PLANNING SCHEME POLICY

STORMWATER DRAINAGE DESIGN

Mackay Region
PLANNING SCHEME

Mackay REGIONAL COUNCIL

Planning scheme policy – stormwater drainage design

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Amendment history

This planning scheme policy commenced on 24 July 2017 as part of the Mackay Region Planning Scheme 2017. Amendments since this date are listed in the below table.

Version number	Amendment title	Summary of amendment	Date adopted and commenced
1.0	Planning scheme administrative amendment 6, and Planning scheme policy administrative amendment 1	This amendment removed the planning scheme policies from Schedule 6 of the Mackay Region Planning Scheme 2017 and placed them in individual PDFs on Council's website. This amendment introduced standardised formatting, introductory sections and explanatory information regarding intent and legislative relationship for this planning scheme policy. It also updated numbering and cross references.	Adopted 11 December 2019 Commenced 3 February 2020

1 Introduction

1.1 Application

This planning scheme policy supports the Mackay Region Planning Scheme 2017 by providing information on: how to achieve compliance with assessment benchmarks; supporting information/studies required; and/or actions required under the development assessment process. This planning scheme policy has been made by Mackay Regional Council in accordance with Chapter 2, Part 3, Division 2 of the *Planning Act 2016*.

1.2 Relationship with planning scheme

Mackay Region Planning Scheme 2017 refers to this planning scheme policy in assessment benchmarks in the following code/s or any other relevant part of the scheme:

(a) Table 9.4.1.3.A – General development requirements code

1.3 Purpose

The purpose of this planning scheme policy is to:

1. Set out the guidelines for the design of stormwater drainage systems for urban and rural areas.
2. Ensure stormwater drainage is designed to:
   (a) provide a drainage system that will collect and convey stormwater from a catchment to its receiving waters with minimal nuisance, danger or damage and at a financial and environmental cost that is acceptable to the community as a whole;
   (b) limit flooding of public and private property, both within the catchment and downstream, to acceptable levels; and
   (c) provide convenience and safety for pedestrians and traffic in frequent stormwater flows by controlling those flows within prescribed velocity/depth limits.

For new developments, the engineer shall design a stormwater drainage system in accordance with the "major/minor" system concept in accordance with Queensland Urban Design Manual (QUDM). That is, the "major" system shall provide safe, well-defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events.

For redevelopment areas, the on-site drainage system is to be designed in such a way that the estimated peak flow rate from the site for the design Average Exceedance Probability of the receiving minor system is no greater than which would be expected from the existing development. Further, it is not to be concentrated in such a way as to cause nuisance to downstream properties.

1.4 Referenced documents

(a) Council guidelines and specifications:
- (i) Construction standard C220 – Stormwater drainage – general
- (ii) Construction standard C221 – Pipe drainage
- (iii) Construction standard C222 – Precast box culverts
- (iv) Construction standard C223 – Drainage structures
- (v) Construction standard C224 – Open drains including and kerb and gutter
- (vi) Standard drawings – various
- (vii) Council policy MW16 – Clearances to water and sewerage assets

(b) Australian Standards:
- (i) AS1254 – Unplasticised PVC (uPVC) pipes and fittings for stormwater or surface water applications
- (ii) AS2032 – Code of practice for installation of uPVC pipe systems
- (iii) AS/NZS2566.1 – Buried flexible pipelines, structural design
- (iv) AS3725 – Loads on buried concrete pipes
- (v) AS4058 – Precast concrete pipes
- (vi) AS4139 – Fibre reinforced concrete pipes and fittings

(c) Queensland legislation:
- (i) *Local Government Act 2009*
- (ii) *Sustainable Planning Act 2009*

(d) Queensland authorities:
- (i) Department of Natural Resources, Brisbane City Council and IMEAQ (1993) *Queensland Urban Drainage Manual, Volumes 1 and 2*
- (ii) Department of Community Safety (2003) *State Planning Policy 1/03, Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*
- (iii) Department of Transport and Main Roads (2002) *Road Drainage Design Manual*

(e) Other:
- (i) Argue J, *Australian Road Research Board Special Report 34, Stormwater drainage design in small urban catchments: a handbook for Australian practice*
- (ii) Australian National Conference on Large Dams, Leederville WA (1986) *Guidelines on design floods for dams*
- (iii) AustRoads, *Bridge design code*
- (iv) Chow, Ven Te (1959) *Open channel hydraulics*
- (v) Concrete Pipe Association of Australia, *Concrete Pipe Guide, charts for the selection of concrete pipe to suit varying conditions*
- (vi) Hare, C.M., (1983) *Magnitude of Hydraulic Losses at Junctions in Piped Drainage Systems*, Institute of Engineers Australia
- (vii) Henderson F.M. (1966) *Open channel flow*
- (viii) Institute of Engineers Australia (1997) *Australian rainfall and runoff, a guide to flood estimation (ARR)*
- (ix) Sangster, W.M., Wood, H.W., Smerdon, E.T., and Bossy, H.G. (1958) *Pressure changes at storm drain junction, engineering series, Bulletin No. 41, Engineering Experiment Station*, University of Missouri

(f) Council documents:
  (i) Various stormwater drainage studies, catchment management plans and waterway management plans

1.5 General

A suitable qualified and experienced professional engineer (RPEQ) shall undertake or oversee all aspects of the drainage design. The design shall comply with all relevant requirements of:

(a) this planning scheme policy;

(b) all Reference and Source Documents listed in section 14;

(c) any Development Approval conditions relevant to the design;

(d) any specific relevant and reasonable request provided by Council in writing.

The RPEQ shall sign all plans associated with the drainage, certifying that the design complies with this section.

The Queensland Urban Drainage Manual (QUDM) shall be the basis for design of stormwater drainage except where amended by this Guideline.

The engineer shall ensure that Council's requirements relating to stormwater quality management, erosion and sediment control and acid sulphate soils are provided for in the stormwater design.

These requirements are detailed in Council's Soil and Water Quality Management guideline. Council has had prepared, or are in the process of producing, drainage studies for a number of particular catchments. Where a drainage study does not exist, the developer will be required to prepare a drainage study for Council approval prior to the lodgement of any development application.

The drainage study will act as a master plan for determining the drainage system and contributions for the development. The cost of the drainage plan shall be credited against drainage contributions required.

The design of the stormwater drainage system for any development shall be such that it caters for:

(a) that upstream drainage / properties are not adversely affected;

(b) that the downstream drainage system is capable of adequately catering for the discharge of the modified flow produced as a result of the development;

(c) it is consistent with any relevant drainage study or catchment and waterway management plan; and

(d) is based on the premise of peak load reduction by the use of suitable detention or infiltration methods.

If the downstream system is not capable of carrying the modified discharge, the engineer shall indicate the measure proposed to ensure the downstream system is capable of carrying the modified discharge. This will involve negotiation with adjoining landowners to produce easements over downstream drainage paths from the development site to the legal point of discharge.

Alternatively, where a development will result in increased runoff, the stormwater drainage system may include on-site measures such as detention basins to ensure that the peak discharge from the development area is restricted to a level no greater than that discharging prior to the development.

All works proposed within creeks and natural watercourse must have the approval of all relevant authorities prior to commencing the work and evidence of such approvals shall be provided with the design submission.

The design of the stormwater drainage system shall accommodate the future developed peak flows from upstream catchments on the basis of potential development in accordance with the Planning Scheme.

The engineer shall be responsible for assessing the existing and future developed flow regime entering the development site from upstream catchments and shall provide detailed calculations with the design submission.

Unless approved otherwise by the Council, piped drainage systems shall extend to the lawful point of discharge, with inlet works within the subject property.

2 Design, construction and other criteria

2.1 Hydrology

2.1.1 Design rainfall data

Council shall provide the design rainfall Intensity–Frequency–Duration (IFD) relationship data, for the particular catchment under consideration, upon request.

The nine basic parameters read from Maps 1–9 in Volume 2 of ARR shall be shown in the calculations submitted to Council, except where the Bureau of Meteorology provides a polynomial relationship for the catchment.

The design Annual Exceedance Probability (including climate change factor) is 1%.

For in-fill development and reconstruction works within existing developed areas, Council may vary the design Annual Exceedance Probability to be compatible with existing conditions. Where Council approves a lower Annual Exceedance Probability for in-fill development it will not be less than 50 years.

For minor events, the Annual Exceedance Probability depends on the zoning of the land being serviced by the drainage system. The minor system design Annual Exceedance Probability shall be:

(a) open space – 1 Exceedance per year

(b) residential – 18.13% Annual Exceedance Probability (former 5 year ARI)

(c) commercial – 18.13% Annual Exceedance Probability (former 5 year ARI)

(d) industrial – 18.13% Annual Exceedance Probability (former 5 year ARI)

(e) rural residential – 18.13% Annual Exceedance Probability (former 5 year ARI)

(f) central business – 7.5% Annual Exceedance Probability (former 15 year ARI)

For Cross-drainage requirements, refer to Table 5.06.01 in QUDM. Please note, a “Major” road, as defined in QUDM, is considered as a “Major Collector” road, and higher classifications, in Council’s Road Hierarchy Plan.

Where a development is designed in such a way that the major system flows involves surcharge across private property, then the underground system (both pipe and inlets) shall be designed to allow the collection and containment of flows having a 1% Annual Exceedance Probability (including climate change factor) flood event from the upstream catchment within an easement in the private property.

A surcharge path shall be defined for systems even where 1% Annual Exceedance Probability (including climate change factor) flows can be maintained within the underground system. Easements shall be provided in private property over pipe systems and surcharge paths.

2.1.2 Catchment area

The catchment area of any point is defined by the limits from where surface runoff will make its way, either by natural or man-made paths, to this point. Consideration shall be given to likely changes to individual catchment areas due to the development of the catchment.

The catchment boundary shall be determined by using the most accurate information available subject to such information being acceptable to Council as appropriate. This shall be presented to Council in a contour map along with the source of information.

Catchment area land use shall be based on current available zoning information or proposed future zonings, where applicable.

Catchment plans shall be produced to reflect both the minor and major event catchments.

2.1.3 Rational method

Rational Method calculations to determine peak flows shall be carried out in accordance with QUDM Section 5.02.

A suitably qualified and experienced professional engineer (who shall be an RPEQ), using the approach outlined in this Guideline shall undertake or oversee all hydrologic calculations.

Co-efficients of Run-off shall be calculated in accordance with QUDM.

Details of percentage impervious for specific locations and for individual zonings shall be based on those stated in Council's *PSP 16.04 Stormwater Trunk Infrastructure Contributions Policy*.

The time of concentration of a catchment is to be determined in accordance with QUDM Section 5.05. For smaller urban catchments, standard inlet times in accordance with QUDM Table 5.05.1 are to be adopted unless otherwise agreed or directed by Council.

The maximum time of concentration, to the first inlet pit, in an urban area is to be 20 minutes unless sufficient evidence is provided to justify a greater time.

Where the flow path is through areas having different flow characteristics or includes property and roadway, then the flow time of each portion of the flow path shall be calculated separately.

Where it is deemed more appropriate to determine the time of concentration for a particular area, flow paths to pits shall be representative of the fully developed catchment. The engineer shall consider such things as fencing and the likely locations of buildings with the flow path shown for each collection pit on the catchment area plan. Consideration shall be given to likely changes to individual flow paths due to the full development of the catchment.

Surface roughness coefficients "n" in the kinetic wave equation is to be in accordance with QUDM Section 5.05. Note that the surface roughness / retardance co-efficient "n" referred to in QUDM is not the same as Manning's "n" value for surface roughness.

2.1.4 Other hydraulic models

The use of hydrological models may be used as long as the requirements of ARR and QUDM are met.

Where computer analysis programs are used, copies of the final data files and details of all calculations shall be provided on submission of the design to Council along with the final drawings.

2.2 Hydraulics

2.2.1 Hydraulic grade line

A suitably qualified and experienced professional engineer (who shall be an RPEQ), using the approach outlined in this Guideline shall undertake or oversee all hydraulic designs.

The calculations shall substantiate the hydraulic grade line adopted for design of the system shown on the drawings.

The criteria for determining the downstream water surface level are given below:

(a) known hydraulic grade line level from downstream calculations including pit losses at the starting pit in the design event;

(b) where the downstream starting point is a pit and the hydraulic grade line is unknown, a level of 0.15m below the invert of the downstream pit inlet is to be adopted;

(c) where the outlet is tidal or into other waterways the engineer shall refer to section 7.0 of QUDM;

(d) where the outlet is an open channel or natural watercourse and the design storm is the major event and the downstream flood levels are not known the top of the outlet pipe shall be the downstream control; and

(e) where the outlet is an open channel or natural watercourse, the design storm is the major event and downstream flood levels are known, the downstream control shall be the major event flood level.

The engineer shall take into consideration the following requirements during major flood events with regard to the road inundation depth:

(a) maximum depth of inundation at the kerb & channel lip to be limited to 300mm, based on the local catchment; and

(b) where the road reserve is adjacent to a trunk drain (as advised by Council) the road shall be graded such that the maximum water level from a Q100 event is to be less than 75mm at the kerb and channel lip.

The water surface in drainage pits shall be limited to 150mm below the kerb and channel invert for inlet pits and 150mm below the underside of the lid for junction pits.

In addition detailed calculations shall be provided to substantiate compliance in relation to:

(a) depth of flow criteria in relation to surcharging of major system flows;

(b) flow velocities to ensure vehicle / pedestrian safety; and

(c) road reserve inundation depths.

2.2.2 Minor system criteria

The acceptable channel flow widths shall be in accordance with section 5.09 pf QUDM unless otherwise agreed by Council.

Minimum conduit sizes shall be as follows:

(a) pipes – 375mm diameter (under roads/streets); and

(b) box culverts – 600mm wide x 300mm high

Minimum and maximum velocity of flow in stormwater pipelines shall be in accordance with section 5.16 of QUDM.

2.2.3 Pits

Inlet Pits shall be spaced so that the channel flow width is limited in accordance with sub-clause 5.09.1 and so that the inlet efficiency is not affected by adjacent inlet openings. Preference is to be given to the location of drainage pits being centred opposite the side boundaries or centre of an allotment.

Other pits shall be provided:

(a) to enable access for maintenance;

(b) at changes in direction, grade, level or class of pipe; and

(c) at junctions.

The maximum recommended spacing of pits where flow widths are not crucial is given in section 5.11.1 of QUDM.

Kerb inlet sections to gully pits are to be a preferred maximum of 2 number.

Information on pit capacities is available in the following sources:

(a) Queensland Urban Drainage Manual (QUDM);

(b) pit relationships given in Volume 1, Chapter 14 or ARR; and

(c) pit manufacturer's charts.

The engineer is able to assume that Mackay Regional Council (MRC) Standard gully pit has the same inlet capacity as a Bro Pit, but with no trough.

The engineer shall make allowance for a potential blockage as per the requirements of section of 5.10.2 of QUDM.

2.2.4 Hydraulic losses

The pressure change co-efficient “Ke” shall be determined from the appropriate charts given in QUDM.

Allowable reduction in “Ke” due to benching is given in QUDM.

Construction of a junction without a structure should be avoided where possible. Permission to do this is required by Council prior to detailed design. Where this is unavoidable, the pressure change co-efficients Ku, for the upstream pipe and Kl, for the lateral pipe, shall be determined from the charts given in QUDM Volume 2.

Going from larger upstream to small downstream conduits is to be in accordance with section 5.11.4 of QUDM.

2.2.5 Major system criteria

Surcharging of drainage systems which would provide for water depth in excess of the top of kerb will not be permitted except where the requirements of table 5.08.1 of QUDM are met.

The velocity x depth product of flow across the footpath and within the road reserve shall be such that safety of children and vehicles is considered. The maximum allowable depth of water within the road reserve, at the lip of the kerb and channel, is 0.3 metres and the maximum velocity x depth product of $0.4m^2/s$ is permitted. Where the safety of only vehicles can be affected, a maximum velocity x depth product of $0.6m^2/s$ is permitted. In open channels, the above velocity x depth product criteria will generally be followed or the engineer shall address the requirements for safety in relation to children by providing safe egress points from the channel or other appropriate methods.

Major storm flows in new developments shall be in accordance with section 5.09 of QUDM. In situations where allotments do not drain toward the new road frontage, the depth of the major storm flow shall not extend above the top of the roadway kerb. Roadway flow capacity shall be determined in accordance with section 5.09.2 of QUDM.

2.2.6 Open channels

Generally, open channels will only be permitted where they form part of the trunk drainage system and shall be designed to have smooth transitions with adequate access provisions for maintenance and cleaning. Where Council permits the use of an open channel to convey flows from a development site to the receiving water body, such channel shall comply with the requirements of this planning scheme policy.

The design of open channels shall be in accordance with Volume 1, Chapter 14, of ARR, Section 8 of QUDM. Council is also supportive of the approach adopted in the *Natural Channel Design Guidelines* published by Brisbane City Council.

Open channels will be designed to contain the major system flow less any flow that is contained in the minor system, with an appropriate allowance for blockage of the minor system.
Mannings “n” Roughness Co-efficients for open channels shall generally be derived from information in Chapter 14 of ARR.

Friction losses applicable to specific open channel types shall generally be determined using Mannings “n” values given below:

(a) concrete pipes of box sections – 0.013

(b) concrete (trowel finish) – 0.014

(c) concrete (formed without finishing) – 0.016

(d) sprayed concrete – 0.018

(e) bitumen seal – 0.018

(f) bricks or pavers – 0.015

(g) pitchers or dressed stone on mortar – 0.016

(h) rubble masonry or random stone in mortar – 0.028

(i) rock lining or rip-rap – 0.028

(j) corrugated metal – 0.027

(k) earth (clear) – 0.022

(l) earth (with weeds and gravel) – 0.028

(m) rock cut – 0.038

(n) short grass – 0.033

(o) long grass – 0.043

Where the product of average velocity and average flow depth for the design flow rates is greater than $0.4m^2/s$, the design will be required to be in accordance with Volume 1, Chapter 14, of ARR to specifically provide for safety.

Side slopes on grassed lined open channels are to be as shown in Council's standard drawing. Channel inverts are generally to have minimum cross slopes of 1 in 20.

The clearance between the top of the side slope batter and the boundary of the reserve, or easement, shall be an absolute minimum of 1.0m as shown on Council's standard drawings.

The preferred solutions for open channel treatments are natural treatments including the use of river rock lining, vegetation treatments, bio-retention systems or other soft engineering solutions.

Low flow provisions in open channels (man-made or altered channels) will require low flows to be contained within a pipe system or concrete lined channel section at the invert of the main channel. Sub-surface drainage is to be provided in grass lined channels to prevent waterlogging of the channel bed.

Transitions in channel slopes are to be designed to avoid or accommodate any hydraulic jumps due to the nature of the transition.

Energy losses associated with channel transitions and channel bends shall be determined in accordance with section 8.05 or QUDM.

2.2.7 Major structures

All major structures in urban areas, including bridges and culverts with a total waterway area greater than $3m^2$ shall be designed for the 1% Annual Exceedance Probability (including climate change factor) storm event.

A minimum clearance of 75mm in urban catchments and 300mm in rural catchments is required to allow for passage of debris without blockage between the 1% Annual Exceedance Probability (including climate change factor) flood level and the underside of any major structure superstructure, unless otherwise approved by Council. The engineer is required to liaise with Council where the proposed major structure is located in an urban area, and likely to be of piped construction, to discuss the need to provide debris clearance (to minimise the impact of flooding adjacent to the structure) and the desire to provide hydraulic efficiency in the design.

Certified structural design shall be required on bridges, major culverts and some specialised structures. Structural design shall be carried out in accordance with the Guidelines D3- *Structures / Bridge Design*.

Culverts (either pipe or box section) shall be designed in accordance with Queensland Department of Main Roads Road Drainage Design Manual, with due regard being given to inlet and exit losses, inlet and outlet control and scour protection.
Major structures, such as bridges and culverts, need to be considered by the designer as possible routes for fauna movements and where appropriate catered for in the design.

2.3 Stormwater detention – detention basins

Detention Basins may be provided as part of the drainage solution to limit the post development discharge to pre-development levels. Any proposed detention basin must be in conformity with Council's drainage strategy for the area and shall be designed in accordance with Section 6 of QUDM.

Minimum floor levels of dwellings adjacent to the detention basin shall be 0.3m above the 1% Annual Exceedance Probability (including climate change factor) flood level in the basin.

Installation of stormwater detention may be required on sites where the existing downstream drainage system is under capacity, or where large increases from pre-development flows are likely.

The storm duration for the design flood downstream of the detention basin is likely to be longer than without the basin. A graph showing the range of peak flood levels in the basin and peak discharges from the basin shall be provided for the storms examined.

Detention Basins shall be designed with the following characteristics:

(a) The peak discharge resulting from a storm having an average recurrence interval of 1% Annual Exceedance Probability (including climate change factor) on the fully developed catchment shall be attenuated. The extent of attenuation will be such that the peak discharge from the detention basis is equal to, or less than, the peak discharge produced from the undeveloped catchment by a storm of 1% Annual Exceedance Probability (including climate change factor). In addition the minor system Annual Exceedance Probability event shall be assessed to ensure downstream drainage systems can contain these flows. Where downstream easements are not in place the developer shall be responsible for obtaining such easements as is required to contain discharges in all events; and

(b) Alternatively the detention basin may be designed to alternate peak discharges from both minor system recurrence interval and 1% Annual Exceedance Probability (including climate change factor) recurrence interval events such that this discharge is equal to, or less than, the peak discharge produced from the undeveloped catchment for both the minor system recurrence interval and 1% Annual Exceedance Probability (including climate change factor) events.

The designer of the detention basin shall check its performance during floods resulting from the probable maximum precipitation to ensure that sudden catastrophic failure will not occur.

The engineer shall also check that the flow paths in excess of the design discharge are provided at locations where public safety will not be endangered.

The engineer shall consider the incorporation of a number of public safety measure in the design of the detention basin. The measures will be site-specific but may include:

(a) warning notices;

(b) fencing off the basin;

(c) depth gauges;

(d) child-proofing access to inlet structures, gully pits and manholes; and

(e) having due consideration for the probable maximum discharge and the safe conveyance of this flow through downstream properties.

Without limiting the approach taken by the engineer, Council will give due regard for the need to incorporate appropriate and specific safety measures in the design of the detention basin when considering its approval.

Unless prior separate approval has been given, any detention basin floor shall be graded to ensure it is self-draining.

The developer may propose that part of the detention basin is to be contributed to Council's part of their open space contribution. Prior to seeking any ‘credits’, the engineer should check that the circumstances proposed comply with the Planning Scheme Policy.

Any ‘credits’ for public open space contribution shall be at the sole discretion of Council.

2.4 Interallotment drainage

Interallotment Drainage shall be provided for every allotment in urban environments that does not drain directly to its frontage. Such drainage shall be designed to conform to Council’s standard drawing.

Interallotment drainage shall be contained within an easement as detailed in Council’s standard drawing. The easement shall be in favour of Council.

The interallotment drain shall be designed in accordance with Section 5.18 of QUDM to accept concentrated drainage from buildings and paved areas on each allotment. The engineer shall adopt Level III as the basis of the design for the roof and allotment drainage system – refer to Fig. 5.18c of QUDM.

The minimum pipe size for interallotment drainage shall be 225mm diameter.

Pipes installed as part of the interallotment drainage shall have a minimum longitudinal gradient of 0.2%.

The interallotment piped drain shall be constructed from rubber ring jointed pipes of either fibre reinforced concrete drainage pipe, reinforced concrete pipe, or uPVC pipe and shall conform respectively to the requirements of AS 4139, AS 4058 and AS 1254. In public road and recreation reserves where vehicle loads may be encountered, reinforced concrete and fibre-reinforced pipe shall be used. Should the Designer wish to propose an alternate material type, then separate Council approval must be obtained. Approval will only be given following satisfactory demonstration that the proposed alternate material will meet the performance requirements with regard to design and installation.

Interallotment drainage pits shall be located at all changes of direction. Pits shall be constructed in accordance with the Standard Drawing.

Where interallotment drainage and sewer mains are laid adjacent to each other they are to be spaced as specified in Council's standard drawing.

Where sewer mains are within 2 metres to interallotment drainage lines, they shall be shown on the interallotment drainage drawing.

2.5 Roof / allotment drainage

All roof drainage is to be conveyed to the underground drainage system.

The stormwater drainage system is to allow for underground drainage connections from the following:

(a) multi-unit developments on allotments greater than 900m^2;

(b) commercial developments;

(c) industrial developments; and

(d) other significant developments as determined by Council.

These connections are to be provided with an appropriately sized and located stub pipe extending at least 1m into the property. The designer shall provide for a minimum 600mm x 600mm drainage pit inside the private property at the end of the stub pipe.

The street inlet design capacity shall not account for the direct drainage connections.

Allotments including those adjoining drainage or park reserves are required to drain to the road frontage, unless otherwise approved.

Where allotments do not drain to the road frontage, allotment drainage shall be provided in accordance with Council's standard drawing. The outlet discharge point shall be as approved by Council.

Roof drainage outlets shall be provided on each side of the allotments, between 0.5m and 1.5m from the side boundary. The outlet shall include an approved kerb adaptor and pipe extending 1.0m into the property. Connections to the underground system shall be undertaken on the most elevated side of lots with one-way crossfall.

Where the underground drainage system is to be extended to provide a lawful point of discharge for 1-2 lots, then the designer shall provide for a 600mm x 600mm drainage pit inside the private property at the end of the stub pipe.

The stub drainage pipe shall be a minimum diameter of 225mm and the pipe invert shall be suitable to allow for the future installation of an upstream Gross Pollutant Trap (GPT), if considered appropriate.

2.6 Detailed design – conduits

The engineer shall specify the material type to be used in the conduit for the underground drainage system. The material type shall be either:

(a) precast reinforced concrete pipes complying with AS 4058;

(b) fibre reinforced concrete pipes complying with AS 4139;

(c) steel pipe and steel arches complying with AS 2041, AS 1761, AS 1762 or AS 3703 as appropriate; and

(d) UPVC pipes complying with AS 1254.

Alternate pipe material subject to satisfactory demonstration that the proposed alternate material will meet the performance requirements with regard to design and installation.

Conduits shall be designed to take into accordance requirements detailed in the Construction Specification C221 – Pipe Drainage.

Flexible pipes (PE and PP types) complying with AS 5065 are suitable for use in interallotment drainage, or in drainage reserves, where the conduit will be subject to infrequent and light traffic use.

The engineer shall ensure that any proposed use of flexible pipes confirms with the requirements of AS 2566 and Construction Specification C222 - *Pipe Drainage*.

If the engineer proposes to use reinforced concrete pipes in areas where any part of the pipe is below the potential acid sulphate zone, then the pipes shall be specified to have acid sulphate cover and the appropriate type of cement, unless otherwise approved by Council.

If the engineer proposes to use reinforced concrete pipes in areas where any part of the pipe is below the Highest Astronomical Tide (HAT), then pipes shall have saltwater cover to reinforcement, unless otherwise approved by Council.

Where the outlet of any proposed drainage system is below HAT then the engineer shall include an approved mechanism to prevent ingress of saline water into the drain during high tide.

Pipe bedding and cover requirements for reinforced and fibre reinforced concrete pipes shall be determined from the Concrete Pipe Association “Concrete Pipe Guide: or AS 3725.

For uPVC pipes, the bedding and cover requirements are to be detailed on the drawings and shall conform to AS2032.

In urban drainage systems, unless otherwise approved, all conduits laid under roadways or in areas of high water table and sandy soils shall be specified as rubber ring joint (RRJ) pipes.

Conduits laid along the roadway and in reserves may be flush-jointed, however where flush-jointed pipes are specified they shall be laid with “sand bands” or an approved equivalent.

Box-culverts are to be laid with approved proprietary products to prevent the egress of water and ingress of tree roots into the system.

Drainage lines in road reserves shall generally be located at the kerb line and parallel to the kerb. Drainage lines in easements shall generally be located within easements.

Minimum clear cover shall be the greater of the minimum recommended in Section 5.15 of QUDM or specified by the manufacturer, unless otherwise approved by the Council.

The minimum vertical and horizontal clearances between a stormwater pipe and any other pipe or service conduit shall be 150mm.

Notwithstanding, the engineer shall ensure that the clearance to any water or wastewater mains complies with the requirements of Council’s Policy No. MW16 – *Clearance to Water and Sewerage Assets.*

Anchor blocks shall be designed on drainage lines where the pipe gradient exceeds 15 per cent. The design details shall address the size, and position in the trench as well as spacing along the line.

The penetration of the underground stormwater system with other services is generally not permitted. However, where no reasonable alternative is available, the engineer shall obtain Council approval to incorporate a penetration into the design. Full supporting details are to be lodged with Council, which is to include (but not limited to) service types, relevant pipe diameters, levels, hydraulic grade implications, and of angle of penetration.

If approval is granted to allow the penetration, the engineer shall incorporate into the design any requirement of the relevant Service Authority and provide a manhole around the penetration.

Stormwater conduits located within the road reserve shall be done so at an alignment indicated on Council's Standard Drawings and:

(a) where longitudinal to the road centre line on an alignment below or behind the kerb line as determined by the adopted style of kerb inlets selected; and

(b) where transverse to the road centreline on an alignment perpendicular to the road centreline.

At locations where stormwater conduit alignments conflict with other utility corridors within the verge, such as road intersections and curves, the stormwater conduit shall be laid at a grade and depth to ensure a minimum 1 metre cover to the top of the conduit from finished surface levels. If the 1-metre cover cannot be achieved, the designer shall amend the proposed pipe class or introduce suitable protection measures to ensure that the pipe operates within expected structural standards.

In all cases, the nominated pipe class is to be shown on the design (and if subsequently amended on the “as-constructed”) drawings and shall be nominated by the designer after haven taken into account both construction and in-service loadings.

2.7 Pit design

Roadway gully pits shall be selected from one of the following types:

(a) Mackay Regional Council (MRC) standard gully pits – refer to standard drawing for details;

(b) bro pits; and

(c) drainway Pits.

Where the engineer wants to use an alternate pit design, prior approval must be obtained from Council.

Field gully pits shall be selected from one of the following types:

(a) Mackay Regional Council (MRC) standard field pits – refer to standard drawing for details;

(b) CPO (Circular Punch-Out) pits with approved tops; and

(c) FRC pit system.

Where the engineer wants to use an alternate pit design, prior approval must be obtained from Council.

Manhole pits shall be selected from one of the following types:

(a) Mackay Regional Council (MRC) standard manhole pits – refer to standard drawing for details

(b) CPO pits with approved tops

Where the engineer wants to use an alternate pit design, prior approval must be obtained from Council.

Typical pit designs and other pit design requirements are to be included in the standard drawings. Step irons shall not be detailed for inclusion within pits, unless otherwise approved by Council.

Generally, grated pits are not to be specified in street drainage designs. Where this is not practicable, the grates are to be of a "bicycle safe" design.

Notwithstanding the requirements of section 5.10 of this Guideline, the engineer shall locate all gully pits (including chamber and trough) opposite the boundary of abutting allotments, or at the centre of the allotment.

All roadway pits are to be provided with a 1m long formed kerb and channel transition.

Pits with troughs on horizontal curves are to be saw cut on the appropriate angle – no mortar infill is permitted.

In areas known to be, or likely to be, affected by a high water table, all pits and manholes shall be cast in-situ and not a precast type.

The engineer shall consider the use of a grate, or similar device, at the upstream entrance to all open conduits to prevent the unauthorised entry by any persons, particularly children, into the drainage system. The engineer shall install a grate, or similar, on any open conduit which has a vertical height greater than 750mm.

Any grate, or similar device, to be installed shall be designed to allow for authorised access into the drainage system, easy maintenance of the grate openings, and any metal shall be hot-dipped galvanised.

2.7.1 Stormwater discharge

Stormwater discharge shall be located to avoid recharging groundwater and creating or worsening salinity degradation of adjacent land. Generally, stormwater discharge shall be located to avoid areas with high groundwater tables, groundwater discharge areas or salt affected land. The designer shall meet requirements of the Environmental Protection Agency with regard to the salinity levels of discharge to natural watercourses.

Scour protection at culvert or pipe system outlets shall be constructed to minimise erosion. Generally, erosion protection shall, as a minimum, be designed in accordance with Queensland Department of Transport and Main Roads Road Drainage Design Manual.

Kerb and channel shall be extended to a drainage pit or natural point of outlet. Where the outlet velocity is greater than 2 metres per second or where the kerb and channel discharge is likely to cause scour, then the engineer shall incorporate appropriate protection to prevent scour and to dissipate the velocity.

At points of discharge from gutters or stormwater drainage lines, or at any concentration of stormwater onto adjoining properties, either upstream or downstream, Council will require an easement over the property(s) to the lawful point of discharge.

The easement shall be in favour of Council.

Where the drainage is to discharge to an area under the control of another statutory authority, the design requirements of that statutory authority are also to be met.

Piped stormwater drainage discharging to recreation reserves is to be taken to a natural watercourse and discharged in an approved outlet structure or alternatively taken to the nearest trunk stormwater line.

The engineer shall ensure that the quality of stormwater discharge complies with Council's Soil and Water Quality Management guideline.

2.7.2 Trench subsoil drainage

Subsoil drainage shall be provided in pipe trenches in accordance with the requirements of SC6.14 – Engineering design guideline – subsurface drainage design.

2.7.3 Reserves and easements

Urban developments

All overland flow paths and open channels not located within a road reserve or park reserve shall be located within an easement or drainage reserve.

All detention basins shall be located within a drainage reserve.

Easements shall be provided through and downstream of private property over underground drains or overland paths to the lawful point of discharge. All easements shall be in Council's favour and provided free of cost to Council.

Overland flow paths between allotments may be provided within local linkage or linear parks which shall have a minimum width of 15m. Narrow reserves between allotments to cater for overland flow paths only will require specific approval and are generally not acceptable.

Any linkage of reserves is to be designed as an integral part of a development by providing access to parks, schools, shops and other community facilities.

The location and layout of any linkage of reserves shall conform to the principles of Crime Prevention through Environmental Design (CPTED).

The minimum width of the easement or reserve shall be the greater of:

(a) the outer width of the largest underground culvert plus 2.5 metres;

(b) the width of the open channel (including batters up to 1:4 slope) plus 1.0m from each batter point; and

(c) where Council has approved open channel batters steeper than 1:4, the required width shall be 1.0m from one batter point and 4.0m from the other batter point. This is required to provide for adequate and safe access for Council plant to maintain the channel.

Evidence of any Deed of Agreement necessary to be entered into to construct any part of the drainage system shall be submitted prior to the issuing of a Decision Notice for Operational Works. Easements will need to be created prior to the endorsement of the plan of survey for the subdivision.

Evidence of any Agreement reached with adjacent landowners to allow an increased flood level on their property, or otherwise adversely affect their property and witnessed by an independent person shall be submitted prior to the issuing of a Decision Notice for Operational Works.

Rural residential development

Council will assess easement requirements for rural developments on an individual basis. In general, an easement, capable of containing the follow from a storm event having a 1% Annual Exceedance Probability (including climate change factor), will be required immediately downstream of the development except in the following circumstances:

(a) where a well-defined natural watercourse exists; and

(b) where the watercourse can contain the Q_{100} flow.

Council will assess the length of any downstream easement, to its lawful point of discharge, on an individual basis.

An easement is to be provided upstream of any culvert inlet where the calculated Q_{100} headwater extends beyond the road reserve and into private property.

Evidence of any Deed of Agreement necessary to be entered into to construct any part of the drainage system will need to be submitted prior to the issuing of a Decision Notice for Operational Works. Easements will need to be created prior to endorsement of the plan of survey for the subdivision.

Evidence of any agreement reached with adjacent landowners to allow an increased flood level on their property, or otherwise adversely affect their property and witness by an independent person shall be submitted prior to the Issuing of a Decision Notice for Operational Works.

3 Drawings and documentation

3.1 Design criteria and calculations

The design shall be submitted for consideration by Council and include all correspondence, Deeds, assumptions, reference material and calculations.

All drawings and documentation to be submitted to Council for approval shall conform to the requirements of Council's *Drawings and Documentation Guideline.* A copy of this Guideline will be made available on request.

Details including standard and non-standard pits and structures, pit benching, open channel designs and transitions shall be provided on the Drawings.

Failure to comply with Council's *Drawings and Documentation Guidelines* may result in the drawings and/or documentation being returned to the engineer without consideration by Council.

3.2 Summary sheets

A copy of a Hydrological Summary Sheet providing the minimum information is to be submitted by the engineer with the drawings. An example of the information required is including in QUDM – Volume 2 Appendix 5.

In addition, the engineer shall submit calculations for major storm events including backwater analysis of the surface drainage flow, including the volume of flow, depth of water, maximum velocity and extent of inundation.

3.3 Computer program files and program output

If requested, the engineer shall submit to Council for review, copies of computer program output and final computer data files for both hydrological and hydraulic models.

3.4 Special requirements – overland flow

Overland flow paths shall be provided at all sag points.

Where the underground drainage system has a design capacity less than 1% Annual Exceedance Probability (including climate change factor) flow, then the balance surface flow up to this flood event is to be accommodated within a drainage reserve which may include a concrete invert of minimum width of 1.2 metres. Where a concrete invert is required, it shall commence from the back of the kerb. The concrete section across the footpath shall be grade away from the kerb at 1:50.

The balance of the drainage reserve shall be turfed with a maximum slope of 1:4.

Where underground drainage has a design flow of 1% Annual Exceedance Probability (including climate change factor), then the underground system may be accommodated within an easement and include a positive outlet by surface drainage along the route of the easement. The inlet capacity of the sag pits is designed to capture the 1% Annual Exceedance Probability (including climate change factor) flow is to provide for blockage in accordance with QUDM.

Allotments adjacent to overland flow paths are to have floor levels in excess of the Q100 level shown on the relevant design drawings.

The engineer shall provide weir calculations at locations where overland flows cross the footpath adjacent to private allotments.