

CHANGES TO DOCUMENTS: D5 STORMWATER DESIGN

D5 Stormwater Design

| 1 | Document order of priority included | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|----------------------|--------------|------------------------|------------------------|--|-----------|---------|-----------|---------|-------------------------------|-----|---|----|----|------------|-----|---|--------------|----|--|-----|---|---|-----------------|--|-----|---|---|-----------------|--|-----|---|---|----|--------------------------|-----|---|---|----|--|-----------------------|-----|---|----|----|---------------------------|-----|---|----|---|------------|--|----|---|------------------------|------------------------|--|----|---|----|----|
| 2 | Reference documents updated | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | D.05.04.01 I-F-D Data clause updated to accommodate for removal of design rainfall intensity graphs and tables. The assessment must be based on latitude and longitude of the location under design. Refer to www.bom.gov.au/water/designRainfalls . | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | <p>Design ARI <i>Table D05.04.01 Design Annual Exceedance Probabilities</i> updated with added columns for AEP.</p> <p>Table D05. Error! No text of specified style in document..1 - Design Annual Exceedance Probabilities</p> <table border="1"> <thead> <tr> <th rowspan="2">Development Category</th> <th colspan="2">Major System</th> <th colspan="2">Minor System</th> </tr> <tr> <th>ARI (yrs)</th> <th>AEP (%)</th> <th>ARI (yrs)</th> <th>AEP (%)</th> </tr> </thead> <tbody> <tr> <td>Central Business & Commercial</td> <td>100</td> <td>1</td> <td>10</td> <td>10</td> </tr> <tr> <td>Industrial</td> <td>100</td> <td>1</td> <td>5</td> <td>39</td> </tr> <tr> <td>Urban Residential (High Density – greater than 20 dwelling units/ha)</td> <td>100</td> <td>1</td> <td>5</td> <td>418</td> </tr> <tr> <td>Urban Residential (Low Density – 6 & up to 20 dwelling units/ha)</td> <td>100</td> <td>1</td> <td>5</td> <td>318</td> </tr> <tr> <td>Rural Residential – 2 to 5 dwelling units/ha</td> <td>100</td> <td>1</td> <td>2</td> <td>39</td> </tr> <tr> <td>Open Space – Parks, etc.</td> <td>100</td> <td>1</td> <td>1</td> <td>63</td> </tr> <tr> <td rowspan="2">Major Collector / Distributor and higher</td> <td>Kerb and channel flow</td> <td>100</td> <td>1</td> <td>10</td> <td>10</td> </tr> <tr> <td>Cross drainage (culverts)</td> <td>100</td> <td>1</td> <td>50</td> <td>2</td> </tr> <tr> <td rowspan="2">Minor road</td> <td>Kerb and channel flow [Note 5]</td> <td>20</td> <td>5</td> <td>Note 4</td> <td>Note 4</td> </tr> <tr> <td>Cross drainage (culverts) [Note 5]</td> <td>20</td> <td>5</td> <td>10</td> <td>10</td> </tr> </tbody> </table> | Development Category | Major System | | Minor System | | ARI (yrs) | AEP (%) | ARI (yrs) | AEP (%) | Central Business & Commercial | 100 | 1 | 10 | 10 | Industrial | 100 | 1 | 5 | 39 | Urban Residential (High Density – greater than 20 dwelling units/ha) | 100 | 1 | 5 | 4 18 | Urban Residential (Low Density – 6 & up to 20 dwelling units/ha) | 100 | 1 | 5 | 3 18 | Rural Residential – 2 to 5 dwelling units/ha | 100 | 1 | 2 | 39 | Open Space – Parks, etc. | 100 | 1 | 1 | 63 | Major Collector / Distributor and higher | Kerb and channel flow | 100 | 1 | 10 | 10 | Cross drainage (culverts) | 100 | 1 | 50 | 2 | Minor road | Kerb and channel flow [Note 5] | 20 | 5 | Note 4 | Note 4 | Cross drainage (culverts) [Note 5] | 20 | 5 | 10 | 10 |
| Development Category | Major System | | Minor System | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ARI (yrs) | AEP (%) | ARI (yrs) | AEP (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Central Business & Commercial | 100 | 1 | 10 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Industrial | 100 | 1 | 5 | 39 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Urban Residential (High Density – greater than 20 dwelling units/ha) | 100 | 1 | 5 | 4 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Urban Residential (Low Density – 6 & up to 20 dwelling units/ha) | 100 | 1 | 5 | 3 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rural Residential – 2 to 5 dwelling units/ha | 100 | 1 | 2 | 39 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Open Space – Parks, etc. | 100 | 1 | 1 | 63 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Major Collector / Distributor and higher | Kerb and channel flow | 100 | 1 | 10 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cross drainage (culverts) | 100 | 1 | 50 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Minor road | Kerb and channel flow [Note 5] | 20 | 5 | Note 4 | Note 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cross drainage (culverts) [Note 5] | 20 | 5 | 10 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | <p>Design ARI <i>Table D05.04.01 Design Annual Exceedance Probabilities</i> notes added:</p> <p>4. Council specific or refer to development category.</p> <p>5. VDg, flow depth and width limitations are applicable in accordance with QUDM.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | <p><i>D05.06.01 Rational Method</i> clause updated:</p> <p>D05.06.01. The Rational Method shall be used for regular shaped catchments and as long as requirements for QUDM are met. Where catchments are an irregular shape or run-off characteristics vary considerably within the catchment, partial area calculations may be required to determine peak flows to be used in design. Rational Method calculations to determine peak flows shall be carried out in accordance with QUDM.</p> <p>Rational Method</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | <p><i>D05.06.02 Qualified Person</i> clause updated to:</p> <p>D05.06.02. All calculations shall be carried out by a qualified person experienced in hydrologic and hydraulic design under the supervision of a Registered Professional Engineer of Queensland (RPEQ) experienced in this field.</p> <p>Qualified Person</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | <p><i>D05.06.03 Runoff Co-efficient</i> clause updated to:</p> <p>D05.06.03. Coefficients of discharge shall be calculated in accordance with QUDM. Unless agreed otherwise with the local Council, the following Table D05. 06.1 - Fraction Impervious for Development shall be used to determine C₁₀.</p> <p>Runoff Co-efficient</p> <p>& including a new table (<i>Table D05.06.01</i>) mentioned in the preceding clause:</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table D05.Error! No text of specified style in document..**02 - Fraction Impervious for Development Categories**

| Zones | Fraction Impervious |
|---|---------------------|
| Central business areas (including in the Principal centre zone and Major centre zone) | 1.00 |
| Industrial uses and other commercial uses (including in the District centre zone and Neighbourhood centre zone) | 0.90 |
| Significant paved areas (e.g. roads and car parks) | 0.90 |
| High Density Residential land uses (> 20 dwelling units per hectare) | |
| Townhouse type development | 0.80 |
| Multi-unit dwellings | 0.85 |
| High-rise residential development | 0.90 |
| Medium, Low-Medium, and Low density residential area (including roads) | |
| Average lot $\geq 750m^2$ | 0.60 |
| Average lot $\geq 600m^2 < 750m^2$ | 0.75 |
| Average lot $\geq 450m^2 < 600m^2$ | 0.80 |
| Average lot $\geq 300m^2 < 450m^2$ | 0.85 |
| Average lot $< 300m^2$ | 0.90 |
| Medium, Low-Medium, and Low density residential area (infill subdivision excluding roads) | |
| Average lot $\geq 750m^2$ | 0.55 |
| Average lot $\geq 600m^2 < 750m^2$ | 0.60 |
| Average lot $\geq 450m^2 < 600m^2$ | 0.65 |
| Average lot $\geq 300m^2 < 450m^2$ | 0.75 |
| Average lot $< 300m^2$ | 0.80 |
| Rural/ environmental protection areas (2-5 dwellings per ha) | 0.20 |
| Open space areas (e.g. parks with predominately vegetated surfaces) | 0.20 |

- 9 D05.06.06 clause added for time concentration:
~~D05.06.06.~~ The minimum time of concentration shall be 5 minutes for any catchment to its point of entry into the drainage network.

- 10 Clause for the *Overland Flow Retardance* is corrected to be *Manning's 'n'* and updated for QUDM reference.
~~D05.06.08.~~ Mannings 'n' surface roughness co-efficient ~~in accordance with~~ *Manning's 'n'* QUDM shall ~~generally~~ be derived from information contained in ~~in Chapter 14 of AR&R 1987.~~ QUDM.

- 11 **New Table D05.** Error! No text of specified style in document..**3 for Approved computerised Modelling Packages**

- 12 D05.07.01 Qualified Person for Hydraulics have been updated to include RPEQ supervision

- 13 Note QUDM edition 2 still referenced. QUDM issue 4 is under consideration for incorporation into CMDG.

- 14 Clause D05.07.05 for Water Surface Limits amended so the pits are *no higher than 0.15 metres, below the gutter invert for inlet pits and 0.150m below the underside of the lid for junction pits.*

- 15 D05.08.03 Maximum Conduit Size clause added:
~~D05.08.03.~~ Maximum ~~conduit~~culvert ~~size~~depth/diameter to be located beneath the kerb alignment is 600mm. ~~Conduits~~Culverts above this size are required to be located within the road carriageway.

- 16 D05.08.05 Maximum Compaction Loadings clauses added:

| | | |
|-----|--|---|
| | <p>D05.08.05. Maximum construction loads for each compaction layer of stormwater trench must be nominated and included on design (Intended to avoid cracking of concrete structures).</p> | <p>Maximum Compaction Loadings</p> |
| 17 | <p>Clause D05.08.06 Clearance updated to include sewer.</p> <p>D05.08.06. The minimum vertical and vertical and horizontal clearance between stormwater conduits culverts and other services is to be 0.3m except for sewer that requires 0.3m and 0.6m respectively. except sewer main shall be 0.2150m. The minimum vertical and horizontal clearance between stormwater conduits and sewer main shall be 0.6m and 0.3m respectively.</p> | |
| 18 | <p>Clause D05.09.03 has approved C-M Concrete Products and other alternative products, but no longer are Drainways automatically approved</p> <p>D05.09.03. Gully inlets shall be local authority approved proprietary inlet structures. Current approved products are stormwater gully inlet from "C-M Concrete Products —Pits" and "Drainways"". Alternative products may can be utilised subject to are by approval by the Local Government Authority approval. </p> | |
| 19 | <p>Clause D05.09.05 has information regarding capacity charts removed.</p> <p>D05.09.05. Inflow capacities shall be in accordance with the manufacturer's specifications with Blockage Factor applied in accordance with QUDM. Where manufacturer's specification for inflow capacity is not available, Gully Inlet Capacity Charts published by Brisbane City Council can may be used. Section 7.05.</p> | |
| 20 | <p>Clause regarding safety fencing is added:</p> <p>Safety fencing shall be provided at dangerous sections in accordance with CMDG specification and standard drawings, and QUDM, AS 1926.1, and AS 1926.2. Fence height of 1.2m is considered to be appropriate.</p> | |
| 211 | <p>Clauses for Major Structures deleted D05.12.01 Afflux and amended to suit Major and Minor Structures:</p> <p>D05.12.01. Refer to D3 STRUCTURES & BRIDGE DESIGN for the requirements on stormwater drainage design in relation to these structures.</p> | <p>Major and Minor Structures</p> |
| 22 | <p>Clauses D05.12.02-05 have been deleted.</p> <p>For bridges a minimum clearance of 0.5m shall be maintained between the designed ARI flood level at an appropriate AEP and the underside of the lowest part of bridge superstructure in order to any major structure superstructure is required to allow for passage of debris without blockingage.</p> <p>All bridges shall be designed for impact from debris loading and debris loading for a maximum probability flood event</p> <p>Hydraulic and structural design of bridges, culverts, and relevant structures shall be carried out under supervision of RPEQ experienced in the relevant field. Certification from RPEQ experienced in the relevant field for the design works is required to be submitted to Council. ed structural design shall be required on bridges and other major culvert structures and may be required on some specialised structures. Structural design shall be carried out in accordance with AS 5100 set and Austroads USTROADS Guide to Bridge Technology Bridge Design Code.</p> | <p>Freeboard</p> <p>Bridges</p> |

22 Section D04.14 amended to be D04.13 Water Sensitive Urban Design (WSUD) with new clauses as follows:

Water Sensitive Urban Design (WSUD) shall be implemented in accordance with the respective Council's Planning Scheme and/or policy.

D05.13.02 Design guidelines for implementing WSUD shall be in accordance with Australian Runoff Quality: Guide to Water Sensitive Urban Design by Engineers Australia and Water Sensitive Urban Design: Healthy Waterways WSUD Technical Design and Bioretention Technical Design Guidelines.

Design Guidelines

D05.13.03 Bioretention Basins shall be designed in accordance with Bioretention Technical Design Guidelines by Healthy Waterways.

Bioretention Basin Design

D05.13.04 Plants species for a bioretention basin shall be selected in accordance with Table D05.22.1 to Table D05.22.5 of Appendix D05A, Bioretention Technical Design Guidelines and WSUD Technical Design Guidelines for South East Queensland by Healthy Waterways. Climatic regions are in accordance with State Planning Policy Interactive Mapping System, Department of Infrastructure, Local Government and Planning (known as SPP Interactive Mapping System), and Climate Classification of Australia (Köppen maps), BOM. Table D05.13.01 provides climatic region in accordance with SPP Interactive Mapping System for participating local government areas. For lists of plants, refer to Appendix D05A.

Plant Species

Table D05.13.01: Climatic Regions for Local Government Areas

| Local Government | Climatic Region |
|-----------------------------------|--|
| Banana Shire Council | Western Queensland |
| Central Highland Regional Council | Western Queensland |
| Gladstone Regional Council | Central Coast (South) |
| Livingstone Shire Council | Central Coast (South) and Western Queensland |
| Maranoa Regional Council | Western Queensland |
| Rockhampton Regional Council | Central Coast (South) and Western Queensland |

Table D05.13.02: Correlation between Climatic Regions

| Climatic Region in accordance with SPP Interactive Mapping System | Equivalent Climatic Region Köppen maps in accordance with Bureau of Meteorology | Regions as specified in Bioretention Technical Design Guidelines, v1.1 by Water by Design |
|---|---|---|
| South East Queensland | Subtropical | Subtropical (ST) |
| Central Queensland (North) | Subtropical | Subtropical (ST) |
| Central Queensland (South) | Subtropical | Subtropical (ST) |
| Dry Tropics | Tropical | Dry Tropics (DT) |
| Wet Tropics | Tropical | Wet Tropics (DT) |
| Cape York / Far North Queensland | Equatorial | Wet Tropics (WT) |
| Western Queensland | Grassland and Desert | Arid (A) |

- D05.13.05. Detention and Retarding Basins shall be designed in accordance with QUDM, Austrroads Guide to Road Design - Part 5A.
- D05.13.06. For all Stormwater Quality Improvement Devices (SQID), RPEQ certifications are required to be provided to Council for design, construction, and stormwater quality compliance.

D05.13.07. The Manufacturer's supplied maintenance plan for proprietary devices (~~e.g. Gross Pollutant Traps, Stormceptor, Humeceptor etc.~~) and/or RPEQ certified maintenance plan (~~e.g. Bioretention, Retention, and Detention Basin etc.~~) for vegetated devices shall be submitted to Council.

- D05.13.08. Approved information signage shall be installed for all Stormwater Quality improvement Devices. Signage shall be educative and shall focus on habituated created and local habitat. Signage strategies should consider following key issues:
 - Signage should be kept simple and easy to understand for general people.
 - Location of signage should be selected such that it attracts people attentions;
 - Location of signage should be at key areas requiring interpretation
 - Signage materials need to be low maintenance and durable, resistant to UV and graffiti and easily installed.

D05.14

23 Clause D01.15.01 Lawful Point of Discharge amended to add in various reserves and controlled land conditions:

~~D05.15.01.~~ All discharge points from developments are required to be a Lawful Point of Discharge (LPOD) ~~at all discharge points.~~ A Lawful Point of Discharge shall be determined in accordance with the ~~Two Point Test~~ two-point test as specified in QUDM. Lawful points of discharge shall ~~generally~~ be located in ~~one or more than one of~~ the following locations:

- ~~Road Reserve: Local Authority owned stormwater infrastructure within a dedicated road reserve. (i.e. kerb and channel, table drain, road side gully);~~
- ~~Drainage reserve/Drainage Easement: Local or State Authority owned stormwater infrastructure within a dedicated drainage reserve or easement (i.e. field inlet, open channel, swale drain); and~~
- ~~Council controlled land: Council controlled land where there is stormwater infrastructure within the Council controlled land.~~

Lawful point of discharge.

24 Figure and new clauses added for drainage easements. Clause D05.16.02:

D05.16.02. Inter allotment drainage shall be provided where lands are developed such that **Drainage Easements**

- lots do not drain to Council infrastructure(s),
- developing lands are located at the higher side and lower side is developed prior to higher side. Refer to figure D05.15.01 as an illustration:



D06.03.54.D06.01.01. Figure: D05.15.01: Higher Side Development

- Developing lands are located at the lower and higher side is developed prior to lower side. Refer to figure D05.15.02 as an illustration: two choices either connect upstream existing roofwater to new pipe (level II) OR INSTALL LEVEL III DRAINAGE.

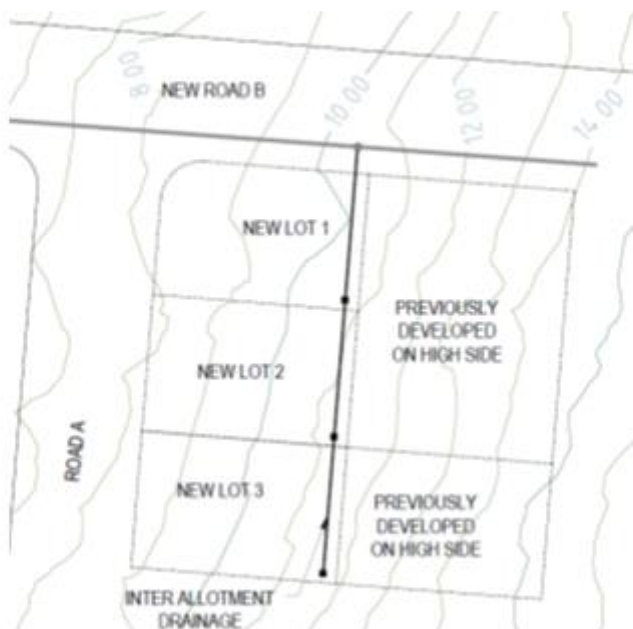


Figure: D05.15.01: Lower Side Development

25 Table D05.16.02 Inter Allotment Drainage Easements has new note added to the Easement Widths:
¹ Easement widths mentioned in the above table are the minimum, as a wider easement may be required for larger drainage infrastructure, additional services, and for ease of maintenance.

26 Clause for Allotment Drainage for Sewer D05.16.07 has the minimum horizontal clear distance from 0.75m to 0.60m.