerage: Provide on-site disposal or connection to existing sewer, in conformance with Council's requirements and the requirements of the relevant sewerage authority. Provide a geotechnical report to support the on-site sewerage treatment proposal.

Electricity: Provide reticulation of electricity services in conformance with the relevant electricity authority requirements.

Natural Features

Configuration: Configure the subdivision with consideration of the following natural features:

- Rivers.
- Creeks.
- Topography of the land.
- Tree groupings.
- Other prominent features.

Buffers: Provide buffers to separate conflicting land uses and to protect water courses.

Run-off to streams: Conform to state legislation and regulations on the diversion or storage of rainfall run-off to allow passage to natural streams.

5.4.5 Rural Development Areas

Roads

Access: Provide a dedicated all-weather road system for functional and safe vehicular access to the development or each allotment, taking into consideration the following:

- The status of the road.
- Existing road surface condition.
- Cost of upgrading.

- Flooding frequency and hazards of creek or river crossings.
- Potential population catchment.
- Bushfire hazard.

Sealing of roads: Provide bitumen sealing to all new roads which are to be an extension of existing sealed roads.

Right-of-way: Council may consider the creation of a right-of-way to serve allotments having the minimum dedicated road frontage but not having road access. Such right-of-way should link an allotment directly to an existing or proposed dedicated road, constructed in conformance with Council's requirements.

Services

Sewerage: Provide on-site disposal in conformance with Council's requirements. Provide a geotechnical report to support the on-site sewerage treatment proposal.

Electricity: Extend reticulation of electricity services to each allotment within the subdivision in conformance with the relevant electricity authority requirements.

Electricity in remote areas: If the subdivision is remote from reticulated electricity services, submit a written agreement from the relevant electricity authority to not supply electrical mains with the application.

Flooding

Requirement: For development and subdivision on rural land partly flood prone to be considered, demonstrate the following:

- The provision of flood free homestead and stock holding areas on each allotment to the designated ARI.
- No adverse effect on flood patterns or levels from the provision of allotments.
- No significant embankments formed by internal roads.

5.4.6 Industrial/ Commercial areas

General

Lot Size: Provide lots of a size to accommodate parking and landscaping and the specific industrial or commercial use.
Design standards: as per DCP

Heavy vehicles: Provide pavement for heavy vehicular traffic.

Services

Water and sewerage: Provide reticulation water and sewerage and connections to existing services in conformance with the relevant water and sewerage authority requirements.

Electricity: Provide reticulation of underground electricity services in conformance with the relevant electricity authority requirements. If underground services are not appropriate seek approval from Council and the relevant electricity authority. Determine the maximum loading requirements of the electricity service.

Gas: Provide reticulation of gas services in conformance with the relevant gas authorities requirements.

Telephone and data services: Provide underground telephone services. Where underground services are not appropriate seek approval from Council.

Stormwater runoff: Provide for urban stormwater runoff in conformance with Council's requirements, both within the development and to an external point of discharge.

5.4.7 Contributions for Off Site Provisions

Council's authority

General: Council has the authority to impose conditions of contribution towards off site provisions.

Open space

Public reserve in residential subdivisions (both rural and urban): Provide an area of public reserve (open space) useable for recreation, or a monetary contribution in lieu of land or a combination of both.

Public reserve in rural subdivisions: Provide an area of public reserve (open space) where the subdivision contains significant areas of special scenic or public recreational value.

Contributions

Requirement: Provide a contribution in conformance with the contribution plan for the following:

- Augmentation of water supply if reticulation is available to the development in the form of sewerage headworks.
- Arterial roadworks where upgrading requirements can be attributed to the development.

5.5 Post-Determination Requirements

5.5.1 Certificates

Building approval

General: Obtain building approval before any works commence on site. Refer to:
http://www.singleton.nsw.gov.au/index.aspx?NID=818

Certifying authority: Singleton Council

Compliance certificates

General: Obtain a compliance certificate at the completion of each stage identified by the certifying authority. Refer to:

http://www.singleton.nsw.gov.au/index.aspx?NID=575

Occupation certificates

General: Obtain an occupation certificate prior to occupation of a building. Refer to:

http://www.singleton.nsw.gov.au/index.aspx?nid=1173
Certifying authority: Singleton Council, PCA

Subdivision certificates

General: Obtain a subdivision certificate authorising the registration of the plan of subdivision. Refer to: http://www.singleton.nsw.gov.au/index.aspx?NID=1255
Certifying authority: Singleton Council, DLI

Construction certificates

General: Obtain a construction certificate prior to any construction works. Refer to: http://www.singleton.nsw.gov.au/index.aspx?NID=956

5.5.2 Engineering Documentation

Certification

General: Provide certification of all drawings for the following works by a Professional Engineer or Registered Surveyor:

- Earthworks (site regrading).
- Roadworks.
- Drainage works.
- Water supply.
- Sewerage works.

General: Provide certification of all drawings for the following works by a Professional Engineer:

- Bridgeworks.
- Retaining walls.
- Other major structures.
- Pumping stations.

Documentation

Council documents: Obtain standard drawings, design specifications and construction specifications prepared by Council for use in developments and subdivisions.

Specifications: Provide specifications conforming to Council's requirements for all works not covered by Council specifications.

Design drawings

- Requirement: Provide drawings for the following works:
- Earthworks (site regrading).
- Roadworks.
- Road pavement.
- Road furnishings.
- Stormwater drainage.
- Water supply works.
- Sewerage works.
- Landscaping works.
- Erosion control works.
- Works and signage management (if required)

5.5.3 Commencement of Works

Necessary conditions

Approval: Do not commence works on site unless a construction certificate for civil or building works has been approved and issued.

Quality control

Minimum requirement: Nominate the developer's Superintendent or representative and obtain approval from Council of their qualifications and experience.

Quality assurance

Standard: To AS/NZS ISO 9001.

Quality plan: Submit a quality plan before commencement of works if a quality assured design or construction is a condition of consent.

Water, sewerage and drainage
Certifying authority: Singleton Council

5.5.4 Inspections and Testing

General

Requirement: Submit test results to verify the materials supplied and the work carried out conform to the approved documentation.

Inspections

Key stages: Arrange inspections with Council's nominated person at the following key stages of construction nominated as a condition of consent:

- Site regrading and clearing.
- Installation of erosion control measures.
- Protection of existing services.
- Preservation measures for trees, vegetation or heritage sites.
- Site sampling and testing.
- Provisions for new services.
- Formwork and reinforcement before placing of concrete.
- Drainage installation before backfilling.
- Water supply installation before backfilling.
- Subgrade preparation.
- Establishment of line and level for kerb and channel (gutter) placement.

- Road pavement construction.
- Road pavement surfacing.
- Final inspection.
- End of maintenance period.

Records

Procedures: Submit records of all test results to the certifying authority promptly. Testing to conform to documented test procedures by testing organisations approved by Council before commencement of works.

Access: Allow uninterrupted access at all times for audit inspections or testing.

Hold points: Certain stages of construction will be subject to Hold points, pending acceptable test results. Each construction work-section provides a summary of Hold points and Witness points required during the construction activity. See appropriate construction work-sections for further details.

5.5.5 Insurances

Policies

Professional indemnity: Provide evidence of professional indemnity insurance for the Developer's lead consultant.

- Minimum insured value required ($): 20m

Third party and public risk: Provide evidence that all Contractors have obtained appropriate third party and public risk insurance.

Submission of insurance documentation: Before the commencement of the works.

5.6 Completion

5.6.1 Completion of Works and Title Issue

Documentation

Final survey (original) plan: Provide the final survey plan prepared by a Qualified Surveyor upon completion of all conditions of development consent, and any other certificate approvals.

Subdivision certificate: Submit the following for endorsement of the subdivision certificate:
The final survey plan.

Number of copies: Electronic copies of DP plan and land title registration and 1 hard copy for signing.

Size of final survey plan: A1, A2 with ability to reduce to A3 and A4

Street name approval from: Geographical names board.

Title issue: Submit plans with the land title registration authority to effect plan registration and the issue of new titles for the subdivision lots.

Maintenance period

Commencement maintenance period: At the date of issue of the subdivision certificate

5.6.2 Work-As-Executed

Requirement

Certification: At completion, submit as an accurate record, one full set of WAE drawings marked up in red showing any variations from the design certified by the lead consultant.
Certification for digital submission: Water supply WAE drawings: in .pdf and .dwg

5.6.3 Bonds

Construction Security Bond – SOP

1. Prior to construction of the works commencing the developer is required to lodge a security bond in cash or unconditional Bank Guarantee to the value of 5% of the estimated cost of the construction of the works prepared and certified by the Consulting Engineer.

2. A bank guarantee should include:
   a. A binding contractual relationship between Council and the guaranteeing bank.
   b. Specific requirements for renunciation of the guarantee.
   c. Require adequate notice of renunciation.
3. The bond is to be accompanied by Council's Security Lodgement Form (Appendix A) clearly identifying the purpose of the bond together with the Consulting Engineer's certification of the value of the works.
4. The bond is required to provide security to Council in the event that costs are incurred as a result of the following:
   d. Protection of on-street works from damage by contractors, sub-contractors and suppliers.
   e. Repairs to on-street works resulting from damage caused by contractors, subcontractors and suppliers.
   f. Protection and repair of existing Council services (i.e. sewerage connections, water connections etc.).
   g. Non-compliance with the approved Erosion and Sediment Control Plan during construction.
   h. Failure to provide adequately for traffic.
   i. Urgent action required by Council to resolve unsafe construction or emergency repairs required to protect persons and/or property from consequential damages.
5. Any costs incurred by Council in responding to the above circumstances will be recovered from the Security Bond.
6. At the completion of the works and the commencement of the Defects Liability period, the construction security bond shall be returned to the developer or may be substituted for the defects liability bond.

Defects Liability Bond

1. Council requires a bond, in an amount of 5% of the value of the works, which is kept for the period of twelve months or until the works are finally accepted.
2. The bond is to be submitted with Council's Security Lodgement Form (**Appendix A**) clearly identifying the purpose of the bond together with the Consulting Engineer's certification of the value of the works.
3. The Construction Security Bond lodged prior to construction may be used for the purposes of the Defects Liability bond subject to Council's approval.
4. Following a satisfactory Final Acceptance inspection, the Consulting Engineer shall submit a written request to Council for Final Acceptance of the works and release of the Defects Liability bond. Council will, upon confirmation that no outstanding payments arising from the development are due to Council, confirm acceptance of the works, and arrange for the release of the Defects Liability bond

Appendix A

SECURITY LODGEMENT FORM

This sheet must be completed prior to the acceptance of any bond by Council.

Development Name: .....

Stage: ..... DA No.: .....

Applicant: .....

Consultant: .....

Purpose of Bond:

O Construction Security O Defects Liability

.....

.....

Construction/Defects Liability Bond Assessment

Consulting Engineer's estimated value of completed works $ .....

Construction/Maintenance Bond Value (apply Factor 0.05) (min $500.00) $ .....

Consulting Engineer: .....

Signature: .....

Date: .....

6 Applications for Works Approval

6.1 General

A **Construction Certificate** must be obtained prior to commencement of any site establishment and construction works to which a Development Consent relates. The Construction Certificate normally relates to works only within the properties to which the Development Consent relates.
A **Civil Works Approval** must be obtained prior to commencement of any site establishment and construction works in relation to works where the approval of those works is required under the *Roads Act 1993* or the *Local Government Act 1993* or the *Water Management Act 2000*.
In addition to the preparation of engineering plans and specifications, the issuing of a Construction Certificate or Civil Works Approval may involve compliance with a range of matters which may include:

- Development Consent conditions.
- Integrated Development Approval requirements.
- Utility suppliers' information and requirements.
- Affected landowner requirements.

Applications to Council for Construction Certificates involving civil works and for Civil Works Approvals shall be made using the appropriate application forms which may be obtained from the Council. Application forms shall be accompanied by all documentation relevant to the application.

A Compliance Certificate for Complying Civil Works is only issued by Council where Council has been engaged to carry out compliance inspections as the Certifying Authority.

6.2 Consultation with Council

It is recommended that the Service Provider and their Design Consultant meet with Council prior to commencement of the design process to gain an understanding of critical aspects of the Development Consent and the approval processes relevant to the design.

6.3 Development Consent

The Development Consent may require:

- Obtaining approvals from other authorities.
- Obtaining further approvals from Council regarding aspects of the development.

It is the responsibility of the Project Manager to make enquiries and meet any additional requirements to enable the detailing of drawings and preparation of specifications as required for such matters as:

- Integration of environmental and professional report information.
- Integrating requirements of other Council approvals.
- Location, protection or relocation of utility mains and Installations.
- Provision of utilities and street lighting.
- Approval body compliance.
- Affected private landowner agreement.

Council may require copies of appropriate documentation for any consent, licence, permit, permission or any form of authorisation prior to the issuing of a Construction Certificate or Civil Works Approval.

6.4 Preparation of Engineering Design Submission to Council

Plans and documentation which accompany an application for **Civil Development and Subdivision Works** shall be prepared in accordance with Council's *Engineering Design Guideline* and the Development Consent.
Design plans and documentation are also to serve as the reference plans for detailing other site activities or controls required by conditions of the Development Consent, for example, wildlife and heritage protection. Where supplementary plans, documentation or studies are required to appropriately detail other site activities or controls, notes shall be included on the appropriate design base plans referencing the supplementary requirements.
It is necessary that engineering plans for civil works incorporate all necessary details for all approved development activities. It may not be sufficient to reference environmental or other reports without incorporating relevant report recommendations into the design.

6.5 Submission of Preliminary Engineering Plans to Council

A preliminary set of plans and supporting information may be submitted for examination with a view to resolving technical issues. Subsequent submissions shall comprise of a full application for a Construction Certificate and/or Civil Works Approval, a Compliance Certificate or other required approval.
Fees will be applicable for preliminary reviews and resolving technical or other design related issues in accordance with Council's fees and charges.

6.6 Other Approval Applications Required by Council

A range of applications to Council may be required where Council is responsible for approvals outside the *Environmental Planning and Assessment Act 1979* or where Council-controlled land is affected.
These approvals may include:

- Local Approvals under the *Local Government Act 1993*.
- Water and Sewer connections or adjustments.
- Section 306 Certificate of Compliance Notice of requirements (*Water Management Act 2000*).
- Application for Approval of Engineering Plans and Specifications for Water and Sewer works under Section 306(2) (b) the *Water Management Act 2000*.
- Applications for Approval under Sections including 74, 75,115, 122, 138 and 139 of the *Roads Act 1993* to do work or control traffic on a Public Road.
- Works on Council-controlled land.
- Approvals under Section 51 of the Road Transport (Safety and Traffic Management) Act 1999.

The requirement to make these applications will usually be contained in the Development Consent conditions. However, the requirement for these applications may not be evident until assessment of Civil Works designs or the commencement of construction.

7 Site Earthworks Design

7.1 General

Provisions of Council's *Engineering Construction Specification* and other Council references apply to subdivision development site works involving earthworks or earthen structures as well as other development related works on land under Council's control.
Requirements from any management plans related to the development approval or required by the development approval conditions shall be incorporated in the design of earthworks.
The Developer is to ensure that necessary environmental licences pertaining to site earthworks are obtained and their requirements are incorporated in the engineering design and any supplementary Specification.
The Designer shall consider as a minimum those factors that may affect the earthworks listed in Section 2 of AS 3798 *Guidelines on earthworks for commercial and residential developments*, for all types of development.
A Geotechnical Consultant shall be engaged by the Developer to carry out site investigation and provide site specific recommendations regarding earthworks design and construction.

7.2 Expansive and Reactive Soils

The retention and use of expansive and reactive soils shall be in accordance with the recommendations of a Geotechnical Engineer's report obtained in respect of the impact of any reactive soils on the following:

- Design of road pavements.
- Design of public infrastructure.
- Behaviour in conjunction with the operation of Water Sensitive Urban Design systems.
- Suitability for building foundations.
- Design of thrust restraint.

7.3 Urban Salinity

The Designer shall seek specialist advice regarding 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 Consultant identifies urban 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 proposed private land.
- Prevent any immediate or progressive increase in severity or coverage of areas affected by salinity.

7.4 Minimisation of Soil Surplus

The Designer shall endeavour to minimise the amount of surplus material that will be required to be removed from the site. Factors that must be considered in relation to surplus material include the cost to remove and dispose of material to an approved waste facility, classification of the material and reuse of the material at an alternative approved site if allowed by the materials waste classification.

7.5 Site Regrading

Site regrading may only be carried out as identified in the Development Consent.

The Designer shall consider the following points as part of the design:

- Any requirements arising from the Development Consent conditions in particular a Stormwater Management Plan and a Vegetation Management or Tree Protection Plan.
- Cut and filled areas are generally to be shaped and graded at a minimum of 1% to avoid surface ponds and facilitate drainage.
- The fall of the regraded surface shall direct surface flow to generally retain existing runoff conditions beyond the regrade area other than where being collected and conveyed by a designed drainage system such as a roadway. Surface runoff from regrade areas is not to be directed into existing interallotment drainage systems. Provision shall be made along the toe of the fill batters or base of retaining walls within or adjacent

to regrade areas to permit the free passage of stormwater and subsurface water away from adjoining properties.

- Regrading or retaining works at property boundaries are not to cause surface ponding or the reduction in stormwater disbursement from adjoining properties or impact on the amenity of such properties. Catch drains, sub-surface drains and/or interallotment drainage shall be provided to adequately drain such areas. The drainage system shall be designed and have a capacity to ensure that there is no risk to persons, inundation of habitable property or potential for drainage nuisance due to flooding.
- Where slopes exceed four horizontal to one vertical (4:1), geotechnical advice shall be obtained in respect of groundwater flows and slope stability issues in areas affected by regrading.
- The design of works within areas affected by regrading must consider the proposed finished surface levels in addition to the existing surface levels.

7.6 Retaining Walls and Batters

The location of retaining walls or batters will depend on the following:

- Type and design of the wall or batter including surface and subsurface drainage and backfill material.
- Foundation requirements.
- Construction method with provision for support throughout construction activities.
- Locations of existing and proposed services including interallotment drainage and sewers.
- Locations of existing and proposed drainage secondary flow paths.
- Measures and works designs required for the protection and support of services throughout construction activities and in a permanent manner.
- Any structures on the properties adjacent to a proposed excavation.
- Vegetation to be retained.
- Permit to Enter or impacts on adjoining land or structures.
- Impact on existing drainage overland flow paths.
- Achieving the required sight distance where retaining wall is located adjacent to a road.
- Location of existing or proposed water or sewer mains.

Where practicable, avoid placing public utility services in fill zones, particularly existing or proposed water and sewer mains. Best practise is to install these mains in virgin cut material rather than within a constructed fill embankment due to the increased risk of water ingress and subsequent slip failure.

All retaining walls and batters must be consistent in height and extent as approved in the Development Consent. Road batters shall be blended into adjacent proposed lots where possible.

Retaining walls, including the footings, footing support and batters, other than road batters, shall be wholly located within the lot required to provide support (Note: The common law duty of care for negligence regarding support for land is contained in Section 177 of the *Conveyancing Act 1919*).

All retaining walls (cut or fill) to be wholly constructed with the zone of influence (ZOI) being in the land requiring the retaining wall and **not in the council reserve**.

The Service Provider shall arrange for the retaining wall to be designed and certified by a Qualified Civil or Structural Engineer using recommendations made by a Geotechnical Engineer. The design shall, as a minimum design standard, be carried out in accordance with AS 4678 *Earth-retaining structures*. The absolute minimum design life shall be 60 years. Where access to the proposed retaining wall will not be practicable in the future for its reconstruction or replacement, or the wall is for a road formation, the design life must be increased to 100 years.

The design of batters shall be carried out using recommendations made by a Geotechnical Engineer who shall also identify any constraints on the use of adjoining areas of land and any ongoing maintenance requirements for batters. Batters shall not impose or create onerous constraints and maintenance requirements or result in unreasonable construction or maintenance costs.

The desirable gradient to batters within lots shall be 6:1, with a maximum design gradient of 4:1 except where written advice is provided by a qualified Geotechnical Engineer, which supports steeper batters.

7.7 Effects on Utility Services

The Designer is to identify all services that are impacted by proposed earthworks.

8 Control of Erosion and Sedimentation

This guideline provides additional information on erosion prevention and sediment control to support a development application in accordance with Council's Development Control Plan (DCP). This guideline covers:

- Erosion and Sediment Control Plans,
- Soil and Water Management Plans, and
- Erosion and Sediment Control Techniques.

8.1 General

The minimum standard of erosion prevention and sediment control planning required for a development is categorised by the total area of soil surface, which will be exposed. This includes areas of cut and fill, vegetation removal, driveways and access ways.

Minimisation through effective prevention and control management is required for all development. This should be through a ***TREATMENT TRAIN*** approach that utilises various devices in sequence.

Failure to comply with the requirements of this Plan can cause serious erosion and sediment control problems, costly to the community and the environment, as individual or cumulative effects. Thus, failure to comply may can result in the issuing of an order and/or the imposition of a monetary penalty under the *Environmental Planning and Assessment Act 1979*.

It is also an offence to pollute waters under the *Protection of the Environment Operations Act 1997*.

8.2 Erosion and Sediment Control (ESC) Plans

8.2.1 Disturbance 250m^2 to 1000m^2

Where disturbance is between 250m^2 and 1000m^2, the ESC Plan should be a graphic plan (at a scale of at least 1:200) that identifies the erosion prevention and sediment control measures required for the site. Minimum requirements are outlined below.

Erosion Prevention and Sediment Control Plans as a minimum should contain:

- Locality details (address, lot no, etc),
- North point and scale,
- Property boundaries and adjoining roads,
- Existing land contours,
- Location of existing trees and vegetation,
- Location of existing significant landscape features,
- Existing watercourses and drains flowing through, or adjacent to, the site,
- Outline of proposed building/structures and disturbed areas,
- Proposed vehicular access,
- Extent of vegetation to be cleared,
- Extent of earthworks and limits of cut and fill,
- Location of proposed stockpiles,
- Location of proposed temporary and permanent site drainage,
- Location of proposed temporary erosion prevention and sediment control measures,
- Location of temporary and permanent re-vegetation areas,
- An explanation of any changes to the erosion prevention and sediment controls as the works proceed,
- Supplementary notes covering inspection and maintenance requirements.

8.2.2 Disturbance Exceeding 1000m^2

When disturbance exceeds 1000m^2, ESC Plans or Soil and Water Management Plans (SWMP's) must be prepared that provide more detailed consideration and are prepared in accordance with the publication, The 'Blue Book' (Managing Urban Stormwater Soils and Construction) – by Landcom, Fourth Edition (2004).

This publication states that an ESC Plan should comprise a set of drawings showing the proposed site controls and a narrative describing how erosion and sediment control will be achieved on site. The narrative should also include

proposed measures for ongoing maintenance of the installed controls. The requirements below are in addition to the Minimum Requirements for *Disturbance 250m^2 to 1000m^2* above.

The following additional details are required for EP&SC Plans where development exceeds 1000m^2:

- Soil classification and statement regarding erosion hazard,
- Site access and site management through the various stages of the work,
- The nature and extent of regrading and filling,
- Locations where ground cover will be maintained as 'no access' areas,
- Topsoil storage, protection and re-use methodologies,
- Catchment definition and calculations,
- Details of the diversion of stormwater from upslope areas around disturbed areas,
- Site rehabilitation including schedules, revegetation program,
- The frequency and nature of maintenance activities recommended,
- Symbols key, and
- Standard notes

8.2.3 Disturbance Exceeding 2500m^2

When disturbance exceeds 2500m^2, ESC measures are incorporated as a component of a SWMP in accordance with The 'Blue Book' (Managing Urban Stormwater Soils and Construction) – by Landcom, Fourth Edition (2004).

Soil and Water Management Plans as a minimum should contain:

- Detailed calculations to determine the soil loss and the size of any sediment basins that may be required on the site,
- Information required for an EP&SC Plan,
- The location of lots, public open space, stormwater drainage systems, schools, shopping centres/community centres – (if nearby),
- The location of land designated or zoned for special uses,
- Location and diagrams of all erosion and sediment site controls used,
- Locations, calculations and engineering details of any sediment basins,
- Location and details of other stormwater management structures such as; constructed wetlands, gross pollutant traps, trash racks or separators.
- Procedures for the operation and maintenance of pollution control equipment/works must also be noted including:
  - ❖ quality and characteristic of any wastes before treatment,
  - ❖ estimate quality of wastes after treatment,
  - ❖ details of permitted maximum pollution levels specified by Council or the EPA,
  - ❖ estimate of the average volumes of waste from the site,
  - ❖ details of the treatment methods eg flocculation agents,
  - ❖ methods of disposal of the wastes, including discharge points and/or disposal areas,
  - ❖ details of major items of equipment used eg pumps, sprays etc.,
  - ❖ identify any special requirements or site conditions that exist (and may require specialist services/advice),
  - ❖ identify inspection procedures and inspectors,
  - ❖ any other relevant matters.

Statement of compliance for ESC and SWMP

The applicant shall submit with the ESCP/SWMP, a Statement of Compliance, stating that:

- The Plan has been developed by an appropriately qualified and experienced professional in erosion and sediment control;
- The Plan complies with the requirements of a ESCP/SWMP as set out in LMCC's DCP and these guidelines;
- The Plan and associated documents, calculations and drawings, have been prepared to a standard, which, if properly implemented, will achieve the water release criteria of 50mg/L of Total Suspended Solids (TSS) as identified in The Blue Book (Managing Urban Stormwater – Soils and Construction. Landcom, 2004); and
- All erosion and sediment control measures are in accordance with the latest version of The Blue Book (Managing Urban Stormwater – Soils and Construction. Landcom, 2004), Best Practice Erosion and Sediment Control - International Erosion Control Association (Australasia) 2008, or other current recognised industry standard for erosion and sediment control for Australian conditions.

8.3 EROSION AND SEDIMENT CONTROL TECHNIQUES

All measures are to be in line with The 'Blue Book' (Managing Urban Stormwater Soils and Construction) by Landcom, Fourth Edition (2004) as a minimum and then additional measures as required to prevent any sediment leaving the site.

8.4 FURTHER INFORMATION

For further information on erosion and sediment control requirements, please contact Council's Erosion and Sediment Control Officer.

The 'Blue Book' (Managing Urban Stormwater Soils and Construction) – Landcom, Fourth Edition (2004). www.landcom.com.au

'White Books' - IECA 2008. Best Practice Erosion and Sediment Control. Books 1-6. International Erosion Control Association (Australasia). Picton NSW. http://www.austieca.com.au/

9 Geometric Road Design – Urban and Rural

9.1 General

Detailed Design Drawings and documentation shall describe the extent of works specified in the Development Consent, contract or project plan.
The Designer is to assume that the works will include but not be limited to signs, pavement marking, street lighting, safety barriers, utilities adjustments, transitions and tie-ins to existing structurally sound road pavements, stormwater drainage, concrete footpaths, shared paths, cycleways and remedial works or reconstruction or relocation of adjacent infrastructure necessary for the safe operation and use of the new works.
Design submissions shall be accompanied by a Design Report which addresses road design issues including provisions for safety, geometric constraints, stormwater drainage, public utilities, whole asset life consideration and justification for the design parameters adopted.

All designs must be in accordance with Austroads publications, Australian/New Zealand Standards, TfNSW Supplements and this *Design Guideline*. Deviations from any standards shall be expressly stated in the Design Report.

9.2 Design

9.2.1 Road Design Widths

Road carriageway and verge widths for new roads shall be in accordance with Table 1 Road Hierarchy and Road Width Schedule.
Consideration needs to be given to future proposals and matters such as:

- Current annual daily traffic (ADT) volume and type of use.
- Proposed road works or traffic management schemes.
- Proposed zoning changes or developments.
- Alignment and condition of constructed road pavement, kerb, etc.
- Drainage (location and adequacy) and topography (for access and verges).
- On-street car parking requirements.
- Standard of geometric design.
- Location of existing and proposed services and street trees.
- Requirements of TfNSW on Classified Roads.

9.2.2 Consistent Road Width

Where lot catchment numbers trigger more than one road type within a defined length of road/street, unless justified, the higher road type shall be adopted. Opportunities where road width may be varied may be at intersections, traffic management device, curving horizontal alignment, or similar.

9.2.3 Impact on Existing Roads

Where a new subdivision impacts on the existing local road network and road-works such as pavement widening or rehabilitation are required, the road alignment and pavement needs shall be determined by Council independently of the following Road Type table taking into account traffic volume and type, the needs and amenity of the existing road network, and an appropriate service to the community. Road widths greater than those shown in the ‘table’, may be required.

Where works are required as part of the development to augment an arterial or classified road, Council shall determine independently of this Manual the needs for that road.

Table 1 Road Hierarchy and Road Width

Road Types and Dimensions									
URBAN ROADS									
Road Type	Maximum traffic volume (vpd)	Max No. Lots	Reserve Width (m)	Carriageway / Kerb-Kerb (m)	Footway Verge (m)	Kerb Type	Footpath (1.5m Wide)	Design ESA	Maximum Longitudinal Gradient (%)
Urban Local 3 (Laneway)	20	-	8	4	2	Upright one side	As Required	1×10^5	15
Urban Local 2	300	50	17	8	4.5	Upright	One Side	2×10^5	15
Urban Local 1	2500	100	18	9	4.5	Upright	One Side	5×10^5	15
Urban Collector	6000	600	20	11	4.5	Upright	One Side	5×10^6	12
Urban Sub-Arterial	>6000	3500	22	13	4.5	Upright	Both Sides	1×10^7 min	10
Industrial - Secondary	60	-	20	11	4.5	Upright	As Required	5×10^6	6
Industrial - Primary	>60	-	22	13	4.5	Upright	As Required	1×10^7	6
RURAL ROADS									
Road Type	Maximum traffic volume (vpd)	Min Lot Area	Reserve Width (m)	Minimum Pavement Width (m)	Footway Verge (m)	Kerb Type	Footpath (1.5m Wide)	Design ESA	Maximum Longitudinal Gradient (%)
Rural Local 3 / Cul-de-Sac	150	40Ha	22	6	8	As Required	Nil	1×10^5 min	15
Rural Local 2	250	20000	21	7	7	As Required	Nil	Per ‘lots’ above	15
Rural Local 1	1000	10000	21	8	6.5	As Required	Nil	Per ‘lots’ above	15
Rural Collector	2000	5000	22	10	6	As Required	One Side	Per ‘lots’ above	10
Rural Sub-Arterial	>2000	2000	20	11	4.5	As Required	One Side	Per ‘lots’ above	8

Notes:

1. **Location specific Engineering Design Guidelines** requirements take precedence over the values stated in the DCP.
2. **Indicative operating speeds** are to assist in encouraging designs that influence lower speeds in line with safe system principles.
3. **Carriageway widths** for each road type shall be based on the applicable road function and traffic volume in achieving the required road hierarchy. Urban road centre and edge line markings shall only be installed on roads ≥11m wide, unless specifically required. Traffic lane widths on higher volume collector/distributor roads (ADT >6,000), which are bus routes, shall be 3.5m min, resulting in greater road reserve widths. Both bus service and school bus routes shall be defined as bus routes for road design, pavement design and road width requirements.
4. **Verge widths** must be widened to accommodate shared paths and the widening shall be the difference in width between the shared path and a standard 1.5m wide footpath.
5. **Road grades** should be arranged and designed to achieve mobility requirements, where practicable.
6. **Shared path(s)** minimum 3.0m wide may be required on all the above road types.
7. **Design ESAs** for pavement designs shall be determined from traffic study volumes for the subject road based on a 40-year design life.
8. **Rural road operating speed, road width and geometric design** shall be based on Austroads Guide to Road Design, TfNSW Supplements and Rural Fire Service requirements.

Grades above the ones stated will be permitted in special circumstances with the approval from Council design engineer.

9.2.4 Horizontal Curves

The horizontal alignment should be carefully chosen to balance the topography, with the desired speed control and adequate safety, for all road users.

- In urban areas, a changing alignment is encouraged in order to maintain low traffic speeds. Curve radii are generally established by the approved subdivision plan.
- Long straights connected with short (isolated) radii curves are undesirable.
- The maximum deflection for which a curve is not necessary is 1.5 degrees.
- Horizontal curves on urban arterial, sub-arterial and distributor roads shall comply with Austroads standards. The desirable minimum curve length should be 70m and the minimum desirable radius, 400m (due principally to adverse crossfall). [Ref: Urban Road Design, A Guide to the Geometric Design of Major Urban Roads (AP-G69/02)]
- Horizontal curves on rural roads shall comply with Austroads & RMS standards for rural roads
- “Broken-back” curves (created by a short length of intervening straight between two uni-directional curves) should be avoided in an urban street environment regardless of road hierarchy due to an unsafe changing alignment. Such curves are not permitted on roads of Collector status or greater, or within Large-Lot subdivisions. Exceptions may be granted by Council where travel speed necessarily varies appreciably (as may occur at sharp curves/bends approaching 900 or approach to a traffic control facility, interrupting traffic flow) and, where the connecting straight is greater than 150m between tangent points. Regardless, good design practice should prevail with improvement by the substitution of a single curve or a compound curve.
- Compound (uni-directional) curves with common tangent points should provide comparable radii ratios, generally not less than 0.75 (smaller divided by larger), although a lesser value may be considered in constrained urban situations.
- Reverse curves without tangent point separation, are not desirable and should be avoided.
- Where vertical curves are combined with horizontal curves, the combined respective sight distance requirements should ensure compliance with relevant standards.
- All curves must be assessed to accommodate large-vehicle access to urban areas taking into account the road hierarchy and the potential for passing of moving vehicles, and of parked vehicles.
- Travel lane widening for vehicle-tracking must be considered on major roads (roads with a carriageway width greater than an 11m) in relation to line marking and parking requirements. Generally, a 3.3m wide travel lane will accommodate large vehicles. [Ref Guide to Road Design – Part 3: Geometric Design 4.2.4 & 5]

9.2.5 Longitudinal Grades

For urban and rural areas centreline longitudinal grade limits are as shown Table 1 Road Hierarchy and Road Width.

9.2.6 Vertical Curves

Crest vertical curves shall be designed as a minimum for Stopping Sight Distance (SSD) for the nominated design speed. Sag vertical curves shall be designed for riding comfort. Where minor changes in grade (less than 1%) occur, vertical curve lengths shall satisfy appearance criteria.
Reaction times shall be 1.5 seconds for urban and 2.5 seconds for rural areas.

In order to improve gutter flows and pit inlet capacity where grades are less than 1%, sag vertical curves in kerb and gutter design should be eliminated. An increase in the road crossfall in the vicinity of the sag pit to achieve this requirement will ensue.

9.2.7 Crossfall and Superelevation

Generally, roads should be crowned in the centre with 3% crossfall. Offset crowns are acceptable where warranted, to achieve satisfactory cross section profiles for adequate gutter/road capacity for stormwater runoff.

One-way crossfall may be applied in special circumstances subject to Council’s concurrence (such as in difficult cross-sloping topography) with special attention given to control of the catchment contributing stormwater runoff to the gutter, (such as providing IAD pipelines) that does not exceed gutter capacity.

Superelevation should not be applied, but may be permitted on major urban and rural roads with design speeds of 80 km/h or greater, unless otherwise advised by Council.

Table 2 Road Crossfalls for various pavements

Type of pavement	Crossfall (%)
Earth, loam	5
Gravel, water bound Macadam	4
Bituminous sprayed seal	3
Asphalt	2.5 – 3
Concrete	2 - 3

9.2.8 Footways, Footpaths

Footpath and footway parameters shall be designed in accordance with standard drawings SCSD - 702, SCSD – 301 to 305 and the following:

- Footway minimum widths - 4.5m & 5.5m (subject to footpath width)
- Footway crossfall – 2.5%.
- Footpath width - ≤1.5m
- Shared path width - ≤1.5m
- Footpath crossfall - ≤2.5%
- Longitudinal grades of footpaths shall match adjacent roadway/kerb grades.
- Where footpath grades exceed 12% special consideration shall be given to pedestrians.
- Steps are an undesirable element in public space design and should be replaced with ramps wherever possible. Where approved, they shall conform to the Building Code of Australia and handrails shall be provided.

Variation to these parameters will only be considered under exceptional justifiable circumstances.

A concrete footpath within the footway shall be provided, in principle, for lot catchments of generally greater than 10 lots. Footpath warrants, particularly in the vicinity of, or within the desire-line of, commercial and school precincts must be determined in conjunction with such surrounding development (present and planned), and with direction/desire-line destinations. Footpaths in industrial (IN1) and rural (RU1, RU2 & R5) zoned areas are not generally required unless specifically required by a planning instrument.

9.2.9 Batters

Batters of cut and fill should generally comply with the following requirements unless otherwise advised by the geotechnical engineer. This is to ensure that property access, pedestrian safety, and maintenance issues are satisfactorily achieved. Refer to Council's standard drawing SCSD - 702.

Table 3 Maximum Batter Slopes

	MAXIMUM SLOPE (HOR : VERT)
Road Reserves	4 : 1(1)
Lots	4 : 1(2)
Public Open Space	5 : 1(3)

Notes:

(1) This slope is nominated primarily for purposes of maintenance rather than batter stability.

(2) Steeper slopes, up to 3:1 are permitted but should be avoided. Lots with steep batters shall be assessed for acceptable garage locations and driveway grades that conform to Council Standard Drawings SD008.

(3) Where regular maintenance is expected, 6:1 should be provided. Where maintenance is not required such as for natural bush, 3:1 may be permitted.

- Confirmation by a geotechnical engineer of suitable batter slopes for particular soil types may be necessary.

- Cuttings in rock may be near vertical, as recommended by an engineer.
- Batters for lotfill shall be contained within the lot.
- Road batters which extend into lots, should intersect with the natural surface level within the building line setback as adopted by Council.
- Variations outside of these parameters will only be approved where justified.

9.2.10 Kerb Returns and Cul-de-Sac

A *circular* turning head within a cul-de-sac is the preferred treatment. Other treatments will be considered only where site constraints exist, with a turning head layout that caters for manoeuvres of a single unit Heavy Rigid Vehicle (HRV), typically a garbage truck. See Council's standard drawing SCSD-701.

> An adequate kerb radius/road-width relationship shall be adopted for the maximum sized expected design vehicle (usually a 19m Articulated Vehicle - AV) to provide acceptable access to a subdivision and for manoeuvrability within intersections. In urban environments the usual minimum standard kerb radius is 8m, although, depending on the type or the Level of Service (LoS) of the intersection, Council shall determine an acceptable sweep path (and hence kerb radii) that may or may not employ cross-lane vehicle manoeuvres.

The minimum pavement crossfall in turning heads shall be 2%. In turning heads where the depth of excavation is significant, in order to reduce the effect of the cutting and batter, the crossfall from the circle centre may be adverse (positive).

	RESIDENTIAL	INDUSTRIAL
Cul-De-Sac	10	16
Transition	30	50
Kerb Return (at intersection)	8	12
Kerb Return (at sharp mid-block bends)	15	See Note

Note: Sharp mid-block bends are not appropriate in industrial areas. If unavoidable, B-Double turning paths must be satisfied.

9.2.11 Shoulder Construction

Shoulder crossfalls must not be less than the existing adjoining pavement. The design edge of bitumen or lip of channel level should have a 3% crossfall from the ultimate design centre line levels as determined in the design. Crossfalls of the new pavement shoulders in the range of 2% to 6% may be acceptable provided the ultimate half road crossfall of 3% is achievable in the future.
The condition of the existing carriageway pavement and the ability to tie the proposed design levels to the existing pavements with appropriate transition lengths as defined in Council's *Civil Works Specification - Standard Drawings* will determine the extent of new pavement construction and/or reconstruction associated with the shoulder construction.

The cost of the relocation of utility services can be substantial. Where this becomes evident the designer shall discuss preliminary design issues and utility costs with Council's Representative.

9.2.12 Upgrading Rural Public Roads

Rural public roads shall be designed in accordance with Austroads publications and TfNSW Supplements.
Where the upgrading of a rural road is required, Council's Representative may advise on matters such as, but not limited to the following:

- Required road cross section.
- Required surfacing and pavement type and required pavement design.
- Design traffic loadings.
- Design Annual Exceedance Probability for flooding events for longitudinal and cross drainage.
- Table drain treatments and outlets.
- Effects on farm dams.
- Applicability of street lighting.

- Need to comply with NSWRFS *Planning for Bush Fire Protection Guide*.

9.2.13 Extension of and Connections to Existing Roads

Where new works are required which extend or connect with an existing road, the Design Drawings shall detail connect 60m past the scope of works to detail connections.
Transitions shall be designed to safely and efficiently merge the new Works with existing road pavements, road shoulders, table drains, path width and shape, existing vehicle access crossings, driveways, traffic control devices and other features in the road reserve.

Transition designs must not create roadside hazards such as utility poles, vehicle access crossings, driveways, deep edge drains, steep path paving at the start and end of works. The design must address any identified hazards and be included in the scope of works.

9.2.14 Roundabouts

Roundabouts shall be designed in accordance with Austroads and RMS Guidelines.
General geometric layout principles should be confirmed with Council prior to preparation of a detailed design. Particular attention will be given by Council to future traffic needs as they relate to the number and configuration of approach and circulating lanes. Wherever possible and appropriate, two approach lanes should be adopted. Pavement markings shall be utilised for dedicated traffic-lane movements. Two lane circulating roundabouts must employ two travel lanes at departures.
The following principles should also be addressed:-

- Circulating vehicle paths catering for a 19m Articulated Vehicle (AV)
- All roundabout road pavements should be constructed in reinforced concrete. (see chapter 5)
- Adequate design capacity and strength, with a 40-year (min) design life.
- Appropriate sight distance and provision for future services, pedestrians, cyclists, drainage, lighting, signposting and line marking.
- A maximum through-movement deflection radius of 100m.
- An absolute maximum adverse radial crossfall of 4%
- Splitter islands, where pedestrian movement is expected, should be of sufficient width to accommodate “refuge” design parameters
- Suitable landscaping in the central island (where approved) providing sight lines at the adopted design eye-height.
- Subsoil drainage for any landscaped (unsealed) areas.
- Subsoil drainage at the perimeter (upright) kerb returns.
- On-road cycleways are to be provided for arterial and sub-arterial roads and in accordance with the Bike plan. **Blockage factors**

9.2.15 Intersections

Urban

In urban environments intersections configured within the standards of kerb radii and road-width within this chapter shall generally be adequate for traffic access needs in local streets. Roads with higher levels of traffic usage such as Collectors or greater, should be assessed regarding traffic volumes and safe traffic usage in accordance with Austroads standards, addressing auxiliary lane potential for left and right turn manoeuvres. Use of regulatory signposting and linemarking can usually accommodate most movements. Entry and exit movements for heavy vehicles that cross the road centreline within high volume roads are not permitted. (See “Kerb Returns” below)

Staggering of intersections, to achieve a desirable minimum separation distance of 40m between opposing road centrelines, is desirable. Four-way intersections should be considered where the separation is below the above standard, employing adequate traffic control measures.

Rural

In rural, or transitional urban/rural environments (being generally where the legal speed limit is greater than 60kms/h), and where single-lane two-way roads are impacted by a new road junction, intersections shall be assessed regarding traffic volumes and safe traffic usage in accordance with Austroads and RMS standards, addressing potential for auxiliary lanes for left and right turn manoeuvres, and flag lighting.

9.2.16 Structures

Designs related to concrete, masonry, steel and timber elements, such as for bridges, large culverts, retaining walls, headwalls, subdivision entry features, etc, shall be carried out in accordance with relevant Australian Standards and RMS Design Standards, and shall be certified by a practicing structural/civil engineer.
All precast and pre-assembled structures shall be similarly certified for structural adequacy. Where design elements are ancillary to a Construction Certificate for *Roads & Drainage*, documentation shall be submitted to Council for each component.

Retaining Walls

Retaining walls in this Manual relate to an integral part of a development and must be designed by a qualified Consultant Civil Engineer.

Location

The location of retaining walls shall be determined by Council and the design engineer and should adopt the following guidelines:

- At public/road reserve boundaries – within the adjoining lots.
- At adjoining lots (common boundaries) – within the uphill lot with the face of the wall on the boundary. An easement 900mm wide within the downhill lot, to prevent excavation and for access for maintenance, shall be created.
- At stormwater overland flow paths – within the dedicated flow path or easement, being of concrete or masonry construction suitable for a flow path.
- Obstructions, such as walls or any other above-surface structures are not permitted within easements that act as overland flow paths. These easements are usually 3m wide, or greater.

Retaining walls within stormwater drainage easements (Inter-allotment Drainage) are not desirable due to the potential interference with the stormwater pipe and difficulty for access to the pipe for maintenance purposes.

- If a retaining wall is permitted/required, then the following guidelines/actions should be considered:
- Avoidance of adverse impacts on the pipe from any structural elements of the wall
- Footings shall be finished below the zone of influence * of the drainage line and no loading shall be directly applied to the pipe without a detailed design demonstrating mitigation of the load.

  * The zone of influence is defined as a line drawn at 1:1 slope from the invert of the pipe.

- Maintenance of a reasonable means for physical access for personnel and light machinery to “lay, place and maintain a line of pipes” (Conveyancing Act).
- Adequate measures to eliminate any potential loading on a pipe that passes through a wall or its footing.
- If a retaining wall is permitted/required and an adjustment to the pipeline is also required, a review of the hydraulic design of the pipeline, such as Hydraulic Grade Line, surcharge, pipe capacity, etc, must be made to ensure that there is no compromise to stormwater flows, that may create an adverse affectation on properties that either benefit, or surround the proposed adjustments.

Design

Retaining wall design shall be in accordance with AS 4678 Earth Retaining Structures, and be certified by a qualified engineer, taking into account loads from existing or future anticipated dwellings, pools, vehicles, etc.
Excessive cut and fill and subsequent retaining structures are not desirable. In this regard Council’s policy of a maximum height of 1.5m between lots should be maintained. Retaining wall heights beyond 1.5m for other than “lot benching” (such as for road embankments) shall be subject to Council’s approval through development consent.
Where approved by Council, retaining walls shall:

- Be designed in accordance with the Australian Standards
- Be of the materials in the specified locations, as nominated in the section of the Manual
- Where supporting a public/road reserves, be constructed in masonry or reinforced concrete.
- Where supporting lots adjacent to public/road reserves may be other than concrete/masonry, being installed in accordance with the manufacturer’s recommendations.
- Where located within a public/road reserve, under justifiable circumstances, be constructed of reinforced concrete or an approved masonry specification.

Retaining walls of treated timber walling (sleepers) at common lot boundaries shall be incorporated into galvanised steel I-beam posts set in concrete in accordance with an engineer’s design.

9.3 Documentation

9.3.1 General

Design process

System: Develop a flow chart to incorporate the brief, consultation, selection of design parameters, approvals and critical dates.

Design review, verification and validation: Provide design documentation that conforms with AGRD08.

Design calculations

Calculations: Provide results and reference software used for relevant distance or curvature calculations. If friction is a factor in layout/geometry, note the pavement type assumed for surface conditions and noise minimisation.

Approvals

Authorities: Drawings are signed by the Council Designer or Council's Consultant and where required by Council, certify as complying with the appropriate design work-sections.

Certificate format: To *0010 Quality requirements for design.*

9.3.2 Drawings

Drawing sheets

Requirement: Provide separate sheets for the following:

- Carriageway Width
- Verge Width
- Reserve Width
- Utilities Location on Verge
- Control Line Road Setout
- Typical Road Cross Section
- Provisional Pavement Design
- Miscellaneous Sections and details
- Road Longitudinal Sections
- Road Cross Sections
- Intersections Details
- Linemarking Details
- Cul-De-Sac Details
- Traffic Island Section Details

Drawing presentation

Plain English: Drawings form part of the permanent record and are legal documents. Keep terminology in plain English, enabling drawings to be easily read and understood by those involved in the construction of the Works.

Drawings: Present drawings on A1 sheets unless otherwise authorised. Prepare clear and legible drawings with consistent lettering and style, and clearly referenced with notations and tables as appropriate.

Compliance

Consistency: Provide drawing sheets consistent with the scope and sequence of the example provided in Annexure B of *0010 Quality requirements for design.*

Drawings content

Drawing scale: Conform to the following:

- All plans for Council works: 1:500. However, rural plans may be 1:1000.
- Longitudinal sections: 1:500 Horizontal and 1:100 Vertical.
- Cross Sections: 1:100 Natural.

9.3.3 Work-As-Executed

General

Work-as-executed drawings: Provide additional set of final construction drawings for the purpose of recording the work-as-executed by the Contractor.
Drawing format: in .pdf and .dwg

9.3.4 Certification

General

Final certification of completed works: as per inspection with Council's Asset Commissioning Officer

10 Pavement Design

10.1 General

This Section outlines the minimum requirements for geotechnical investigations and the design of pavements for:

- Public roads (existing and proposed including minor works).
- Footpaths.
- Shared paths.
- Driveways and accesses.
- Public and private car parks.

10.2 Pavement Types

Typical pavements types are as follows:

- Unbound granular flexible pavement which may contain one or more modified layers
- Bound granular flexible pavement
- Rigid pavements (concrete)

10.3 As-Built Records

Records of actual pavement construction, where pavement amendments occurred, or where alternative pavements were approved, together with any subgrade replacement or modification, shall be collated as a final report to accompany the WAE plans.

10.4 Design Criteria

10.4.1 Design Report

A pavement design for all new roadworks shall be prepared for approval, subject to a geotechnical engineer's report. The report shall utilise 4 day soaked "Californian Bearing Ratio" (CBR) testing undertaken on the relevant subgrade in accordance with AS1289 and shall recommend a design CBR and a pavement design thickness, determined using the methods outlined in Austroads standards for pavement design, based on Council's minimum standard Equivalent Standards Axle (ESA) requirements. Sub-grade and/or pavement material modification may form part of the design. The geotechnical report and pavement design report shall be submitted with the engineering plans. The engineering plans shall show pavement layer thicknesses (including the nominated ESA and design CBR parameters) based on the reports. Where alternative pavement designs are offered, the decision for the final adopted design shall be confirmed by the supervising geotechnical engineer and be reported to Council prior to construction of the pavement. Generally, pavements shall be consistent over long lengths of road, such that alternative designs for short sections of pavement are avoided.

10.4.2 Design Traffic Loadings

The design traffic loadings of Equivalent Standard Axels (ESA) are given in Table 1 Road Hierarchy and Road Width. The nominated values may be increased by Council, subject to an assessment of any special circumstances for subdivision or development, where a higher value is adopted, based on ultimate traffic generation for the catchment area, originating from:

- strategic planning for future rezoning of land
- ultimate development of current zoned land
- staging of works and the resultant development and construction traffic

Council or the RMS reserve the right to nominate specific ESA's for Arterial roads such as a State or Regional roads. A general minimum of $1x10^7$ will apply.

10.4.3 Subgrade Evaluation

Investigation by a qualified practicing Geotechnical Engineer and soils testing through a NATA registered laboratory will be required. Testing and test samples shall be undertaken at the approximate design subgrade level.
The design of rigid pavements requires the determination of an Equivalent Design CBR. This calculation considers subgrade material properties to a depth of 1m. See Austroads *Pavement Guide to Pavement Technology - Set* and the relevant TfNSW Supplement(s).
Investigation of materials below subgrade level is also necessary to assess subsurface moisture and to expose any weak layers below the subgrade. Test pitting, recording of bore logs and materials sampling shall be carried out to include materials to a minimum depth of 1m below design subgrade or to the next material layer change where ground is found to be soft or loose. Subgrade conditions including CBRs and depths to rock shall be confirmed by a practicing Geotechnical Engineer.

> In deep cuttings, deep fills or other instances where testing of subgrade is possible only after bulk earthworks, pavement designs may be assumed for the purpose of submitting the Pavement Design Report for approval. In areas where pavement designs have been assumed, pavement investigations, sampling and testing shall be carried out in full upon excavations reaching subgrade level and then a Pavement Design Report shall be prepared and submitted for acceptance by Council's Representative.

10.4.4 Subsurface Drainage

Subsurface drainage must be provided to protect the subgrade and pavement in locations that necessitate its use such as boxed construction, cuttings or areas with high water tables or in areas where subsurface moisture requires treatment.
Subsoil drainage pipes shall be provided on both sides of road pavements and where required by design, at new-to-existing pavement joints (see SCSD-702)

Where highly expansive soils and/or high moisture conditions are encountered special care should be taken for the placement of subsoil drains with respect to the any potential adverse affects upon the road pavement from significant moisture removal from the deeper levels of the subgrade.

10.4.5 Flexible Pavement Design

Pavement thickness designs shall be based upon assessed subgrade strength and in accordance with the design chart for granular pavement with thin bituminous surfacing from Austroads Pavement Design Manual.

The minimum pavement thickness for flexible pavements will be derived as follows:-

- Overall pavement thickness shall be a minimum of 300mm.
- Base-course shall be determined from the Pavement Thickness Design Chart, where the minimum thickness is 100mm.
- Sub-base thickness shall be determined from the Pavement Thickness Design Chart, using the relevant CBR curve by subtracting the base-course layer thickness from the required total pavement thickness. Irrespective of the foregoing, the minimum sub-base thickness shall not be less than 125mm.
- Asphaltic concrete thickness shall be a minimum of 30mm and may be included as pavement "depth" in determining the pavement thickness. Two coat flush bitumen seals shall not be considered part of the pavement thickness.
- The pavement designer should be satisfied that the design will meet the requirements of this Manual in respect to permissible deflection and pavement life.
- Where a combined sub-base/base single-layer (with for example bound materials) pavement is proposed, a geotechnical engineer shall report on the proposal, nominating the materials (source) and relevant compaction and testing methods.

10.4.6 Rigid Pavement Design

Rigid pavements on public roads shall be designed in accordance with the following documents:

- Concrete Pavement Design for Residential Streets - Cement and Concrete Assoc. of Aust.
- Pavement Design - Austroads Standards
- RMS supplements and directory notes to Austroads standards.
- RMS Concrete Pavement Manual.

Minimum thicknesses shall be:

- Sub-base - 150mm minimum

- Base - 170mm minimum

The base shall be jointed, reinforced concrete.
Details prepared by an engineer, are required for (but not limited to):

a. subgrade preparation to achieve a design CBR
b. a proposed sub-base concrete mix adopting 5MPa minimum characteristic strength
c. a proposed base concrete mix adopting 32MPa minimum characteristic strength
d. a nominated maximum slump and testing procedure (with reference to chapter 7)
e. a proposed thickness for sub-base and base courses
f. steel reinforcement
g. joint types and locations
h. interface treatments between layers
i. placement, compaction, surface texture and curing methods
j. Nominating the finished surface to be rake-textured in accordance with the RMS rake specifications
k. Nominating the application of a curing agent.

10.4.7 Accessways

Accessways to specialty-use areas or facilities such as public utility plant, parks, pollution control devices etc. where heavy vehicles are expected to gain access, shall be a minimum of 3.0 metres wide and constructed in concrete in accordance with the publication by the Cement and Concrete Association of Australia – “Concrete Pavement Design for Residential Streets”.
Generally the following parameters shall be maintained (see SCSD-201):

- 150mm thick
- 32 MPa 28 day strength
- Two layers of SL72 mesh fabric
- Sub-base, 100mm compacted thickness of “road-base” material

10.4.8 Roundabouts

All roundabout pavements shall be designed for construction with reinforced concrete, with reference to “rigid pavement” RMS standard design and construction requirements. The minimum concrete design mix specification shall provide 32MPa characteristic strength, 4.25 Flexural strength, with 50kg/m3 of steel (Reo Pave 25 or equivalent). Where construction constraints are significant such as major traffic flow impediments, consideration may be given to alternative pavement types, such as deep-strength asphalt or similar, where justified.

10.4.9 Pavement Joints

All vertical pavement joints (new-to-existing), whether longitudinal or transverse, shall be benched a minimum of 300mm. (with reference to SCSD-702)

Unless the adjoining pavements consist of the same material, and satisfactory compaction bonding of those materials can be achieved, subsoil drainage shall be provided in accordance with RMS QA Spec R37 “Intra-pavement Drains” at the direction of Council or the geotechnical engineer.

10.4.10 Wearing Course

For the application of bituminous surfacing, refer to Chapter 7 - Construction.
For alternative decorative finishes, Council’s approval is required to use such finishes in public roads. Smooth and/or irregular surfaces for roads and footway crossings, such as “deep-stamped” or “exposed river gravel” paving, is not permitted. Supporting documentation shall be submitted with any request to decorative finished products and shall include:-

- Full specifications of the product.
- Durability and colour fastness
- Skid/abrasion resistance.

10.4.11 Existing Pavement Reconstruction

Where required by Council, existing road pavements shall be reconstructed, rehabilitated or re-surfaced. A pavement design shall be prepared for and approved by Council based on this chapter adopting an ESA value as determined by Council.

Where new works abut an existing natural gravel pavement, it is preferred that the new pavement materials be an approved natural gravel in accordance with the specifications of this Manual. (Refer to “Pavement Joints” above). Circumstances where construction works may be necessary are:

- Where either the existing pavement or surface quality are assessed by Council as incapable of sustaining the additional traffic loads from the development
- Where vehicle turning movements occur, such that an asphalt wearing surface is appropriate to control premature surface deterioration
- Where a longitudinal surface profile is significantly irregular
- Where surface shape (eg. crossfall) does not conform to standard design parameters
- Where small local “patching” type pavement failures are required by Council.
- Where works coincide with Council’s Forward Works *Management Plan*.

The limits of such works shall be determined by Council, but will normally be applied to development that:

- creates new intersections onto an existing road
- requires shoulder or parking lane works
- warrants new or replacement kerb and gutter
- has frontage to, or requires vehicle access along an existing road that exhibits stress and/or has significant surface deterioration, and (subject to geotechnical testing) exhibits a failure to meet design requirements in this Manual.

Best design practice shall be employed such that a holistic approach is achieved, eliminating partial (“patchwork”), or part-lane, pavement sections. Refer to drawing sdsc-702.

11 Subsurface Drainage

11.1 General

This section outlines the requirements for the installation of subsurface drainage system for the road pavement and/or subgrade.
This Specification contains procedures for the design of subsurface drainage, including:

- Subsoil and Foundation Drains
- Sub-Pavement Drains
- Drainage Mats, including Type A and Type B Mats.

The objective in the design of the subsurface drainage system is to control moisture content fluctuations in the pavement and/or subgrade to within the limits assumed in the pavement design.

Reference guidelines for the application and design of subsurface drainage include ARRB Special Reports 35 and 41, and the AUSTROADS publication - Guide to the Control of Moisture in Roads. The full titles of these guidelines are given below.

11.2 Drain Types

- Subsoil drains are intended for the drainage of ground water or seepage from the subgrade and/or the subbase in cuttings and fill areas.
- Foundation drains are intended for the drainage of seepage, springs and wet areas within and adjacent to the foundations of the road formation.
- Sub-pavement drains are intended for the drainage of the base and subbase pavement layers in flexible pavements. They may also function to drain seepage or groundwater from the subgrade.
- Type A drainage mats are intended to ensure continuity of a sheet flow of water under fills, to collect seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water.
  Type B drainage mats are constructed to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings.

11.3 Subsoil Drain

- Subsoil drains are designed to drain groundwater or seepage from the subgrade and/or subbase in cuttings and fill areas.
- Sub-pavement drains are designed to drain water from base and subbase pavement layers in flexible pavements, and to drain seepage or groundwater from the subgrade.
- Subsoil or sub-pavement drains shall be provided on both sides of the formation in the following locations, unless the geotechnical report indicates the absence of subsurface moisture at the time of investigation and the likelihood that changes in the subsurface moisture environment will not occur within the design life of the pavement and/or the pavement has been specifically designed to allow for likely variations in subgrade and pavement moisture contents:
  a) Cut formations where the depth to finished subgrade level is equal to or greater than 400mm below the natural surface level.
  b) Locations of known hillside seepage, high water table or isolated springs.
  c) Irrigated, flood-prone or other poorly drained areas.
  d) Highly moisture susceptible subgrades, ie. commonly displaying high plasticity or low soaked CBRs.
  e) Use of moisture susceptible pavement materials.
  f) Existing pavements with similar subgrade conditions displaying distress due to excess subsurface moisture.
  g) At cut to fill transitions.

  Where only one side of the formation is in cut, and the other side in fill, it may be sufficient to provide subsoil or sub-pavement drains only along the edge of the formation in cut.
- The need for subsoil and sub-pavement drains may otherwise become apparent during the construction process, due to changes in site moisture conditions or to areas of poorer subgrade being uncovered that were not identified in the geotechnical investigation. The Design Drawings shall be suitably annotated to the potential need for subsoil or sub-pavement drains in addition to those shown on the Drawings.

11.3.1 Layout, Alignment and Grade

Typical cross sections of subsoil and sub-pavement drains are to be provided in accordance with standard drawing SCSD-426. As indicated in these figures, subsoil drain trenches are excavated to below subgrade level, while sub-pavement drains extend into or adjacent to the pavement layers to facilitate drainage of the pavement layers in addition to the subgrade.

In kerbed roads the line of the trench shall be directly behind the kerbline. Pavement layers must extend to at least the line of the rear of the trench.

In unkerbed roads, subsoil and sub-pavement drains shall be located within the shoulder, preferably at the edge of the pavement layers as shown in standard drawing SCSD-426, Alternative Subsoil Location section.

The minimum desirable longitudinal design grade shall be 1.0%. For non corrugated pipes, an absolute minimum grade of 0.5% is acceptable.

Trench widths shall be a minimum of 300mm, with a minimum depth below finished subgrade level of 600mm in earth and 450mm in rock, and below the invert level of any service crossings.

Outlets shall be spaced at maximum intervals of 150 metres. Where possible,subsoil and sub-pavement drainage pipes shall discharge into gully pits or other stormwater drainage structures. Where not possible, outlets shall be provided through fill batters. Unless otherwise authorised, where subsurface drains outlet through fill batters, a small precast concrete headwall shall be installed at the drain outlet with a marker post to assist maintenance and protect the end of the pipe.

Cleanouts are to be provided at the commencement of each run of drain, and at intervals not exceeding 60 metres. Cleanouts shall generally be located directly at the rear of kerb or at the edge of shoulder, as applicable.

11.3.2 Foundation Drains

Foundation drains are designed to drain excessive ground water areas within the foundation of an embankment or the base of cutting, or to intercept water from entering these areas.

The need to provide foundation drains may be apparent from the results of the geotechnical survey along the proposed road formation alignment, and in this case the location shall be shown on the Drawings. However, more commonly, the need to provide foundation drains is determined during construction, and hence in this situation requirements and locations cannot be ascertained at the design stage.

Where the road formation traverses known swampy, flood-prone, or watercharged strata, the Drawings shall be suitable annotated to the potential need for foundation drains at various locations, in addition to those shown on the Drawings.

11.3.3 Layout, Alignment and Grade

Foundation drains to be located at the base of the fill batters. Council Engineer to review location and confirm design. The minimum desirable design grade shall be 1.0%. For non corrugated pipes an absolute minimum grade of 0.5% is acceptable.

Foundation drains shall be a minimum trench width of 300mm, with a variable trench depth to suit the application and ground conditions on site.

Outlets shall be spaced at maximum intervals of 150 metres.

Where practicable, cleanouts are to be provided at the commencement of each run of foundation drain and at intervals not exceeding 60 metres. Where not practicable to provide intermediate cleanouts, outlets shall be spaced at maximum intervals of 100 metres.

11.3.4 Drainage Mats (Blankets)

Type A drainage mats are designed where there is a need to ensure continuity of a sheet flow of water under fills, to collect surface seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water. Type A drainage mats are constructed after the site has been cleared and grubbed and before commencement of embankment construction.

Type B drainage mats are designed where there is a need to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings. Type B drainage mats shall be constructed after completion of the subgrade construction and before construction of the pavement.

The need to design for the provision of drainage mats should be apparent from the result of the geotechnical survey along the proposed road formation alignment.

11.4 Materials

11.4.1 Subsoil And Sub-Pavement Drain Pipe

Pipes designated for subsoil, foundation and sub-pavement drains shall be 100mm dia. slotted pipe.

Corrugated plastic pipe shall conform with the requirements of AS2439.1. The appropriate class of pipe shall be selected on the basis of expected live loading at the surface. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1.

Slotted rigid UPVC pipe shall be of a type and class approved by Council.

All pipe shall be slotted, and fitted with a suitable geotextile filter tube, except for cleanouts and outlets through fill batters which shall be unslotted pipe.

11.4.2 Intra Pavement Drain Pipe

Pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses neither less than 150mm nor more than 200mm shall be slotted thick walled UPVC pressure pipe complying with AS/NZS 1477.

Pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses exceeding 200mm shall be slotted pipe of a type and class approved by Council.

Pipes for use in Type B drainage mats shall be slotted thick walled UPVC pressure pipe complying with AS/NZS 1477.

11.4.3 Filter Material

The types of filter material covered by this Specification shall include:

- Type A filter material for use in subsoil, foundation, and sub-pavement (trench) drains and for Type B drainage mats.
- Type B filter material for use in subsoil, foundation and sub-pavement (trench) drains.
- Type C filter material comprising crushed rock for use in Type A drainage mats.
- Type D filter material comprising uncrushed river gravel for use in Type A drainage mats.
-

Material requirements and gradings for each type of filter material are included in the Construction Specification, SUBSURFACE DRAINAGE GENERAL.

The type of filter material specified to backfill the sub-surface drainage trenches (subsoil, foundation and sub-pavement drains) shall generally comprise materials complying with the specification. (Refer Construction Specification C230.12 FILTER MATERIAL). Further guidance to the selection of appropriate filter material is contained in ARRB Special Report 35.

11.4.4 Geotextile

To provide separation (ie. prevent infiltration of fines) between the filter material in the trench and the subgrade or pavement material, geotextile shall be designated to encapsulate the filter material. The geotextile shall comply with the requirements included in the Construction Specification, Subsurface Drainage General.

Geotextile shall also be designated for both Type A and Type B Drainage Mats.

11.5 Documentation

11.5.1 Drawings And Calculations

The proposed location of all subsurface drains shall be clearly indicated on the Drawings, including the nominal depth and width of the trench, and the location with respect to the line of the kerb/gutter or edge of pavement. The location of outlets and cleanouts shall also be indicated on the Drawings.

Assumptions and/or calculations made in the determination of the need or otherwise for subsurface drainage in special circumstances or as a variation to the requirements of this Specification shall be submitted to Council for approval with the Drawings.

12 Pathways and Cycleways

12.1 General

This Section outlines the minimum design requirements for property access, car parks, paths and on-road cycleways. In addition to designs being in accordance with this *Engineering Design Guideline*, they shall also be designed in accordance with the appropriate Australian Standards, Austroads publication, TfNSW Supplements and Council's *Standard Drawings.*

12.2 Footpaths and Shared Paths

12.2.1 Design Standards and Guidelines

Footpaths and shared paths shall be designed with reference to, but are not limited to the following:

- AS 1742.10 *Manual of uniform traffic control devices: Pedestrian control and protection*.
- AS 1743 *Road signs - Specifications*.
- AS/NZS 2890 *Parking Facilities Set*.
- AS 3727.1 *Pavements: Residential*.
- Austroads *Guide to Road Design*, including *Part 6A: Paths for Walking and Cycling*.
- Relevant TfNSW Supplements.
- Council's *Standard Drawings*.

12.2.2 Designing for Pedestrians and Mobility Impaired People

Consideration shall be given to designing for pedestrians and mobility impaired people in applicable aspects of the design of roads and road related areas, to address the requirements of the *Disability Discrimination Act 1992* and AS 1428 *Design for access and mobility: General requirements for access - New building work*.

Provision shall be made for the use of all public pathways by mobility impaired people.

Provision for use by mobility scooters shall be made where such use is likely or where required by an approval. Examples include access for aged care facilities, shopping centres and in passive recreation areas.

12.2.3 Paths in Road Reserves

New paths shall be minimum 1.5m wide and shall comply with Council's *Standard Drawings*.
Paths in road reserves must have a longitudinal grade the same as the roadway. Where grades exceed 15% special consideration shall be given to alternative access for pedestrians.
Crossfalls on paths shall be between 1% and 2.5% sloping towards the kerb, where practicable.
Consideration shall be given to the requirements of lot access, the volume and type of pedestrians and Service Authority requirements for existing and proposed utility services.

Kerb ramps shall be provided at road crossing points. Kerb ramps shall be designed and constructed in accordance with Council's *Standard Drawings*.

12.2.4 Public Paths Not in Road Reserves

Public paths may be required to be constructed outside a road reserve to:
Complete a path system.

- Be used in conjunction with an overland flow path. Refer to Council's *Standard Drawings*.
- Provide access to a specific facility.
- Facilitate a maintenance activity.
- Provide for recreational, scenic or tourist purposes.

Paths shall be shown on Design Drawings where:

- Nominated by an applicant as part of the development works.
- Required separately by conditions of a Development Consent.

The standard of design may vary depending on the volume and type of pedestrians expected, streetscape, public safety and other considerations. The requirement of Austroads Guides and

AS 1428 publications shall be used when designing paths and any associated pedestrian bridges.
Path pavements shall be constructed in accordance with Council's *Standard Drawings*.
Alternative details to Council's *Standard Drawings* may be required to cater for a particular circumstance. Approval from Council's Representative will be required. Refer to Pavements Design section.
The design of off-road paths may require consideration of matters not encountered in providing paving in formed road paths including:

- Catch drains to control uphill runoff.
- Protection of batters.
- Provision of handrails, barriers, fences or bollards.
- Cross drainage.
- Additional lighting.
- Public safety.
- Minimisation and facilitation of maintenance activities.

12.2.5 Public Paths used as Overland Flow Paths

Pathways used as overland flow paths shall generally have:

- Preferred crossfall of 2.0% (2.5% maximum).
- An integral 150mm kerb on the low side unless flows are of such a magnitude to warrant special treatment.
- Sufficient capacity to carry the flows with required freeboard.
- Velocity x depth flow criteria for safety to be in accordance with *ARR 2019*, in particular: Chapter 7 (Safety Design Criteria) within *Book 6 (Flood Hydraulics)*.

Other forms of pathways for overland flow paths may be considered by Council. Concepts shall be discussed with Council's Representative prior to preparation of detailed designs.

12.3 Shared Paths, Cycleways and Bicycle Facilities

Consideration shall be given for cyclists in all aspects of road design and road related areas. Shared paths and other facilities such as cycle parking facilities shall be included in the design where specifically nominated in a Development Consent, Singleton Council's *Bike Plan* or other applicable documents.
Shared paths and bicycle facilities shall be designed in accordance with the requirements of Austroads publications and TfNSW Supplements. Issues not covered by Austroads publications shall be discussed with Council's Representative.
Shared paths and bicycle paths shall be reviewed and endorsed by the local Traffic Committee due to their regulatory function.
Where shared paths, cycleways and bicycle facilities are required, all related issues including the following shall be considered and detailed on the Design Drawings:

- Location, horizontal and vertical alignment.
- Width (4m minimum) and crossfall.
- Sight distance.
- Drainage.
- Signs and pavement markings for pedestrians, cyclists and motorists.
- Vertical and lateral clearance to structures, top of embankments, hazards.
- Minimisation of projections into the cycleway (service pits, etc).
- Maintenance and access crossings. Thickening, reinforcing and highlighting of such areas.
- Provision of adequate safety railings, rub rails and barrier fences.
- Provision of shared path handrails at intersections and road crossings, where warranted.
- Need for the provision of lighting.
- Measures to ensure the distinctiveness of presence and continuity of cycleways, e.g. through changes in pavement types or character of the facility.
- Any identified need for path terminal treatments to deter or restrict motor vehicle access. Where this need is identified and approved by Council's Representative, terminal treatments shall be designed and installed in accordance with Council's *Standard Drawings*.

13 Stormwater Drainage

13.1 General

This chapter addresses stormwater design for the development of land (principally as greenfield subdivision sites), Drainage structures inundated by such flooding are not prohibited by this Manual, although particular requirements may apply.

Stormwater drainage systems shall be designed to achieve the following goals:

- An underground “minor system” of conduits that eliminates inconvenience to traffic and pedestrians.
- An overland “major system” that conveys stormwater flows within suitable velocity/depth limits, generally located within public land, or where approved or unavoidable, within private land covered by an easement.
- Detention of stormwater flows that mimics natural, pre-developed flows for all storm events up to and including the 1% Annual Exceedance Probability (AEP) event.
- Retention of stormwater flows to achieve target water quality standards.
- Control of stormwater flows to minimise the impacts of erosion and sediment in the environment.
- Consideration of upstream and downstream catchments in their ultimate developed state to achieve a total system which does not adversely affect existing systems or properties within the flow path and catchment.
- Minimisation of the maintenance burden of Council
- Enhancement of the urban landscape.
  Employment of principles of Water Sensitive Urban Design and Stormwater Reuse.

13.2 Design Standards

13.2.1 General

Design of stormwater drainage (water quantity and quality) for roads, reserves and inter-allotment systems the subject of this chapter, shall adopt the principles of a minor/major drainage system in accordance with the publication Australian Rainfall and Runoff (AR&R) and Australian Runoff Quality (ARQ) and as specified in this manual.

All calculations to be carried out by a competent persons, qualified and experienced in hydrologic and hydraulic design, utilising drainage models that are accepted as currant industry standards.

An EY/AEP/ARI comparison for frequencies in the range 99.75% to 0.50% AEP (1 year to 200-year ARI) is shown in Table 4 below:

Table 4 EY / AEP / ARI COMPARISION

EY	AEP (%)	ARI
6	99.75	0.17
4	98.18	0.25
3	95.02	0.33
2	86.47	0.50
1	63.21	1
0.69	50.00	1.44
0.5	39.35[1]	2
0.22	20[1]	4.48
0.2	18.13	5

0.11	10.00[1]	9.49
0.05	5.00	20
0.02	2.00	50
0.01	1.00	100
0.005	0.50	200

Note 1: For practical purposes in day-to-day practice, the 60%, 40% 20% and 10% AEP events are taken to be equivalent to the 1 year, 2 year, 5 year and 10 year ARI events respectively.

13.2.2 General Requirements for Developments

The level of runoff control required is dependent on the type of development proposed. Flow control requirements are stipulated for the following:

- New developments.
- Redevelopment of existing sites.
- Augmentation of existing stormwater systems.

13.2.2.1 New Developments

Each new development shall be considered individually regarding existing and proposed drainage systems, location in the catchment and other matters relating to stormwater.

Generally, it can be expected for new development proposals that, the post-development peak flow from the outlet point(s) of the site to the downstream public drainage system or receiving water shall not exceed the pre-development peak flow for both the major and minor system design storm AEP.

Pre-development peak flow shall be the estimated flow from the site based on known or estimated catchment conditions prior to the new development.

To reduce peak outflows, the stormwater system may be provided with flow attenuation measures such as infiltration devices, detention basins and water quality control ponds and/or the compensating augmentation of existing drainage systems. Design storm AEPs for the major and minor drainage systems shall be selected in accordance with Section 13.3.2 Design Annual Exceedance Probability of this *Engineering Design Guideline*.

The provision of additional stormwater infiltration, retarding, detention, storage or other control facilities may be required by Council after consideration of relevant stormwater drainage analysis and concept plans required as part of the development application documentation.

13.2.2.2 Redevelopment of Existing Developed Sites

Each redevelopment proposal shall be considered individually regarding existing and proposed drainage systems, alteration or abandonment of existing infrastructure, location in the catchment and other pertinent matters. Preferred treatment of abandoned infrastructure is removal of the disused asset. Other options shall be approved by Council's Representative.

Redevelopment includes land redevelopment and subdivision redevelopment. Land redevelopment is the redevelopment of single lots or multiple adjacent lots where all the stormwater system will be privately owned. This includes both Unit and Dual Occupancy developments. Subdivision redevelopment is redevelopment where all or parts of the stormwater system will become part of the public drainage system.

Generally, it can be expected for redevelopment sites that, the post-redevelopment peak flow from the outlet point(s) of the redevelopment site to the existing downstream public drainage system or receiving water shall not exceed the pre-redevelopment flow for both major and minor system AEP.

The pre-redevelopment peak flow shall be the estimated flow from the site based on the development conditions (including any existing flow attenuation facilities) prior to redevelopment. The degree of runoff control required will depend on the scale of the development and the net change in impervious area. Flow control will be required for any redevelopment where the density (measured as the total equivalent impervious area) of the redevelopment is greater than that of the existing development.

The stormwater drainage design for redevelopment site is to ensure that the redevelopment does not create or worsen any capacity problems in the existing public drainage system. This will generally require the construction of on-site and/or off-site public detention/retention systems and/or the compensating augmentation of existing drainage systems.

The major and minor system design storm AEPs referred to shall be those appropriate for the existing development in accordance with Section 10.4.2 Design Annual Exceedance Probability of this *Design Guideline*. Note that these are the AEPs that the existing public drainage system must have been designed for, not the as-constructed capacity of the system.

The requirements for the provision of stormwater retarding, detention, storage or other control facilities shall be determined by Council's Representative after consideration of relevant stormwater drainage analysis and concept plans required as part of the development application documentation. Augmentation of Council's existing drainage system may be considered in lieu of on-site detention systems, subject to approval by Council's Representative.

13.2.2.3 Stormwater System Augmentation

Stormwater system augmentations are undertaken in existing urban catchments to alleviate flood hazards due to under-capacity major and/or minor drainage systems. The main objectives for such augmentation works shall improve flood protection for land and to increase pedestrian safety and vehicle stability on roadways.
The potential to increase the flow carrying capacity of existing roadways is usually limited.
To achieve the objectives of the stormwater drainage augmentation it may be necessary to increase the AEP capacity of the minor drainage system above that specified in Table 10.1 Major/Minor System Design in order to ensure that:

- The 1% AEP "gap flow" on roads (refer to Section 10.4.2 Design Annual Exceedance Probability) meets the surface flow criteria limits.
- Overland flow from storms up to and including the 1% AEP is not discharged through easements over private land on the low side of road verges, particularly at steep T-intersections and trapped road low points.

13.2.2.4 Stormwater Inlet and Outlet Discharge

The following requirements shall apply to the design of system inlets and outlets:

- Where no Council drainage system exists, the maximum permissible site discharge from a development to either the kerb and gutter or table drain shall be up to 25L/s at any one discharge point. Discharge points shall be at least 15m apart.
- For other than single residential or dual occupancy developments, Council's Representative shall confirm the maximum discharge that will be allowed to discharge into the street surface drainage system.
- Design of all inlets and outlets shall ensure that there are no adverse impacts arising from any changes of upstream and downstream water surface levels, flow velocities and flow direction.
- The Designer shall design for scour protection at inlets and outlets to suit local conditions. Consideration shall be given to current best practice. Detailed design calculations shall be provided to support the need for and type of energy dissipation devices.
- The Designer shall design inlets and outlets with due diligence, considering public safety requirements based on a risk assessment methodology. Refer to the latest edition of *Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia* and the *Queensland Urban Drainage Manual* for further guidance.
- At points of discharge of gutters or stormwater drainage lines or at any concentration of stormwater from or to adjoining properties, Council will require the Service Provider to enter into a Deed of Agreement with the adjoining owner(s) granting permission to the discharge of stormwater drainage and the creation of any necessary easements with all costs being met by the Service Provider prior to development approval.
- Where the drainage is to discharge to an area under the control of another statutory authority e.g. the Crown or Public Works, the design requirements of that Statutory Authority shall be met.
- Stormwater drainage systems discharging to or through reserves, if permitted under the relevant plan of management, shall be taken to a natural watercourse and discharged through an approved outlet structure or alternatively taken to the nearest stormwater line. All works shall be subject to detailed design. The creation of easements may be required.

13.2.2.5 Stormwater Quality Control

Urban development will generally result in an increased level of export of a wide range of non-point source pollutants. To protect the quality of local streams, lakes, and river systems, the provision of stormwater quality control strategies acceptable to Council shall be considered. These may include, but will not be limited to the following:

- Establishment of urban lakes, primarily as biological treatment systems.
- Utilisation of water quality control ponds (WQCP) and constructed wetlands, as physical and biological treatment systems, upstream of urban lakes.
- Incorporation of gross pollutant traps (GPTs) on inlets to urban lakes and WQCPs to intercept trash and debris and the coarser fractions of sediment.
- Incorporation of 'off-stream' sediment interception ponds (SIP) in land development works to intercept and treat runoff prior to its discharge to the stormwater system.
- Signs/tags (imprinted on the concrete lintel) at pit entry "No dumping to drains" or similar.

The Service Provider and their consultants must consult with Council at the stormwater drainage concept plan stage which strategies have been implemented or planned to be implemented for the catchment in which the development is located.

The Service Provider will be required to demonstrate by recognised modelling and other calculation that stormwater quality treatment objectives quoted in the *Australian Runoff Quality - A Guide to Water Sensitive Design* published by Engineers Australia can be met and maintained by implementation of a stormwater quality strategy for the Development.

13.3 Stormwater Drainage Systems

13.3.1 General

Stormwater drainage systems shall be designed to achieve the following goals:

- An underground “minor system” of conduits that eliminate inconvenience to traffic and pedestrians,
- An overland “major system” that conveys stormwater flows within suitable velocity/depth limits, generally located within public land, or where approved or unavoidable, within private land covered by an easement.
- Detention of stormwater flows that mimics natural, pre-developed flows for all storm events up to and including the 1% AEP event.
- Retention of stormwater flows to achieve target water quality standards.
- Control of stormwater flows to minimise the impacts of erosion and sediment in the environment.
- Consideration of upstream and downstream catchments in their ultimate developed state to achieve a total system which does not adversely affect existing systems or properties within the flow path and catchment.
- Minimisation of the maintenance burden of Council
- Enhancement of the urban landscape.
- Employment of principles of Water Sensitive Urban Design and Stormwater Reuse.

Development consent will not be granted to development that will result in an increase or concentration in the amount of stormwater being discharged to the public stormwater drainage system unless Council is satisfied that:

- The post-development runoff from the land will not exceed the pre-development run-off for all minor/major storm durations up to and including the 1% AEP.
- Any lots resulting from the subdivision of residential, business or industrial zoned land must be provided with connection to the street stormwater drainage system or inter-allotment drainage system.
- The design of the stormwater drainage and discharge system must be sustainable and must not be prone to failure as a result of normal human influence.
- The design of the stormwater drainage and discharge system must comply with Council’s *Engineering Design Specifications* and be consistent with the approaches adopted by the Engineers Australia publications titled *Australian Rainfall and Runoff (AR&R)* and *Australian Runoff Quality – A Guide to Water Sensitive Urban Design.*
  The design of the stormwater drainage and discharge system should achieve acceptable quality outcomes.

13.3.2 Hydrology

Design Rainfall Data

Design Intensity-Frequency-Duration (IFD) relationships shall be derived in accordance with Australian Rainfall and Runoff for the particular catchment.

Design Annual Exceedance Probabilities (AEP)

The minor/major drainage system design AEP shall be selected in accordance with Table 5 below.

Table 5 Minor/Major System Design AEP

Minor System	AEP (%)
Urban Residential (Streets)	10
Urban Residential (IAD)	5

Rural Residential – Longitudinal Drainage	10
Business & General Industrial (Streets and IAD)	10
Public and Drainage Reserves (acting as flow paths)	10
Major System	**AEP (%)**
Overland Flow Paths and Trunk Drainage	1
Structural adequacy of major drainage items	PMF
Land Depressions with no outlet	PMF

PMF – Probable Maximum Flood

In addition to the above, where a development is designed in such a way that the major system flows involve surcharge across private property, the underground system (both pipes and inlets with designated blockage factors) shall be designed to capture and contain 1% AEP flows from the upstream catchment. An emergency overland flow path shall also be provided for these systems. Easements shall be provided in private property over such pipe systems and overland flow paths. Restrictions shall also be placed on the property so as not to permit changes in surface levels or the construction of certain structures within these easements.

Catchment Areas

The catchment at an outlet is defined as the limits from where surface water will make its way by either natural or man made features to this outlet.

Catchment area land-use shall be taken into consideration and be based upon current and possible future planning constraints and zonings. The ultimate developed state of each catchment shall be adopted. Notwithstanding the table below, in some areas Council may nominate design parameters regarding higher urban density uses.

Catchment plans showing the proposed pipeline layout shall be included in Engineering Design plans.

Impervious Areas

Hydraulic calculations are to be based on the fraction impervious figures shown in

Table 6 below.

Table 6 Fraction Impervious

Minor System	Fraction Impervious
Residential lot size < 1000m2	0.6
Residential lot size > 1000m2	0.4
Road Reserve	0.7
Business Areas	1.0
Industrial Areas	0.9
Public Recreation Areas	0.5
Parkland, Natural Public Reserve	0.1

Time of concentration

Time criteria: Conform to the following:

- Minimum time of concentration: 5 minutes.
- Maximum time of concentration in a urban area: 20 minutes unless sufficient evidence is provided to justify a greater time.

If the flow path is through areas having different flow characteristics or includes property and roadway, calculate the flow time of each portion of the flow path separately.

Coefficient of Roughness

The surface roughness coefficient (n) is similar to, but not identical with, Mannings "n" for open channel design. Whilst Australian Rainfall & Runoff provides typical values, Council's recommended values should be adopted from Table 7 shown below.

Table 7 Roughness Coefficient's

Surface Type	Roughness Coefficient 'n'
Parks	0.35
Large-lot Residential R5 X-Z	0.35
Urban Residential R1 to R5-V	0.21
Industrial	0.06
Business	0.04
Asphalt	0.02
Concrete	0.01
Gravel	0.02

13.3.3 Hydraulics

Hydraulic grade line (HGL)

Hydraulic calculations shall substantiate the hydraulic grade line (HGL) adopted for the design of the system and shall be shown on the drawings.
Controls for a downstream hydraulic grade line design are as follows:-

- Hydraulic grade line levels based on downstream calculations including pit losses at the starting pit in the design event.
- If the downstream start point is an existing pit and the HGL is unknown, a level of 0.15 metres below the pit inlet in this pit shall be adopted.
- If the downstream start point is an outlet into an open channel and;
- i) the design storm is the minor event, the outlet pipe shall be the downstream control,
- ii) the design storm is the major event, and the design flood levels in the channel are unknown, the top of the outlet pipe shall be the control,
- iii) The flood levels are known, the control shall be the 1% AEP flood level.
- Where appropriate the Hunter River Flood shall be considered as an outlet control.

The HGL level in drainage pits shall be not higher than 150mm below the top of the inlet grate, gutter or lid.

Grades

The longitudinal grade of a pipeline between drainage structures shall be calculated from midpoint to midpoint of such structures. A minimum of 50mm fall shall be allowed in all drainage structures which shall be shown by the level difference of the inflowing pipe(s) and the out flowing pipes at the midpoint. In areas where this cannot be achieved approval shall be obtained from Council's Representative.

Minimum Grades and Velocity

Stormwater pipelines shall be designed and constructed to be self-cleansing, e.g. free from accumulation of silt. The desirable minimum grade for pipelines with a diameter less than or equal to 600mm is 2% and with a diameter greater than 600mm is 1.0%. The minimum pipe full flow velocity shall be 0.6m/s.

A minimum grade of 0.5% may be acceptable where steeper grades are not practicable. Such instances require the approval of Council's Representative prior to finalising designs.

Maximum Grades and Velocity

Pipeline grades shall be chosen to limit the pipe full flow velocity to a desirable maximum value of 3.5m/s. The manufacturer's guidelines shall not be exceeded. Where the manufacturer's guidelines allow greater than 3.5m/s, approval from Council's Representative is required. Particular care shall be taken to consider the requirements of high energy flows on pit design, pipeline joint pressure capabilities and the potential need for pipe outlet scour protection measures.

Trenchstops and Bulkheads

Pipelines laid on steep slopes and in relatively impervious materials such as rock shall be protected from failure due to wash-out of bedding and backfill by the use of trenchstops or bulkheads. Measures shall be considered by the Designer and detailed on the drawings. Details will be required for all pipeline grades are greater than 5% for trenchstops and 15% for bulkheads. Refer to Council's *Standard Drawings*.

Table 8 Piped Conduit Requirements

Parameter	Requirement
Minimum pipe size	375mm
Minimum box culvert size	600mm wide x 300mm high
Minimum pipe class	'2' for none traffic areas, "3" under kerb and gutter (subject to cover) and '4' for road crossing

Notes

(1) Subject to scouring considerations and velocity/depth coefficient
(2) Unless otherwise approved by Council
(3) Pipe size reduction, from large upstream pipes to smaller downstream pipes is not permitted, unless approved by Council

The designer shall nominate on the plans all specific pipe details and their alignment and level. All drainage pipes within Council controlled drainage systems shall be of steel reinforced concrete (SRC), rubber ringed jointed spigot and socket type. Concrete pipes shall comply with AS 4058 "Precast Pressure and Non-Pressure Pipes". The class of pipe proposed will be determined to suit the design-use and shall comply with the Concrete Pipe Association of Australia (CPAA) minimum cover or Australian Standard 3725 "Loads on Buried Pipes" requirements.
Conduits that will not be under Council ownership/control (such as IAD systems) may be, concrete (as detailed above), polyethylene, or UPVC complying with AS 1254 for un-plasticized PVC (UPVC), and PE & PP pipes.
Pipes should be provided with sufficient cover to avoid conflict with service conduits, to ensure adequate protection from damage during construction and, (at a minimum), to ensure that pipe collars do not protrude into the road pavement.

13.3.4 Pits

Pit Blockage factors

Blockage factor of 0.5 (50% blocked) for sag and 0.8 (20% blocked) for on-grade pits shall apply.

Pit Locations

Pits shall be provided to:

- prevent ponding,
- allow change of alignment, grade or pipe size/number
- enable adequate vehicle entry points to lots. Preferably, pits should be located:

i) in the central section of lot frontage in residential areas, and
ii) at the high side of each lot in industrial areas, immediately downstream of the prolongation of the common side boundary, in order to provide direct discharge points for each individual lot, and/or IAD drainage systems

- prevent gutter flows crossing an intersection and/or a pram ramp
- limit flow widths (shown in Table 9 below)

Table 9 Allowable flow widths on Roadways

Road Type	Carriageway Width (m)	Width of Flow (m)	Depth in Gutter (mm)
Urban Local 2 & 1	8 & 9	2.5 & 3	75 & 90
Urban Collector	11	2.5	75
Urban Sub Arterial	13	2	60
Industrial Secondary & Primary	11 & 13	2.5	75
Rural Residential (if applicable)	6 & 7	2.5	75

The maximum pit spacing as shown in Table 10 below.

Table 10 Pit Spacing

Pipe size (mm)	Spacing (m)
Less than 1200	80
1200 or larger	120

Pit Construction

Pit Construction shall conform to Council's standard drawings. Non- standard pits, greater than 2.5m high or 900 long, or 1450 wide and with oversized soffits, shall be designed by an engineer, and the details provided in Engineering design plans.

Kerb Inlets

Lintels shall have a desirable maximum nominal length of 3.6 metres and a minimum nominal length of 1.8 metres. The general maximum in industrial areas shall be 2.4m to avoid potential breakage due to heavy loads. Nominated kerb inlet length refers to clear opening length, (refer to SCSD-401 for details). A 150mm minimum race depth shall be provided at lintels.

Step Irons

Step irons shall be provided in pits deeper than 1.2m.

Hydraulic losses

The pressure change coefficient "K" shall generally be determined from the 'Missouri Charts' and the 'Hare Equations'. The Hare Equations shall only be used as a guide and the Missouri Charts shall have precedence where discrepancies between the two exist.
Computer program default pressure change coefficients (K) shall not be acceptable unless they are consistent with the above statement.

Pipe friction losses and pipe sizes in relation to discharge shall be determined using the Colbrook White Formula with the following coefficients for roughness, unless circumstances exist that may give effect to "poor" pipe surface quality:-

Table 11 Pit Friction losses

Pipe type	Roughness coefficient
Concrete Pipes	0.15
FRC, PVC, PE, PP	0.03

13.3.5 Overland Flow Paths

Flow paths shall be provided to convey runoff from rainfall events that exceed the minor pipe system capacity. Flow paths shall cater for the 1% AEP flows. These flow paths should generally be public roads and pathways linked to provide a continuous flow at acceptable velocities and depths.
For reasons of public safety, the coefficient of velocity and depth, should not exceed 0.4 for the major storm event ($v.d < 0.4$). Higher velocity, depth products may be permitted by Council where a risk assessment shows limited adverse affect to public safety such as in rural areas.
Where flow paths other than the normal road reserve are necessary, the minimum width shall be 3.5m and shaped to contain the 1% AEP flows.

Overland flow paths within a pathway should generally have, as a minimum treatment, a concrete invert, and the remaining area of the flow path fully turfed with couch grass (beyond any concrete paving). The flow path shape shall provide reasonable access for vehicles where necessary for maintenance purposes and on the low side of a road should incorporate a weir within the section of the footway crossing, ensuring that property boundary levels are flood-free (with 100mm minimum freeboard), graded to direct the major storm flow downstream.

For the calculated 1% AEP flow level in the road gutter and for major flow paths in drainage reserves, a minimum of 100mm freeboard (being measured from the top of water level) shall be provided to properties boundary surface levels. Particular care should be given to properties at levels lower than the footpath or reserve. Where design allows, greater freeboard heights should be achieved.

13.3.6 Open Channels

Open channels generally form part of the trunk drainage system that cater for major 1% AEP events and shall be designed with smooth transitions with adequate access for maintenance and cleaning.
Design of open channels (including safety and maintenance matters) shall be in accordance with Australian Rainfall and Runoff providing:

- A minimum of 300mm of freeboard to the top of the channel (600mm in mine subsidence areas).
- A minimum of 500mm freeboard to adjacent dwelling floor levels.
- Maximum side slopes on conventional grass lined channels shall be 4H :1V.
- Friction losses in open channels shall be determined using Mannings "n" values, or as approved by Council.
- Provision for low flow structures within open grass lined channels shall be provided. In addition subsurface drainage may be required to prevent water-bogging of the channel bed. The low-flow design parameters shall be nominated in the design and be approved by Council.

The following design features should be avoided:
- Hydraulic jumps/supercritical flow
- Transitional changes in cross section
- Superelevated flows

Channels shall be signposted with a “WARNING” sign in accordance with standard drawing SCSD-430.

13.3.7 Grades

Minimum Grades
Open Channels and flow paths shall be constructed with sufficient longitudinal grade to ensure that unintentional ponding and/or the accumulation of sediment does not occur, particularly in locations where sediment removal would be difficult.

Flow paths shall generally have a minimum longitudinal grade of 0.5%.

Maximum Grades
Open Channels and flow paths shall be designed with longitudinal grades that minimise:
- Hydraulic jumps.
- Dangerous conditions for the public.
- Potential erosion.

In regard to potential erosion of channels extra care should be taken for channels that have a longitudinal grade of more than 2%, in respect to channels that are greater than 2% or large flows council will have final say of the treatment of channels (eg. Shotcrete, Earthlok or similar, rock lining, gabion baskets, …).

Longitudinal grades shall be chosen such that the 1% AEP flow or “gap flow” will not exceed the average velocity limits shown in Table 12 below.

Table 12 Maximum Average Flow Velocities

Location	Average Flow Velocity (m/s)
Open channels	2
Swales and flow paths	2
Open channel low flow inverts	4

Maximum Grades
Drop structures must be provided to reduce waterway longitudinal grades such that 1% AEP average flow velocities meet the requirements of

Table 12 Maximum Average Flow Velocities above.
Drop structures shall be in accordance with the current NSW Department of Primary Industries, NSW Office of Water and NSW Local Land Services requirements.
Scour protection shall be provided at the upstream edge and downstream toe of the structure.

13.3.8 Interallotment Drainage

Interallotment drainage shall be provided for every allotment which does not drain directly to its street frontage and for high side properties fronting roads with either kerbing that is unable to satisfactorily accommodate kerb outlets or where the road has one-way crossfall. The interallotment drainage shall be deep enough to serve the entire allotment; property inlets shall be constructed at the low corner of each lot.
A maximum of **10 allotments** shall be served by an interallotment drainage system. Council reserves the right to restrict the maximum number of allotments served based on catchment characteristics and potential for runoff concentration onto downstream properties.
Interallotment drainage in residential areas shall be designed to accept concentrated drainage from buildings and paved areas on each allotment for 5% AEP design flow rates unless otherwise advised by Council’s Representative for other land use zones.

Stormwater discharge from adjoining existing lots onto proposed development sites shall be catered for by the Service Provider by the provision of an interallotment drainage system providing a point of connection for each existing adjoining lots. This will necessitate the construction of the drainage system and creation of easements in favour of the existing properties.

Interallotment drainage shall be placed centrally within easements with a minimum width of 1.5m. The easements shall be created in favour of benefiting allotments. Ongoing maintenance of interallotment drainage remains the responsibility of the benefitting allotments.

Where the impervious areas cannot be determined, the impervious surface areas are to be used in accordance with Table 6.

Pipes

Design pipes to flow full at the design discharge without surcharging inspection pits.
Pips are required to have a minimum pipe cover of 300mm and a Minimum longitudinal gradient of 1% unless approved by Council.

Construction of pipes with rubber ring joints in conformance with the following:

- Precast concrete pipes: To AS/NZS 4058.
- PVC pipes: To AS/NZS 1254.
- Polypropylene pipes: To AS/NZS 5065.
- Buried flexible pipes: To AS/NZS 2566.1 and AS/NZS 2566.2.

Pits

Inter-allotment drainage pits shall be located at the low corner of each lot, at all changes of direction and at distances no greater than 60m.

All pits shall be concrete and all grates shall be hinged and lockable. Grates not complying shall be removed and replaced with hinged and lockable grates, i.e. drop-in grates are not acceptable. All pit grates shall be locked at all times and re-locked after final inspection and acceptance of pits by Council's Representative.

Minimum pit sizes; inlet and grate types shall be in accordance with Table 13 below.

Table 13 Minimum Pit Size based on depth

Depth to Invert D (mm)	Internal Pit Size (mm)	Inlet Type	Grate size and type
D < 450	450 x 450	Grated Surface Inlet	450 x 450 hinged grate
450 ≤ D < 900	600 x 600	Grated Surface Inlet	600 x 600 hinged grate
900 ≤ D <1200	900 x 600	Grated Surface Inlet	900 x 600 hinged grate
1200 ≤ D < 1800	900 x 600	Grated Surface Inlet	900 x 600 hinged grate
D ≥ 1800	900 x 900	Grated Surface Inlet	900 x 900 hinged grate

Pits shall be depressed 100mm below the surrounding ground level, to provide efficient surface water inflow. A 450mm wide turf strip shall be laid around the perimeter of the pit. Segmental pit risers shall be adequately sealed at the joints

Each pit shall have a capped stub for the dwelling connection, and all pit/pipe joints mortared. (Refer SCSD-409). Where pit depth is designed to drain low areas of lots, the riser shall enter the pit at its base.

Drainage Easements

Within lots, easements shall be provided over pipe systems and overland flow paths. The minimum width of easements shall be as follows:

Table 14 - Piped Drainage Easement widths (minimum)

Type and Diameter	Easement Width (m)
IAD up to and including 300mm dia.	1.5(1)

IAD greater than 300mm dia.	2.5
Public Drainage System up to & including 1200mm dia.	3.0
Public Drainage System 1350mm dia. And greater	5.0

Notes:

(1) Where site constraints exist, such as in-fill developments, 1.0m wide IAD easements may be considered as the direction of the council engineer.

For pipe diameters larger than specified and for multiple pipe systems, the minimum clearance from the edge of the pipe to the easement limits shall be of 1.0m.

The specified easement widths may require widening where excessive pipe depth occurs.

13.3.9 Subsoil Drainage

Subsoil drainage shall be designed for installation in areas that are susceptible to groundwater seepage into the pavement and subgrade, and may be in the form of pipes, strips and/or mats.
Subsoil drains shall be placed on each side of all road pavements and in all stormwater pipe trenches within the road pavement in accordance with standard drawing SCSD-426 & 702 with flush points placed behind the kerb (level with the kerb), as a screw-locked plastic fitting in a concrete surround and should be placed at approximately 60m intervals. Flush points within drainage pits are not permitted.
The design should indicate a subsoil drain “lead-in”, 3.0m long installed in Inter-Allotment Drainage lines where the line connects to the road pit, and at every second pit upstream within the IAD pipeline.
Subsoil drainage shall be shown at new pavement interfaces with existing pavements.
All subsoil pipes shall be, nominally, 100mm diameter, and be “socked” with geotextile fabric.

13.3.10 Detention Basins

Detention basins may be provided as an integral part of the major drainage systems to either:

- Provide a more economic system by reducing downstream flow rates and waterway reserve widths; **or**
- Meet a specific planning or floodplain risk management plan requirement that downstream flow rates do not exceed pre-development values for both the major and minor system design AEP.

It must be recognised that the provision of a detention basin is only one method in several techniques available to manage stormwater runoff and therefore must be tested against other drainage strategies to arrive at the optimum solution to meet either of the above objectives.
The provision of detention basins in the drainage system must be planned and designed as part of an overall catchment drainage strategy.
The Designer shall satisfy the requirements of the NSW Dams Safety Committee. Submission of design plans and risk assessment may be required.
Embankments shall be designed and constructed such that they will not breach under any operating conditions for all flows up to and including 1% AEP. Generally, the maximum inundation period during the critical duration 1% AEP design storm shall be 72 hours to prevent long term damage to surfaces. However, this will depend on any secondary usage of the basin.
Detention basins shall not cause floodwaters up to and including the 1% AEP event to inundate upstream roads or land.

Analysis

The Designer shall model the performance of the basin using a range of design storms and long-term records of rainfall to determine the maximum storage requirements and the size of outlets for the basin.
A hydrograph estimation technique shall be used to estimate appropriate inflow hydrographs to the basin. Inflow hydrographs shall be routed through the basin using full reservoir routing calculations to determine the basin characteristics and resultant outflow hydrographs.
Modelling of flood routing shall demonstrate that the basin does not have an adverse impact on the total catchment mainstream flooding, and be based on *ARR 2019*, in particular:

- Chapter 5 (Flood Routing Principles) within *Book 5 (Flood Hydrograph Estimation)*.
- Chapter 4 (Stormwater Volume Management) within *Book 9 (Runoff in Urban Areas)*.

Outlet Design

Primary Outlet

To achieve the design flow control requirements, the primary outlet configuration will generally consist of a multi-outlet structure or several outlet structures combined to provide multi-stage outlet control.
The Designer shall ensure that the stage-discharge relationship adequately reflects the range of different flow regimes that the structure will operate under. The outlet hydraulics for multi-outlet structures may be complicated and difficult to analyse. Care must be taken to ensure that the stage-discharge relationship adequately reflects the range of different flow regimes that the structure will operate under. In some cases, particularly if the consequence of failure of the structure is high, the stage-discharge characteristics may need to be verified by physical modelling
Primary outlets shall be designed to minimise the risk of blocking. The consequences of partial blockage of primary outlets shall be investigated and accounted for in the basin design if found to be significant.
Where a headwall or an open type structure is provided at the entrance to an outlet, consideration must be given to minimising the effect of vortex on the entrance to the outlet to maximise hydraulic efficiency. The need for venting of the outlet must also be investigated.
Pipe systems shall contain the design flow through the detention basin wall and be suitably protected to prevent infiltration of water between the pipe outer surface and the basin wall.
Consideration must be given to the need to protect the toe of the basin embankment and the bed and banks of the downstream waterway from erosion by high velocity outlet discharges.

Secondary Outlet
A secondary outlet to allow a non-catastrophic means of failure above the 1% AEP event shall be provided. The most common outlet is a high-level weir crest and overflow spillway. Spillway design criteria shall be based on the Australian National Committee on Large Dams (ANCOLD) publications and guidelines by the NSW Dams Safety Committee.
The high-level outlet to any detention basin must have a capacity to contain the 1% AEP flood event. Additional spillway capacity may be required due to the hazard category of the structure. The hazard category must be determined by reference to ANCOLD publications and guidelines by the NSW Dams Safety Committee.
The design water level of the emergency spillway, when in operation, shall have a minimum 500mm freeboard to the floor levels of dwellings. An additional 300mm freeboard shall be provided in mine subsidence areas.
The surfaces of the embankment and secondary outlet (normally an overflow spillway) must be protected against damage by scour when subject to high velocities. An open stilling basin may be considered at the bottom of the spillway prior to discharge into the downstream waterway.

Embankment and Floor Slope
Retention basin embankment slopes shall generally have a maximum batter of six horizontal to one vertical (6:1). Slopes up to four horizontal to one vertical (4:1) may be approved in special circumstances by Council's Representative. In any case the design of the basin embankment shall be verified by a suitably qualified engineer.
The floor of the basin shall be designed with a minimum fall of fifty horizontal to one vertical (50:1) to minimise the likelihood of ponding.

Access
Retention basins shall be provided with adequate access for its intended and secondary use and maintenance machinery to remove silt or debris from the floor of the basin. Access for maintenance shall also be provided to the primary and secondary outlets.

13.3.11 On-site Stormwater Detention

On-site stormwater detention (OSD) may be required for individual building developments and on redevelopment sites to attenuate the runoff to discharge levels expected from the pre-developed site for the major and minor storm events.
The stormwater drainage design shall ensure that the works do not create or worsen any capacity problems in the existing public drainage system.
On-site detention calculations shall include any upstream catchments which contribute to the runoff. The use of on-site stormwater detention within lower catchment areas shall be assessed to ensure it does not adversely impact peak flows within the public system.
Various storm durations shall be modelled to determine the critical duration both pre-development and post-development. The on-site detention system must be designed to limit post-development flows back to pre-development flows for all design storms up to and including the 1% AEP. A runoff routing method must be used in the design and analysis of the proposed system.
The temporary storage of water shall be contained within the site and is not to encroach onto adjacent properties or public and road reserves. Pedestrian access is not to be included within the storage area unless readily available alternative routes are provided.
The on-site detention is not to be located within private courtyard, drainage easements, or secondary flow paths.
The maximum water depth for the 1% AEP event is 200mm for car parks and 400mm for gardens.

An overland flow path (or spillway) must be provided for the on-site detention area. A minimum freeboard of 300mm must be provided to floor levels (including adjacent properties) for the 1% AEP event, assuming 100% blockage of the piped discharge.

The piped discharge from the detention area is to connect directly to the street drainage system, Council drainage easement, and/or an interallotment drainage system that discharges to a public stormwater system. However, other discharge locations may be considered.

13.3.12 Drainage External to The Site

Stormwater runoff either entering or leaving the development site must be adequately addressed as part of a drainage design. Adjoining land should be investigated regarding natural surface flows and any existing piped discharge points. Where discharge of stormwater involves works on a public road reserve (other than that permitted in this chapter) such as adjustment of existing pits, new pits, extended pipelines beyond the immediate vicinity of the property, Council approval under the Roads Act must be obtained prior to commencement of works. Development consent under the EP&A Act does not apply for this purpose.

13.3.12.1 Discharge From Upstream

Where stormwater discharges onto the development site from adjoining properties that discharge must be catered for. Allowance should be made for discharge from a fully developed upstream catchment, (consistent with designated zoning), with provision made for major and minor storm events.

13.3.12.2 Discharge Downstream

Where stormwater discharges from the development site is at a level that prohibits discharge at the surface, consideration shall be given to the provision of standard underground street drainage to the closest point of discharge, such as an existing pit, pipe or channel. All pipes entering Council's existing piped drainage system from private property shall be connected at or with a concrete pit constructed in accordance with this Manual, or as a "saddle pit" over the existing pipe in accordance with an engineer's design.
Piped discharge shall be (for example, in large-lot and rural development) to a suitable watercourse and shall extend a minimum of 10 metres past a building or building envelope.

13.3.12.3 Downstream Drainage Upgrade

The existing downstream drainage system may require investigation for its adequacy to accept stormwater runoff from the development site. Works may be required to provide an up-graded pipe system, being either a new pipe system where none exists, or an open channel, to an existing approved discharge point.

14 Water Sensitive Urban Design (WSUD)

14.1 General

This Section provides guidance on modelling parameters and approaches to be used when modelling WSUD elements in *MUSIC (Model for Urban Stormwater Improvement Conceptualisation)*.
Water Sensitive Urban Design (WSUD) is a set of principles that can be applied to sustainably manage water, providing opportunities for the development industry, local government and their communities to achieve more liveable areas with vibrant and healthy waterways.
Urban development using conventional approaches can have a negative impact on the natural water cycle. WSUD seeks to minimise the impact of urbanisation on the water cycle by integrating developments with a site's natural features and promoting the integration of stormwater.

Application of these principles includes:

- Minimise the volume of stormwater runoff.
- Reduce stormwater runoff and peak flows from urban developments by local detention basins and minimising impervious areas.
- Treating urban stormwater to best practice standards for reuse and/or discharge to receiving waters.
- Reducing potable water demand through water efficiency, stormwater harvesting and wastewater reuse.
- Minimising wastewater generation and treatment of wastewater so that is can be reused.
- Integrating vegetated stormwater treatment into the landscape, to provide increased biodiversity, amenity and micro-climate benefits which can reduce the heat island effect.
- Providing green infrastructure and green links to improve habitat corridors.

This Section supports those submitting MUSIC models relating to development within the Singleton Council Local Government Area and has been developed to:

- Ensure a consistent and uniform based approach is applied when submitting MUSIC models to Council.
- Provide guidance on parameters to be used when using MUSIC to assess compliance with Singleton Council's stormwater management objectives.
- Reduce the time taken by Singleton Council in assessing and reviewing models.

This document should be read in conjunction with the *MUSIC User Manual*. Users of these guidelines are expected to know how to use MUSIC software and be sufficiently trained in the use of MUSIC software.

14.2 Stormwater Quality

Recent developments in urban stormwater quality modelling software have resulted in a significant advancement in the ability to simulate the pollutant removal efficiency of a range of stormwater treatment devices. Specifically, MUSIC developed by the Cooperative Research Centre for Catchment Hydrology (CRC-CH) now provides stormwater practitioners with a conceptual design tool that estimates stormwater pollutant generation and the performance of stormwater treatment measures.

The program can be used to estimate pollutant generation from a catchment and to demonstrate the performance of stormwater quality improvement systems. Singleton Council requires treatment of stormwater so that annual pollutant loads achieve the minimum targets set out in the *Best Practice Environmental Management Guidelines* (BPEMG) and the Engineers Australia publication - *Australian Runoff Quality (Wong, 2006) - A Guide to Water Sensitive Urban Design* these are:

Table 15 Minimum Pollutant Removal Performance Targets (Australian Runoff Quality 2006)

Pollutant	Performance Requirements (Targets)
Total Suspended Solids (TSS)	80% of average annual load
Total Phosphorus (TP)	45% of average annual load
Total Nitrogen (TN)	45% of average annual load
Gross Pollutants >5mm	70% of average annual load
Litter > 50mm	Retention up to the 3 month ARI peak flow
Oil and Grease	90% of average annual load

The design intent for any treatment system must be clearly documented and discussed with Council's Representative early in the conceptual design stage. Singleton Council uses MUSIC to assess the impacts of proposed development against adopted performance targets. If alternative methods or models are used, the developer must demonstrate to Council's Representative satisfaction that performance targets can be achieved. This document provides guidance on input parameters and modelling approaches for MUSIC modelling that are recommended by Singleton Council.

14.2.1 Submission Requirements for Development Applications

To demonstrate compliance with Council requirements as outlined above, a Water Cycle Management Plan (WCMP) must be submitted with the development application. A WCMP details the WSUD strategy and the water management measures to be implemented on a proposed development site including water conservation objectives and stormwater quality control to meet Council's stormwater quality targets.
The main elements to be included within a WCMP are:

- Background Information and Site Analysis.
- Proposed development description.
- WSUD objectives applicable.
- MUSIC-***link*** modelling results report demonstrating compliance with parameters and targets and an electronic copy of the MUSIC file (.sqz) for internal review.
- Costs and maintenance requirements (Operations and Maintenance Plan – see below).

14.2.2 Operation and Maintenance Plan (OMP)

To ensure that water quality devices will function effectively into the future it is important that operation and maintenance requirements are considered during initial planning to ensure that the water quality devices can be efficiently maintained by Council. Operation and maintenance requirements for particular water quality devices shall be summarised in an Operation and Maintenance Plan (OMP).
The OMP is a living document that is regularly reviewed and updated at various stages throughout the development lifecycle as further details of the development are confirmed or changes occur. The OMP should typically be prepared, reviewed and/or updated at the following stages:

- Development application (by development applicant);
- Construction certificate (by development applicant);
- Hand over (by development applicant); and
- Operation (by Council/asset owner).

A Draft Operation and Maintenance Plan (OMP) shall be prepared along with the WCMP and lodged with the Development Application. A summary of the elements that shall be addresses in the OMP and the development stage/s for addressing these is provided in Table 7-1

Element	Development Application	Construction Certificate	Handover	Operation
confirm maintenance responsibility	•			
site and development description	•	o		
site access location	•	o		
proposed locations of water quality devices	•	o		
concept sketches of water quality devices	•	o		
maintenance access design	•	o		
maintenance equipment and personnel	•	o	o	o
description of maintenance methods	•	o	o	o
estimate operation and maintenance costs	•	o	o	o
specific performance monitoring activities	•	o	o	o
details of water quality devices construction staging		•		
landscape and weed control management		•	o	o
inspection methods		•	o	o
safe work method statement		•	o	o
work-as-executed drawings			•	
photographs of water quality devices and components			•	o
water quality devices co-ordinates			•	
details of modifications to constructed water quality devices			•	o

Notes:

- Initial consideration, o Review and revise if necessary

14.2.3 Constructed wetlands and ponds

For wetlands to operate efficiently they should be “off-line” accepting, typically, flows up to the 63.21% AEP (1-year ARI) storm event. General objectives for wetland area design are as follows:
The shape of the wetland should be designed to optimise the treatment of the flows with lengthy flowpaths through the wetland.

Wherever possible, existing natural drainage gullies should form part of a stormwater and runoff drainage management system incorporating detention basins and/or wetlands to alleviate stormwater peaks and retain pollutants.

Wetlands should be well-designed creating an attractive, safe amenity and be highly visible for both the adjoining residents and passers-by.

Walking paths should have frequent contact adjacent to the wetland edge

- Vegetation should be designed such that generous unobstructed view of the wetland is provided, but with dense planting where access should be restrictive, such as near deep water
- The design should ensure that emergent macrophytes are minimal and manageable
- Surrounding slopes to wetlands should be gentle and offer convenient tractor-mowing access – general maximum of 5H:1V

The planting list for each section of the wetland shall be provided with the design.
A management plan, including lifecycle costing (MUSIC), shall be submitted with the design indicating a Programme of On-Going Maintenance, appropriate for the particular wetland design. All wetlands shall be provided with a valve/pipe mechanism (other than mechanical pumping) to drain to the lowest possible level for periodic “clean-out” and harvesting of vegetation growth. A typical cross-section of a constructed wetland utilising the general objectives above is shown in standard drawing SCSD-417.
For wetland maintenance purposes, vehicle access around the wetland, and an all-weather access road and standing area to GPT’s shall be provided.
Wetlands shall be signposted with a “WARNING” sign in accordance with standard drawing SCSD-430.

14.2.4 Swales

Swales assist in the attenuation of flow and the removal of pollutants. Swales are most effective as source controls as opposed to end of pipe solutions.
Vegetated swales are suitable for catchments where they are able to convey flows longitudinally, with ultimate relief into a drainage conduit, device or system, and are commonly used as an alternative to kerb and gutter within the road. Swales are intended to be non-trafficable and should only be employed where vehicle crossing is not required, such as within medians of dual carriageways and adjacent to reserves.
Where for a particular reason vehicle access is required, a concrete driveway may be provided across swales either within the swale invert or with a culvert/pipe.
Swale velocity depth coefficient should be kept below 0.4 and longitudinal slope of the swale should be kept between approximately 1% and 4%.
Swales must be fully vegetated on a sandy loam topsoil to ensure maximum filter effectiveness, and plantings, other than couch grass, will be considered on their low-maintenance merits, having regard to flow capacity and long-term maintenance. Woodchip is not permitted. Refer to SCSD-412.

14.2.5 Bio-retention Systems

Bio-retention systems are filtration devices usually located within detention basins which comprise of porous subsurface soil layers and pipes and in some circumstances suitable vegetation (other than grass turf) to filter stormwater.
Like swales, these systems must be non-trafficable and designed for easy maintenance.

14.2.6 Other WSUD Treatments

Examples of other common WSUD treatments that may be provided include:

Primary Treatments:

- Pit inlet protectors
- Trash Racks
- Gross Pollutant Traps (eg. Baramy Traps, CDS Units, ECOSOL Units, Humeceptor, Humeguard or other manufacturer's equivalent)

Secondary Treatments:

- Wet Basins
- Bio-retention swales
- Infiltration systems
- Vegetated Filter Strips
- Sand Filters
- Surface Retention
- Porous Paving

Tertiary Treatments:

- Constructed Wetlands
- Bio-retention

15 Developments

15.1 General

This section provides guidelines regarding vehicular access and drainage for developments other than major subdivision (being the subject of other sections within this Guideline). In general terms this includes all development requiring vehicle access to property from a public road. Specifically, this section provides extended detail for industrial, business, medium density residential developments, small-scale subdivision without creation of a public road, (generally applying to the creation of up to 4 lots) and where re-subdivision of original residential lots is proposed for purposes of development over and above a single dwelling on the land.

15.2 Responsibilities

15.2.1 Insurance

The applicant/contractor/land owner should ensure that he/she has sufficient and current insurance cover for Public Liability and Workers Compensation particularly in respect to works on the public road, in relation to this Manual. A Householder's Policy may not be adequate for works on a road reserve.

15.2.2 Public Utilities

It is the applicant's responsibility to check whether the proposed works affects any Public Utility mains installation or any proposal for new mains. Council cannot guarantee that future “openings” within the road reserve for the installation of mains, will not be required.

Where underground works within the road reserve are required or necessary for supply of services to the development site (such as water, sewer, electricity, gas), further consent for a “*Road Opening*” must be obtained from Council.

15.2.3 Safety of Works

For works within the road reserve, the applicant or contractor, or land owner is responsible to erect and maintain approved standard safety devices such as fencing, barricades, signs and where necessary, lights in accordance with Council’s standards and requirements. The work-site shall be kept in a tidy condition, and maintained safe for pedestrian access for the duration of the work. Upon completion of works and removal of formwork, barricades, etc, the adjacent footway shall be filled or trimmed along the edges of the works to an even grade with a maximum slope of 1 in 8 (i.e. a 100mm rise or fall over a distance of 800mm).

15.2.4 Removal of Defective Works

Council retains the right to alter, repair or in some cases, remove and replace any work on public reserve/land for which approval has not been obtained, or that has not been carried out in accordance with this Guideline, or is considered unsound or unsafe, or is of poor workmanship. The work would be undertaken by Council at the full cost of the responsible person, recoverable in accordance with the Roads Act.

15.3 Driveways (and associated works within the road reserve)

The objective of this part is to ensure that development has a safe, practical and a durable vehicular access between the property boundary and the public roadway, and that the driveway within the property satisfactorily caters for vehicle loads and manoeuvring with acceptable gradients. Driveway design must take into account safety for all road users maximising sight distances based on design guidelines detailed in Austroads standards Part 3 (particularly relevant to a rural environment), and in Australian Standards 2890 for access driveway locations and exits, (being particularly relevant to an urban environment).

> Works within the road reserve must not commence until an approval is gained from Council through the “Application to Carry Out Works on a Public Road” form which is available on the Council web-site.

15.4 Driveway Specifications

15.4.1 Width

For residential development a “single” driveway slab pavement width of 2.7 metres is a desirable minimum. Tapered splays up to generally maximum overall width of 3.9m at the roadway are desirable to assist vehicle approach entry to the property. A “double” driveway servicing a dwelling may generally be up to 6.0m wide (see SCSD-201). Drive-strips are not permitted in Singleton LGA.
For business & industrial developments the driveway shall cater for the expected design vehicle turning paths determined by AS 2890.

For rural access the width shall be sufficient to cater for the expected usage and be a minimum of 3.6m, with additional width for splays at the junction with the edge of the road (see SCSD-203).

15.4.2 Construction Specifications

For urban residential developments the driveway, incorporating the gutter crossing, shall be provided in accordance with Council's Standard Drawings SCSD-201 & SCSD-202 as either, reinforced concrete, or bitumen/asphalt seal on a compacted gravel pavement.
For heritage areas vehicular driveways shall be notified.
For business & industrial developments, the driveway, incorporating the gutter crossing, shall be provided in accordance with Council's Standard Drawings SCSD-201 & SCSD-202, as “Commercial/Industrial Driveway” concrete construction, or as designed by an engineer to cater for the expected (heavy) vehicle loads.

For rural developments, the driveway shall be provided in accordance with Council's Standard Drawing SCSD-203. Driveways crossing roadside table drains should be installed as a 5m long, 375mm diameter (min) concrete class 4 pipe (or equivalent StormPro pipe) with headwalls. The table drain shall be diverted so that the pipe is located a minimum of 2m from the edge of the road bitumen, with sufficient cover. The pipe size shall provide sufficient capacity for the 10-year ARI (10% AEP) storm event for the contributing catchment area with larger overflows being contained by the road pavement/reserve. The crossing shall be of compacted gravelled (300mm minimum thickness), with a 2-coat or asphaltic bitumen seal from the edge of the existing road seal to the property boundary or as shown on Council’s standard drawing SCSD-203.

15.4.3 Profiles

Driveway profiles shall be designed and drawn showing levels for both the design surface and the existing surface, complying with the specifications for high/low level driveway construction indicated on Council's Standard drawing SCSD-202.
The designer/builder should endeavour to match the existing surface levels as close as possible whilst complying with the standard profile. Minor cuts and fills of up to 120mm may be acceptable in a footway provided 14:1 slopes are achievable as transitions to the adjoining existing surface levels. The slope across the driveway must follow the same grade of the kerb and gutter up to a point 3.2m from the kerb face, from which point the slope may be varied to suit property/garage levels. Where requested by Council, provision of a 2.5m wide section within the driveway crossing, with a grade of 2.5%, for a future footpath, shall be applied.
The designer/builder should ensure that, for a property on the low side of a road, the potential for major stormwater flow within the road pavement/gutter to enter the property via the driveway, is avoided. The purpose of the design profile is to contain flows in the roadway.

15.4.4 Grade

The recommended maximum driveway grade is 4 Hor : 1 Vert (25%). Refer to standard drawing SCSD-202. Wherever possible, driveways within the property should be graded to evenly shed water runoff to adjacent landscape/grassed areas within the property, such that runoff is not directed as concentrated flow directly onto adjoining property. Stone/sand-filled trenches adjacent to drives are desirable to enhance infiltration, providing a subsoil outlet is available at the low-point in the trench-line. Otherwise, stormwater collected from the driveway should be piped to the on-site, or street, drainage system.

15.4.5 Clearance

Driveways should provide an absolute minimum of 300mm (desirable minimum, 500mm) clearance from the edge of obstacles such as trees, poles etc. The minimum clearance to stormwater drainage lintels/grates shall be 600mm (layback transition).

15.4.6 Table Drain Crossings

Where driveways cross a roadside table drain, a concrete dish crossing is the preferred option of crossing within the table drain in accordance with Council's Standard Drawing SCSD-101. To achieve this, re-grading the surface by cutting within the verge and into the property may be necessary to avoid “scraping” of the vehicle.

15.4.7 Public Laneways (Existing)

Where permitted by consent, access within an existing public laneway (or unformed or informal “paper road”) to property development is subject to an assessment of the existing road pavement (if any) and include construction or rehabilitation of the laneway to Council’s standards, which shall be with either a bitumen sealed gravel or a reinforced concrete pavement, unless justified otherwise. Works shall be constructed in accordance with this Manual and the pavement shall be a minimum width of 4.0m. Pavement width may vary depending on type and ultimate volume of traffic usage, passing opportunity, length of works, sight distances, etc.
Driveway Crossings over Paths

Where an existing concrete path crosses the driveway, the path shall be retained such that the path appears continuous.

15.4.8 Removal of Paths

Where path removal is necessary, due to damage, added strength or level adjustment or for drainage pipes, the path shall be removed to the nearest existing joint and reinstated to match the existing path appearance (usually plain concrete) dowelled to existing concrete and constructed in accordance with Council’s Engineering Design Guideline.

15.4.9 Verge Damage

Damage to any existing verge or path, due to building construction activity, should be avoided. Restriction of access to the building site should be made to confine potential damage to a single point. Any necessary reinstatement of the verge (with full turf cover) or path (with new reinforced concrete) must be made prior to “Occupation” of the development, and be in accordance with Council's requirements.

15.4.10 Redundant Laybacks

Redundant laybacks shall be removed and reinstated with integral kerb and gutter, and footways and road surfaces restored to match existing surfaces.

15.4.11 Lintel & Grate Adjustments

Council will only permit adjustments to street drainage pits, whereby extended kerb inlet lintels are replaced with heavy duty “V” grates, if the designer can demonstrate that the stormwater inlet capacity of the street drainage system is not compromised. Otherwise the applicant must construct a replacement pit with an EKI lintel to Engineering Design Guideline. The surplus lintel and/or grate shall be delivered to Council’s depot in good condition.

15.5 Driveway Handles (Within the Property)

Driveway access handles should be designed to achieve:

- Opportunity for landscaping to avoid the “gun-barrel” effect (particularly for Residential areas)
- Reduced impervious surfaces, and to introduce a “soft” appearance such as utilising driveway wheel-strips (for Residential only)
- Opportunity for passing and storage of vehicles with adequate pavement width at the end of the handle adjacent to the road reserve (or in long or angled handles, part-way where adequate sight-lines are available) for vehicle storage/passing within the handle. In residential areas, typically passing areas adjacent to the

public road should be provided every 30m being a minimum of 5.5m wide for a length of 6m, with splays being 5m either side (total of 16m of length).
- Provision for services to properties within and along the full length of each individual access handle
- Avoidance of concentrated stormwater runoff onto adjoining properties

Rights-Of-Carriageway, in lieu of “handles” may be acceptable, but only due to site constraints, such as an existing dwelling where building setback distance may be problematic.

15.6 Vehicle Access, Parking and Turning

Vehicle access to on-site parking areas shall comply, as a minimum requirement, with Australian Standard AS 2890. Layout geometry for manoeuvring and parking should in the first instance be assessed under Council’s DCP, catering for the design vehicle appropriate for the development. Vehicle movement to and from the site shall conform with best practice design for sight distance, approach angle, pedestrian and cyclist safety, convenience and safety for traffic for through-traffic and turning-traffic flow and must be executed in a forward direction for exiting traffic. Generally, only for single-lot residential access may traffic reverse onto a public road, although special circumstances such as high traffic volumes, sight distance, adjacent, traffic facilities, etc may dictate otherwise, at Council’s discretion.

15.6.1 Pavement

15.6.2 Sealed

Off-street vehicle parking shall comprise of a wearing surface of either a 2 coat bitumen seal, asphaltic concrete, rigid concrete, or segmental block pavement on a constructed foundation (pavement), designed by an engineer. Heavy-vehicle loading and manoeuvring areas should be rigid pavements.

15.6.3 Unsealed

Where pavement “hardstand” is intended to be un-sealed for purposes of storage of materials or similar use, it is essential that silt controls are put in place. Controls should be implemented by means of surface flow with perimeter (or internal) grass swales (instead of an internal pipe system) and a depressed grassed silt trap retention area incorporating a pit-trap at/near the point of discharge from the site (usually within a landscaped area). The built-in detention features provided may be quantified for the hardstand catchment area only. The hardstand material shall be stabilised with lime or cement depending on the sourced material.

15.6.4 Turning Paths

Vehicle manoeuvring templates, in accordance with Austroads or Australian Standards shall be employed for each appropriate vehicle type for the nominated land-use.

Turning paths shall be applied for the appropriate vehicle to maintain unobstructed “free-flow” conditions within the site for service vehicles such as small rigid vehicles (SRV) and heavy rigid vehicles (HRV) where required.

15.6.5 Intersections

Where determined by Council, and generally for developments that generate high/heavy-vehicle traffic movements an access intersection treatment may be required at the junction with the public road.

Council’s preferred treatment for access to such developments is for intersections that comply with the “Warrants for Basic, Auxiliary, and Channelised Turn Treatment” types as set-out in Austroads Standards (Part 4A). Guidelines for intersection/driveway demand may be determined from Section 3 of AS2890.1 whereby the “Access Facility Category” for categories 3, 4 & 5, in the first instance be assessed as “intersections” rather than “driveways” (See section 3.2.3). Despite such warrants and demands, particular consideration shall be given to providing a protected right-turn and a separated left-turn capability. Left-turn treatments should allow generous turning paths to facilitate continuous free-flow manoeuvres. Such features as describe above may include road reserve and road pavement widening.

Intersections for access shall cater for Articulated Vehicle (AV) turning paths, including “B-Double” where required (and approved) by the type of the development.

15.7 Ancillary off-site works

All works within the road/public reserve shall be designed and constructed in accordance with this Manual. Road works cannot commence without consent under the Roads Act.

15.7.1 Road, Footway and Drainage

Works may be required through development consent, to up-grade the existing road verge and/or pavement, and/or drainage system, generally limited to the frontage of the development site, although may be extended beyond the property frontage to connect to existing infrastructure.
Warrants for such works may be:

- continuation of existing adjoining, or nearby, infrastructure to cater for the additional usage needs created by the development and to enhance the streetscape
- where pedestrian, cycle and vehicle traffic movements/parking are significant or where “desire-lines” of travel result from the development activity.

Typically, works that may be required are:

- Re-shaping and turfing of footway
- Concrete paths
- Concrete dish drain or integral kerb and gutter
- Road shoulder pavement including a bitumen wearing surface
- Pipe and pit drainage

Materials for new pavement works shall be consistent with or similar to the existing adjoining road pavement in accordance with the specifications of this ‘Manual’.

15.7.2 Concrete Works

Concrete works, such as paths, shall be designed and constructed in accordance with this Guideline, with particular attention given to:

- Depth and Strength
- Formwork and Reinforcing
- Joints
- Curing
- Testing (where requested by Council)
- Weather Conditions

15.7.3 Inspection of Works

All works within the road/public reserve are subject to testing, and inspection by Council to ensure compliance with this Guideline and/or manufacturer or material supplier specifications where not covered by this Guideline.

15.8 Preparation and Presentation of Design

15.8.1 General

All drawings prepared and submitted to Council shall comply with the relevant Council standards to ensure that the drawings are suitably legible for review by Council’s Representative.

15.8.2 Data Ownership

All data associated with projects undertaken on behalf of Council becomes the property of Central Coast Council. This includes data provided during and upon completion of the project. No data or information that is considered the property of Central Coast Council may be given to a third party without the formal written consent of Central Coast Council.

15.9 Design Drawings

15.9.1 General

All engineering drawings shall comply with the following in order to standardise the presentation of drawings to facilitate the approval and construction processes.
Engineering drawings shall be uncluttered and information clearly readable.
Council may request any models or calculation for the design.

15.9.2 Size

Engineering drawings shall be supplied on A series ISO standard sheet sizes (A0, A1, A3, A4, etc).
Engineering drawings submitted as A1/A3 PDF files for Development Consent.

15.9.3 Colour

When colour is used in a drawing and it is to be printed in colour, a note must appear on the title block stating that the drawing was created using colour and may appear incorrect if reproduced in greyscale or black and white. Colours used in drawings shall be visible and easily distinguishable and remain clear when the drawings are copied.

15.9.4 Text

The size of construction notes on the plans and drawings shall be minimum 2.5mm on A3 sheets. The size of other lettering or numbering, including text within line types, shall be minimum 2.5mm on A3 sheets. The minimum text size on A1 sheets shall be 3.5mm.
All annotation shall be carried out using CAD systems unless otherwise approved.

15.9.5 Line work

All line work shall have a minimum line weight/thickness of 0.15mm.

15.9.6 Hatching

Hatch patterns and the scale of the hatch shall be easily identifiable and distinguishable. The appearance of the hatching shall match that shown in the legend. Hatch patterns must be consistent across all drawings.

15.9.7 Scales

Plan

- Road and Drainage: 1:500 minimum or as required for clarity. 1:100 or 1:200 for detailed road intersection plans.
- Water and Sewer: refer to Council design guidelines.

Detail

- As required for clarity.

Longitudinal Sections

- Generally, 1:500 Horizontal, 1:100 Vertical.
- Vertical scale may vary in very flat or steep grades.

Cross Sections

- 1:100 Natural.

Kerb Returns

- As required for clarity.

Catchment Areas

- As required for clarity to suitably denote new and existing contributing catchments.

15.9.8 Drawing Title

All sheets must show the following information in the title block:

- Project/Property description.
- Service Provider/consultant/owner.
- Surveyor/Engineer.
- Scale, bar scale and survey datum.
- Project/Development Consent number.
- Sheet number and amendment number/letter.
- Description of work.

15.9.9 General Notes to be Shown on Development-Related Design Drawings

The following general notes shall be shown on the first or cover sheet of all Design Drawings:

1. All work is to be carried out in accordance with Singleton Council's *Engineering Design Guideline* and to the satisfaction of Council's Representative.
2. The Service Provider is responsible for ongoing maintenance of erosion and siltation control measures.
3. All public utilities shall be clearly identified in the field prior to any civil works. Council does not accept any responsibility for damage or relocation costs to public utilities during construction of the development.
4. It is the Service Provider's responsibility to ensure that all works shall be carried out in accordance with the *Work Health and Safety Act 2011*.
5. Permission to Enter, construct works and discharge stormwater onto adjoining properties shall be obtained and submitted to Council prior to the commencement of any works.
6. Pavement to be designed and certified by a practising consultant geotechnical engineer and submitted to Council for approval prior to the commencement of any works. **Approved pavement design reports shall prevail over any design requirements or pavement details shown on the approved drawings.**
7. These drawings shall be read in conjunction with the conditions stated in Singleton Council's engineering plan approval correspondence and the conditions of the Development Consent.
8. **If the standard or requirements for works shown on the approved drawings differ from that required by Council's *Engineering Design Guideline*, then the requirements of the *Engineering Design Guideline* generally will prevail.** Clarification shall be obtained from Council's Representative if there is concern that the requirements of Council's *Engineering Design Guideline* may not be appropriate for a specific circumstance.
9. The Service Provider shall address all preconstruction requirements of Council's *Engineering Design Guideline* prior to commencement of any works.

15.9.10 Drawing List

The following is a list of the sheet types which may be applied for detailed Design Drawings:

- Cover and index.
- Typical cross sections.
- Survey control plan and co-ordinates.
- Alignment control and detailed setting out.
- General plans and longitudinal sections.
- Pavement composition - build-up, jointing, subsurface drainage, etc.
- Cross sections.
- Kerb return profiles.
- Property adjustments and/or driveway adjustments and longitudinal sections.
- Pavement marking, signposting and safety barriers.
- Drainage and subsurface drainage plans.
- Drainage longitudinal sections.
- Drainage calculation tables.
- Drainage catchment plan.
- Detailed drainage structures.
- Public utility services and proposed relocations.
- Erosion and sediment control plan.

15.9.11 Design Drawings

The following details shall be provided as a minimum set of Design Drawings.

Typical cross section details, with pavement details and subsurface drainage.
Typical cross sections as a minimum shall detail:

- Lane configuration and typical crossfalls.
- Typical location of road furniture (including streetlight poles and road safety barriers).
- Typical location of existing and proposed utilities.
- Pavement profile and reference to edge details.
- Subsurface drainage location.

Road and Stormwater Drainage Design Plans
Road and stormwater drainage design plans as a minimum shall detail:

- Site location plan.
- Centre line chainages.
- Chainages shall be aligned with the longitudinal section and generally run left to right across the plan, preferably readable in the direction of ascending chainages.
- North point to define orientation.
- Centre line bearing of straight sections and the radii of curves.
- Location, description and RL of bench marks, to AHD.
- Position of proposed subsurface drainage lines (may be covered by note or shown on typical cross sections).
- Existing road names and proposed road number/names, property boundaries (existing and proposed) and lot and house numbers.
- Proposed type and alignment of kerbs including road and lane widths.
- Proposed dimensions, locations, material and types of all pavement marking (including raised retroreflective pavement markers) and signs, including sign size code, mounting height and lateral clearance requirements.
- Location and level of all existing services with construction notes relating to any necessary alterations or protection treatments (any service impacted by the project shall also be provided with levels).
- Location of proposed drainage structures with pits and headwalls numbered to correspond with drainage calculations and longitudinal section. For clarity, drainage details may be shown on a separate drainage plan.
- Lip of kerb radius for all kerb returns.
- Existing drainage structures and conduits including size, type and invert levels.
- Existing road feature level and location each side of the new road location sufficient to determine design grades and crossfalls to the new work.
- Existing survey features.
- Show merged proposed and existing contours at 500mm intervals, together with any relevant topographical features over the whole site. In flat areas or in watercourses and flood plains, 100mm intervals shall be provided.
- Limits of cut and fill batters of significance.
- Existing and proposed cadastral boundaries, including existing and proposed road reserve boundaries.
- All trees (greater than 3m in height) and shrubs within the road reserve and those within 3m each side of a proposed drainage line together with any others likely to be affected by the works, must be located and shown on the plan.
- Set out co-ordinates for all design centre lines, stormwater structures and any other design features requiring accurate set out information.
- Details of intersections showing kerb return chainages, kerb radii, road design centre lines, finished surface contours at 100mm intervals, or 200mm intervals if required for clarity, and set out co-ordinates.
- Location and details of permanent and temporary survey marks required for set out purposes.

Longitudinal Sections for Roads
Longitudinal sections shall have chainages running left to right across the page. Other information to be shown shall include:

- Centre line chainages.
- Existing surface levels on the design control line.
- Design surface level on the design control line.
- Details of the vertical alignment, including crest and low points.
- Grades, size of vertical curves and chainage, and chainage and RL of intersection points.
- Datum RL of longitudinal section.
- Chainage, size and level of Public Utility mains and services (where information is available).

The longitudinal section shall extend for a minimum of 60m beyond the limits of pavement works, including along existing intersecting roads, to enable proper design tie-ins.

The longitudinal section of an offset cul-de-sac shall be curved to the centre of the turning circle and not in a straight line with an offset to the centre.
Hammerhead turning facilities shall have the long section continued along the main line of the facility. Where a cross section does not show the design centre line of the other turning arm, a long section shall be provided.

Cross Sections

- Cross sections must be shown at a maximum of 15m intervals and at key points for design purposes, e.g. where accesses require special design, where cover requirements over services are critical or where superelevation is required at the relevant transition chainages. Where appropriate for level control, designs may require cross sections at 5 or 10m intervals.
- Cross sections must be placed such that the lowest chainage occupies the bottom left corner of the sheet and run sequentially up the sheet in progressive columns towards the right.
- Cross sections must extend for the full road reserve width or for a sufficient distance to detail the proposed method of satisfactorily matching the design and existing surfaces.
- Additional cross sections shall be provided at each driveway access and be extended to detail transition to existing access or parking area.
- Provide sufficient existing cross section profiles and crossfalls to show transitions to proposed works where required.
- Details to be shown on cross sections shall include:
- Road centre line chainage in bold print below each section.
- Offset chainage from the pegged or design control line.
- Existing surface RL.
- Design surface RL.
- Design crossfall (%).
- Batter slopes (ratio Horizontal:Vertical).
- Access grades (%).
- Design centre line shift, offset crown or transitions where applicable.
- Location of any utility services crossing the work.
- Typical sections and capacities.
- Location of any public utility service mains/services crossing influenced by the work
- Note referring to type of bedding/backfill condition required in accordance with AS/NZS 3725 *Design for installation of buried concrete pipes*.
- Details to be shown on the drainage profiles shall include:
- Drainage longitudinal sections must have the downstream end of the system on the left-hand side of the sheet with chainages to run left to right unless otherwise agreed with Council's Representative.
- Running chainage along the stormwater pipe at each pit structure and structures crossing the drainage line.
- Pipe design invert level.
- Pipe grade.
- Existing surface level.
- Existing invert of drainage where applicable (i.e. pipes, creeks, drains, etc).
- Finished surface levels.
- Pipe size, class and type.
- Type of bedding/backfill condition required in accordance with AS/NZS 3725 *Design for installation of buried concrete pipes*.
- Location, size and level of any public utility main or service that may be affected by the work and proposed treatment.
- Pit/structure reference number and type (to be shown above the section together with details of kerb inlet extensions and pit k value).
- Datum RL of the longitudinal section to AHD.
- Hydraulic grade line and levels including the receiving waters design level.
- Design flow and design storm Annual Exceedance Probability.
- Partial and full pipe velocity.
- Minimum friction grade of the design culvert.
- Trenchstop or bulkhead locations and spacing required.