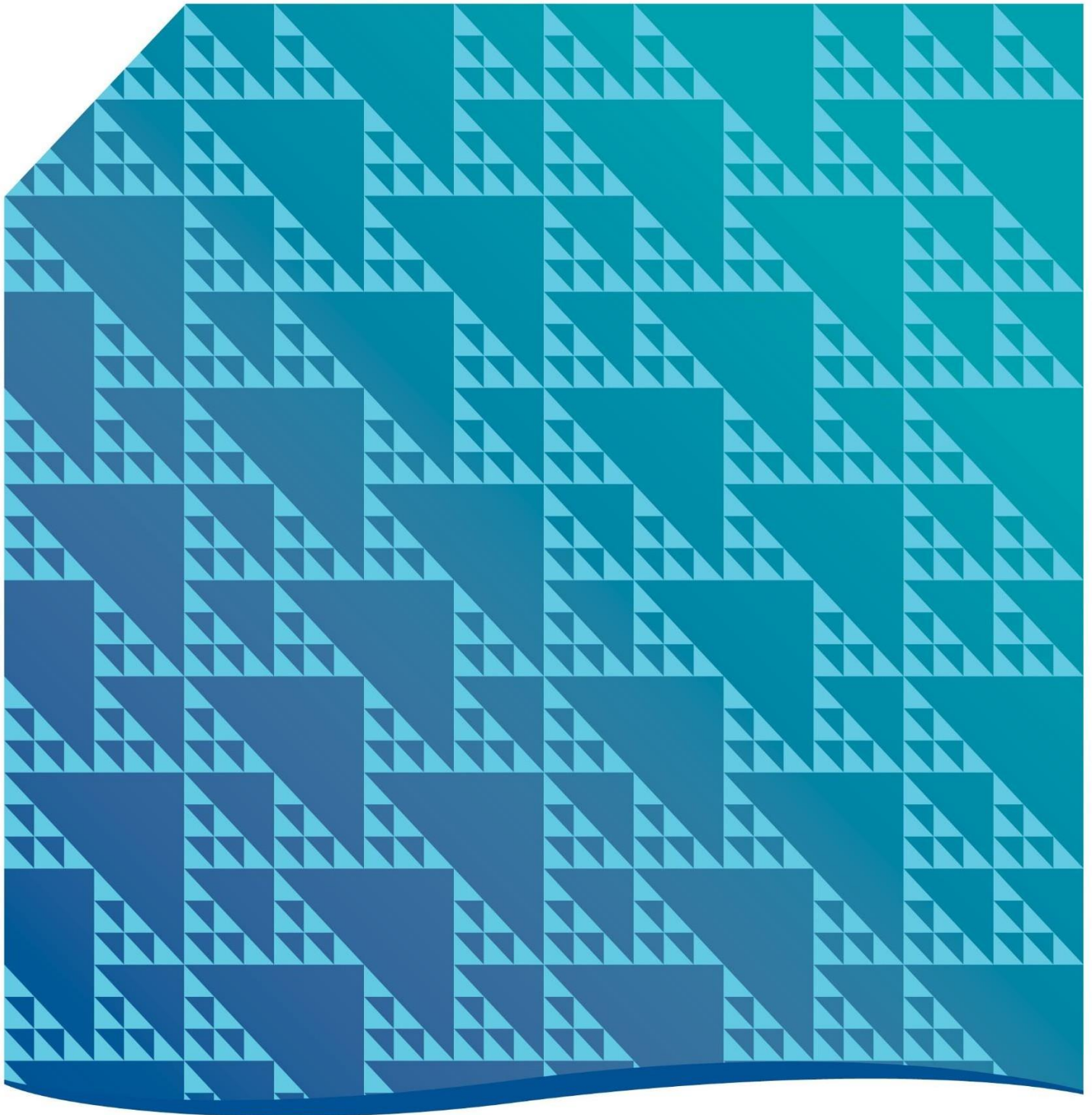


Professional Services
Specifications (PSS)

Last updated:
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T8 – Drainage Design Standards



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Revision History

| Version No. | Date | Description of changes |
|-------------|-------------|---|
| 2.0 | August 2020 | Major revision and update Template updated and old references to superseded documents/entities updated |
| 3.0 | May 2023 | Minor revision and update associated with water film depth and aquaplaning |

T8.1 Scope

This Specification sets out the requirements for drainage design including that required for new roads and for upgrading or reinstatement of existing roads. It defines requirements principally by reference to Austroads publications, but also contains specific requirements.

This Specification is part of the set of specifications comprising the Professional Services Specifications (PSS).

T8.2 Objective

The objective of this Specification is to ensure the Department's drainage design requirements are met in the design of roads and bridges and that these requirements are consistent with Australian Standards, Australian Rainfall and Runoff Guidelines and Austroads Guidelines, to ensure the sustainability of the Department's infrastructure and mitigate any risks for the public.

T8.3 References and Standards

Drainage Design shall incorporate the requirements, and be compatible with, all the Department's Professional Services and Construction Specifications. All relevant Austroads Guidelines and Australian Standards shall be used.

Other key Departmental drainage documents, and non-Departmental Guidelines and Standards relevant to this specification are listed in Section T8.7 – Schedule of References.

T8.4 Definitions

Definitions shall be in accordance with Austroads' *Glossary of Terms* and *Australian Rainfall & Runoff*, as well as the definitions relevant to each of the other references.

T8.5 Basis of Design

T8.5.1 Design Standard

Drainage design shall be in accordance with Austroads *Guide to Road Design Part 5: Drainage - General and Hydrology Considerations*, which includes Part 5A: - Road Surface, Networks, Basins and Subsurface and 5B: Open Channels, Culverts and Floodways. The drainage provisions of Austroads *Guide to Road Design Part 6B Roadside Environment* are also critical to drainage design. As stated in Part 5, drainage design occurs within the broader context of road design and Part 5 should be applied in conjunction with all other parts of the Guides to Road Design.

Design flood estimation shall be determined in accordance with the *Australian Rainfall and Runoff* guidelines. Where the design is for the rehabilitation or extension of existing drainage infrastructure, the hydraulic capacity and condition of the existing drainage infrastructure shall be assessed in conjunction with the new design.

For bridges, the design shall conform to the requirements in the Australian Standard AS5100:2017 for waterways and flood design and shall consider relevant combination of effects from sea level rise, high tide and storm surge together with the rainfall event.

T8.5.2 Flood Protection

For bridges over a waterway, flood design shall be considered in accordance with the requirements of AS5100.1:2017 Clause 11.

Design flood protection standards shall be as listed in *Table T8.5.2.1 Flood Protection Design Criteria*, where the 1% AEP, 2% AEP, 5% AEP are the Annual Exceedance Probability of design rainfall events.

T8.5.2.1. Flood Protection Design Criteria

| State Road Category | Bridge Soffit Level | Minimum Road Level | |
|---------------------------|---------------------|--------------------|---------------|
| | | Catchment Area | |
| | | ≤2500 ha | >2500 ha |
| 1 | 1% AEP + Freeboard | 1% AEP + 0.5m | 1% AEP + 0.5m |
| 2 | | 2% AEP + 0.3m | 1% AEP + 0.3m |
| 3 | | 2% AEP | 1% AEP |
| 4 & 5 | | 5% AEP | 1% AEP |

An allowance for freeboard forms part of the flood protection required at bridges. This allowance is provided to cater for uncertainties in predicting the flood level when modelling the design flood event, floods of greater magnitude, or the effects of blockages and debris.

The freeboard allowance does not include climate change impacts, which are to be considered separately, in accordance with Section T8.5.10. Note that the freeboard value adopted is subject to the Department's acceptance.

The consequences of any backwater or any overtopping of road formations and bridges shall be checked and evaluated.

Catchment characteristics shall be based on projected development for 25 years.

Water flow over trafficable pavement shall be below aquaplaning depth when subject to a rainfall intensity of 5 minute for a 50% AEP rainfall event, or to an intensity of 50mm/hr, whichever is the lesser. The desirable water film depth should be no greater than 2.5 mm and an absolute maximum of 4.0 mm. Approval of water film depth greater than 2.5 mm is subject to the Department's acceptance.

T8.5.3 Kerb and Channel

Kerb and channel shall be designed for a 5% AEP with the consequences of a 1% AEP being assessed. Kerb and channel shall have a minimum gradient of 0.5%.

T8.5.4 Pits

Where pits are to be installed in kerb and gutter, preference is to be given to the use of the side entry pit. Grated pits shall only be used where it is not practicable to use a side entry pit. Where grated pits are used, the grates shall be of bicycle safe design.

T8.5.5 Open Drains

Open Drains shall include, where required:

- Table Drains
- Surface Drains (Catch Drains) on the top of cuttings on the uphill side
- Surface Drains adjacent to the toe of embankments or surface formation.

Open Drains should not be located close to the top of cut batters such that they cause batter instability.

In terrain with erodible soils, the lining of Open Drains with a non-erodible treatment must be considered.

Open drains shall have a minimum gradient of 0.5%.

Open drains should be assessed for scouring at higher gradients, with treatment mitigation measures being specified where deemed appropriate.

For any new drainage connections to existing Open Drains, consideration is to be given to scour protection and the direction of flow alignment from new to existing.

T8.5.6 Culverts & Pipes

Culverts & Pipes shall be designed subject to the following constraints:

- a minimum gradient of 0.5% to avoid siltation
- the pipe / culvert velocity is required to achieve the absolute minimum velocity and not exceed the desirable maximum velocity in accordance with AGRD Part 5A – Table 6.2
- the minimum pipe diameter/height to be used for culverts/ box culverts shall be 375 mm
- the minimum diameter pipe used to drain pits in kerb and gutter shall be 300 mm
- the minimum diameter pipe at accesses shall be 300mm
- pipes constructed on grades greater than 12% shall have anchor blocks constructed on every second pipe
- all culverts shall be assessed for erosion potential, and low maintenance erosion protection incorporated where required, particularly at culvert outlets
- semi rigid and flexible pipes shall not be used under traffic carriageways
- blockage must be considered at culverts, and the assessment is to be undertaken in accordance with Australian Rainfall and Runoff 2019 – Book 6 – Chapter 6, and shall also consider the consequence of blockage.

T8.5.7 Subsoil Drains

Subsoil drains shall be provided to intercept water that would otherwise travel through the road structure and have detrimental effects upon that structure.

The following specific points apply to the location of sub soil drains:

- Longitudinal subsoil drains shall be outside the traffic lanes (generally class 400)
- Subsoil drains under traffic lanes and shoulders shall be Class 1000 or equivalent
- Subsoil drains shall discharge into pits or at an end-wall
- Subsoil drains to have a minimum gradient of 1.0%.

Geotechnical investigations may recommend drainage treatments, particularly in relation to sub soil drains, where recommendations are implemented, the details of sub surface drains (and other features) must be shown on drawings.

In principle, where the location of subsoil (and other sub-surface drainage features such as rock blankets) are known, these shall be shown on drawings.

T8.5.8 Environmental Impacts

The design shall provide for protection of the environment from possible impacts of the works and their operation. This shall include appropriate measures to avoid adverse impacts on flora, fauna and water quality, and to protect from erosion all drains and affected watercourses, including protection of land downstream of road reserve discharges.

The design should consider the effect on the movement of fauna, particularly aquatic fauna, along a drainage path, and provide treatments for the passage of fauna as practicable.

The design shall consider the *EPA State Stormwater Strategy 2010* and the *State Policy on Water Quality Management 1997* as well as the provisions of *Austrroads Guide to Road Design* that relate to water quality and environmental protection.

For bridges, environmental impact shall be considered in accordance with the requirements of AS5100.1:2017 Clause 12.

T8.5.9 Drainage Easements

Where drainage paths are redirected, new flow paths introduced or significant increase in concentration along existing drainage paths, which extend beyond crown land, drainage easements are to be formally acquired across the impacted land. The easement widths are to be considered based on existing site constraints, as well as the depth and size of the required drainage infrastructure.

T8.5.10 Climate Change

For drainage catchments exceeding 100 ha in area and for roads and drains that may be affected by sea level rise, a climate change impact assessment shall be undertaken for all affected roads and drainage systems. For roads and drains that may be affected by sea level rise, the design shall consider the *Tasmanian State Coastal Policy 1996* and coastal vulnerability layers on the *Land Information System Tasmania (the LIST)*.

For bridges, sustainability and climate change shall be considered in accordance with the requirements of AS5100.1:2017 Clause 10.

T8.6 Hydraulic Report

A Hydraulic Report shall be prepared for each drainage structure with a catchment area exceeding 100 ha. This report shall include the following:

- basis of investigation
- impacts due to existing structures
- catchment area and characteristics
- climate change considerations
- record of landowner observations
- calculated flow, AEP and methods of calculation
- consideration of blockage factors and flow losses
- structure type and inlet and outlet style
- waterway area for bridges
- pipe/cell number, size, grade, length for culverts and pipes
- backwater effects
- overland flow path impacts
- scour effects and energy dissipation provisions
- stream deviation or realignment
- stream velocity profile for bridges
- plans, including cross-sections which clearly depict flow paths and flood levels
- design details for passage of aquatic life
- provision for access by animals or people
- clear definition of any assumptions and referenced material utilised.

T8.7 Schedule of References

| No. / ID | Acts |
|-------------------------------|--|
| | <i>Roads and Jetties Act 1935</i> |
| | <i>Land Titles Act 1980</i> |
| | |
| | Austrroads Guidelines |
| | <i>Guide to Road Design</i> |
| <i>Part 3</i> | <i>Geometric Design</i> |
| <i>Part 5</i> | <i>Drainage – General and Hydrology Considerations</i> |
| <i>Part 5A</i> | <i>Drainage – Road Surface, Network, Basins and Subsurface</i> |
| <i>Part 5B</i> | <i>Drainage – Open Channels, Culverts and Floodways</i> |
| <i>Part 6B</i> | <i>Roadside Environment</i> |
| | |
| | Standards Australia Standards |
| <i>AS/NZS 2566</i> | <i>Buried Flexible Pipelines(Parts 1 and 2)</i> |
| <i>AS5100.1:2017</i> | <i>Bridge design Scope and general principles</i> |
| | |
| | Engineers Australia Guidelines |
| <i>ISBN 978-1-925848-36-6</i> | <i>Australian Rainfall and Runoff – A Guide to Flood Estimation</i> |
| | |
| | Tasmanian Government Policies and Strategies |
| | <i>State Policy on Water Quality Management, 1997</i> |
| | <i>State Stormwater Strategy 2010</i> |
| | <i>Soil and Water Management on Building Sites</i> |
| | <i>Water Sensitive Urban Design</i> https://www.derwentestuary.org.au/water-sensitive-urban-design/ |
| | |
| | State Growth Specifications - Standard Sections |
| <i>Section 619</i> | <i>Manufacture, testing and delivery of precast reinforced concrete box culverts</i> |
| <i>Section 701</i> | <i>Underground stormwater drains</i> |
| <i>Section 702</i> | <i>Subsurface Drainage</i> |
| <i>Section 703</i> | <i>General Concrete Paving</i> |
| <i>Section 705</i> | <i>Drainage Pits</i> |
| | |
| | State Growth Standard Drawings |
| | |
| | State Growth - Other |
| | <i>Site Stabilisation and Landscaping Guideline 2018</i> |
| | |
| | Other – International Erosion Control Association |
| | <i>Best Practice Erosion & Sediment Control, November 2008</i> |



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