PLANNING SCHEME POLICY

SUBSURFACE DRAINAGE DESIGN

Mackay Region
PLANNING SCHEME

Mackay REGIONAL COUNCIL

Planning scheme policy – subsurface drainage design

Table of contents

Amendment history 2
1 Introduction 2
1.1 Application 2
1.2 Relationship with planning scheme 2
1.3 Purpose 2
1.4 Referenced documents 3
1.5 Terminology 4
2 Subsoil and sub-pavement drains 5
2.1 Warrants for use 5
2.2 Layout, alignment and grade 5
3 Foundation drains - warrants for use 7
4 Drainage mats (blankets) – warrants for use 8
5 Materials 8
5.1 Subsoil and sub-pavement drain pipe 8
5.2 Intra pavement drain pipe 8
5.3 Filter material 9
5.4 Geotextile 9
6 Documentation 10
6.1 Drawings and calculations 10

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
1.1	Planning scheme policy amendment 3	This amendment updated references, standards, and requirements to reflect modern practice.	- DRAFT FOR CONSULTATION
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 the subsurface drainage system for the road pavement and/or sub-grade.
2. Set procedures for the design of subsurface drainage, including:
   (a) subsoil and f~~F~~oundation d~~D~~rains;
   (b) sub-pavement drains; and
   (c) sheet filter, drainage mats or filter blankets~~drainage mats, including type A and type B mats~~.

~~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 inroads*. The full titles of these references are given below.~~

The objective in the design of the subsurface drainage system is to control moisture content fluctuations in the pavement and/or sub-grade to within the limits assumed in the pavement design. As per Council's subsoil standard drawing A3-867, subsoils are generally installed behind the kerb and at a minimum depth of 300mm below subgrade. This alignment will act as a barrier against ground water from side intrusion and being installed 300mm below subgrade, water levels will be reduced, as the subsoil drains will assist in lowering the water table.

In the areas with a history of salinity problems, subsurface drainage may be prescribed to keep the groundwater table lower in the strata to avoid progressive deterioration of the healthy ~~of~~ topsoil and upper layers due to salinity levels increased by rising and/or fluctuating groundwater tables.

1.4 Referenced documents

(a) Council guidelines and specifications:
- (i) Construction standard C230 – Subsurface drainage – general
- (ii) Construction standard C231 – Subsoil and foundation drains
- (iii) Construction standard C232 – Pavement drains
- (iv) Construction standard C233 – Drainage mats
- ~~(v) Standard drawings – various~~

(b) DTMR Specifications
- MRTS03 Drainage, Retaining Structures and Protective Treatments
- MRTS04 General Earthworks
- MRTS16 Landscape and Revegetation Works
- MRTS27 Geotextiles (Separation and Filtration)
- MRTS38 Pavement Drains
- MRTS51 Environmental Management
- MRTS52 Erosion and Sediment Control
- MRTS70 Concrete
- DTMR Standard Drawings (SD1116)

(c) MRC Supplementary Specifications - https://www.mackay.qld.gov.au/business/planning_and_development/design_and_construction_requirements/design_guidelines2

(d~~b~~) Australian Standards:
~~(~~
- (i) AS/NZS 1254 – Unplasticised PVC (uPVC) pipes and fittings for stormwater or surface water applications
- (ii) AS2032 – Code of practice for installation of uPVC pipe systems
- (iii) AS2439.1 – Perforated plastic drainage and effluent pipe and fittings – Perforated drainage pipe
- (iv) AS/NZS1477 – Unplasticised PVC (UPVC) pipes and fittings for pressure applications
- (v) AS/NZS2566.1 – Buried flexible pipelines, structural design
- (vi) AS3725 – Loads on buried concrete pipes
- (vii) AS4058 – Precast concrete pipes
- (viii) AS4139 – Fibre reinforced concrete pipes and fittings
- ~~i) AS 2439.1 – Perforated drainage pipe and associated fittings~~
- ~~(ii) AS/NZS1477 – Unplasticised PVC (UPVC) pipes and fittings for pressure applications~~

(e~~c~~) Other:
- (i) Austroads - Guide to Pavement Technology Part 10: Subsurface Drainage ~~AustRoads (1983) *Guide to the control of moisture in roads*~~
- (ii) Austroads - Guide to Road Design Part 5A: Drainage- Road Surface, Networks, Basins and Subsurface

(iii) Gerke, R.J. for the Australian Road Research Board (1987) *Special report no. 35 – Subsurface drainage of road structures (ARRB-SR35)*

(iv~~ii~~) Mulholland R.J. for the Australian Road Research Board (1989) *Special Report No. 41 – A structural design guide for flexible residential street pavements (ARRB-SR41)*

(v) Department of Transport & Main Roads – Road Drainage Design Manual - Chapter 11: Road Surface and Subsurface Drainage Design

(f) Council documents:

(i) Various stormwater drainage studies, catchment management plans and waterway management plans

(ii) External Documents Register - https://www.mackay.qld.gov.au/__data/assets/pdf_file/0003/253380/External_Document_Registry_for_Technical_Services_2019_002.pdf

(iii) Drawings - https://www.mackay.qld.gov.au/business/planning_and_development/design_and_construction_requirements/standard_drawings/drainage https://www.mackay.qld.gov.au/business/planning_and_development/design_and_construction_requirements/standard_drawings/parks_and_gardens

1.5 Terminology

Subsoil drainage systems are designed to be installed within the ground in order to remove/control excess water. Subsoil drains are generally installed to ~~s are intended for the~~ control/drain~~age~~ ~~of~~ ground water or seepage from the sub-grade and/or the sub-base. Subsoil drains are also installed where a significant change of material type is present i.e. ~~in cutt~~cut~~ings and fill areas.~~ cut/fill transitions, transitions between stabilised and flexible pavements.

In addition, all vegetated medians and roundabouts shall have subsoil drainage included and connected to a legal point of discharge in order to both drain the vegetated areas and protect the adjacent base, sub-base and subgrade areas. Details of requirements are shown in Std Dwg A4-176.

All playground softfall treatments (sand soft fall, rubber tiles or artificial turf) shall contain adequate subsurface drainage and be connected to the legal point of discharge to protect and maintain the quality of the softfall treatment. Details of requirements are shown in A3-9703 & A3-9704.

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 sub-base pavement layers in flexible pavements. They may also function to drain seepage or groundwater from the sub-grade.

Filter blankets~~Type A drainage mats~~ are intended to ensure continuity of a sheet flow of water under embankment fills, to collect water ~~seepage~~ from ~~a wet~~ seepage areas, or for protection of vegetation or habitat downstream of the road reserve where an embankment ~~fill~~ would otherwise ~~cut~~ block the flow of water.

Sheet filters~~Type B drainage mats~~ are constructed to intercept water that would otherwise enter pavements by capillary action or by other means. The sheet filters are utilised to ~~or fills and to~~ intercept and control seepage ~~water~~ and water springs in the floors of cuttings.

In dispersive, soluble or fine grained soils, the Designer is to evaluate whether geofabric wrapped subsoil drains are required and seek approval from Council for its installation.

2 Subsoil and sub-pavement drains

2.1 Warrants for use

Subsoil drains are designed to drain groundwater or seepage from the sub-grade and/or sub-base in cuttings and fill areas.

Sub-pavement drains are designed to drain water from base and sub-base pavement layers in flexible pavements, and to~~o~~ drain seepage or groundwater from the sub-grade.

The D~~d~~esigner shall ~~ensure~~ consider the installation of ~~that~~ subsoil drains or sub-pavement drains ~~are to be provided~~ on both sides of the formation in the following locations:

(a) all urban/street developments – regardless of abutting land zoning;

(b) cut formations where the depth to finished sub-grade level is equal to or greater than 400 mm below the natural surface level;

(c) locations of known hillside seepage, high water table, isolated springs or salt affected areas;

(d) irrigated, flood-prone or other poorly drained areas;

(e) highly moisture susceptible sub-grades, ie. commonly displaying high plasticity or low soaked CBRs (<7);

(f) use of moisture susceptible pavement materials;

(g) existing pavements with similar sub-grade conditions displaying distress due to excess subsurface moisture;

(h) in trenches in which underground drainage has been installed;

(i) at cut-to-fill transitions;

(j) all landscaped and vegetated road median islands and roundabouts; and

(k) all rural residential developments.

Where only one side of the formation is in cut, 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.

A geotechnical report supporting the elimination of any subsoil drain will need to be submitted if the designer proposes to consider this option.

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~~ unsuitable sub-grade 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.

2.2 Layout, alignment and grade

Typical cross sections or subsoil and sub-pavement drains and the recommended backfill material are shown in Council's standard drawings.

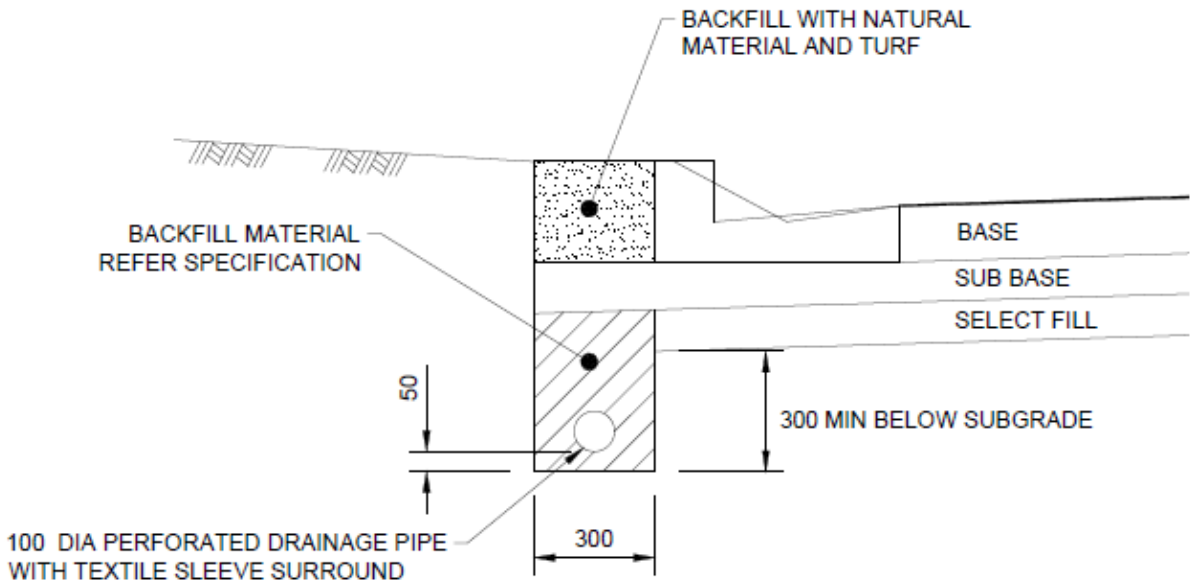
In kerbed roads, the two acceptable alternative options for subsoil drainage both allow for the line of the trench to be directly behind the kerb line. These options are shown in Council's Standard Drawing. Pavement layers must extend to at least the line of the rear of the trench. Where it is not possible to place subsoil drainage directly under or adjacent to the Kerb, the pavement Subbase can be extended at the same or higher slope up to the subsoil drain. In either case, the permeability of sub-base should be enough to allow flow from base to the filter material.

In un-kerbed roads, subsoil and sub-pavement drains shall be located within the shoulder preferably at the edge of the pavement layers and situated below the subgrade as detailed in Council's Standard Drawings.

The minimum desirable longitudinal design grade shall be 0.2~~5~~% ~~1.0%. For non-corrugated pipes, an absolute minimum grade of 0.5% is acceptable.~~

Trench widths shall be a minimum of 300 mm, with a minimum depth of 300mm below ~~finished~~ subgrade ~~level of 600 mm in earth and 450 mm in rock,~~ and must ensure it is installed below the invert level of any service crossings unless otherwise agreed by Council due to mitigating circumstances.

Figure 1: Subsoil Drainage – Typical Cross Section



Outlets shall be spaced at ~~-~~maximum intervals of 150 metres into stormwater (gully) pits or outlet headwalls. Where practical, discharge shall be on the downhill side of the embankment or in the cut-fill area ~~so as~~ to reduce the risk of recharge to the subsurface water table. Unless otherwise authorised, where subsurface drains outlet through fill batters, unslotted plastic pipe of the same ~~diameter~~ cross section area is to be installed~~as the main run shall be specified.~~ and connected to a precast headwall as detailed in TMR SD1116.

A small precast concrete headwall shall be installed at the drain outlet with a pest proof cap and a marker post. ~~to assist maintenance and protect the end of the pipe.~~

Clean out ~~Flush~~points are to be ~~provided~~ installed at the commencement of each run of drain, and at intervals not exceeding 60 metres. Cleanouts points shall generally be located:

(a) ~~within the kerb & channel transition section (when located at~~ In stormwater gully pit~~)~~;

(b) directly at the rear of the kerb; or

(c) at the edge of the shoulder, as applicable.

(d) aligned with property boundary locations to avoid conflict with other infrastructure.

Where the subsoil drains are installed ~~is laid~~ adjacent to new kerb, the D~~d~~esigner shall note on the drawings a requirement for the contractor to indicate the location of the Clean out ~~flush~~points adjacent to the ~~freshly poured~~ new kerb.

In salinity affected areas, the D~~d~~esigner should consider providing a separate drainage system for subsurface drains ~~to~~for discharge to a basin where controlled release or desiccation treatment and removal can be facilitated as a maintenance operation. Saline subsurface drainage should not be routinely discharged directly into natural watercourses.

Reference to water quality targets for downstream watercourses is essential and the D~~d~~esigner shall provide advice on discharge operations and maintenance compatible with water quality targets and the requirements of the relevant land and water resource authority.

3 Foundation drains - warrants for use

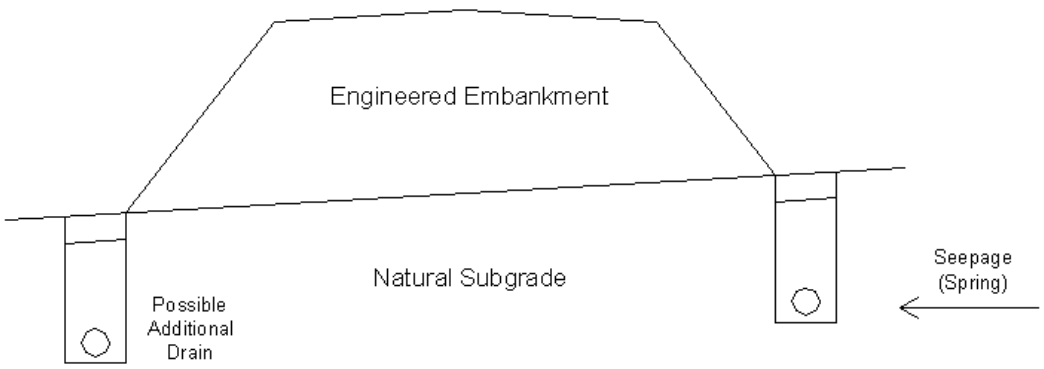
Foundation drains are designed to drain excessive ground water areas within the foundation of an embankment, ~~or~~ the base of cutting~~,~~ or to intercept water from entering these areas.

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, salt affected areas or ~~watercharged~~water charged strata, the Drawings shall be suitably annotated to the potential need for foundation drains at various locations, in addition to those shown on the drawings.

Typical cross-sections of foundation drains are shown below in Figure ~~3~~2.

Figure ~~3~~ 2 – Foundation drains



The minimum desirable design grade shall be 1.0%. For non-corrugated pipes an absolute minimum grade of 0.2~~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~~ subsoil drain clean out points~~flush out points~~ are to be provided at the commencement of each run of foundation drain and at intervals not exceeding 60~~80~~ metres. ~~Where not practicable to provide intermediate cleanouts, outlets shall be spaced at maximum intervals of 100 metres.~~

All playground softfall treatments (sand soft fall, rubber tiles or artificial turf) shall contain adequate subsurface drainage and be connected to the legal point of discharge to protect and maintain the quality of the softfall treatment. Details of requirements are shown in A3-9703 & A3-9704.

4 Drainage mats (blankets) – warrants for use

Filter blankets~~Type A drainage mats~~ are designed where there is a need to ensure continuity of a sheet flow of water under embankment fills. It is intended to collect surface seepage from a wet ~~seepage~~ area or/and ~~for~~ protection of vegetation, ~~of~~ habitats and downstream of the road reserve where an embankment ~~fill~~ would otherwise ~~cut~~block the flow of water.

Filter blankets~~Type A drainage mats~~ are ~~constructed~~ installed after the site has been cleared, grubbed and ground surface treatment (GST) has been completed. ~~and grubbed~~ prior to ~~and before~~ commencement of embankment fill, filter blankets are installed and safely compacted to ensure it is not crushed during the construction of the embankment. ~~construction.~~ Minimum depth of filter material under?

Sheet filters~~Type B drainage mats~~ are designed where there is a need to intercept water that would otherwise enter pavements by capillary action or by other means. The sheet filters reutilised ~~on fills and~~ to intercept and control seepage water and springs in the floors of cuttings.

Sheet filters~~Type B drainage mats~~ shall be installed~~constructed~~ after completion of the sub-grade construction and before construction of the pavement layers.

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

5 Materials

5.1 Subsoil and sub-pavement drain pipe

Pipes designated for subsoil, foundation and sub-pavement drains shall be 100mm diameter slotted pipe. However, alternative design options may be considered by Council, subject to the provision of required design detail and justification.

Corrugated plastic pipe shall conform to the requirements of AS 2439.1. 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 AS 2439.1.

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

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

5.2 Intra pavement drain pipe

Pipes designated for intra pavement drains with crushed rock sub-bases having layer thicknesses ~~neither~~ less than 150 mm ~~n~~or more than 200 mm shall be slotted thick walled UPVC pressure pipe complying with AS/NZS 1477. Alternative design options may be considered by Council subject to the provision of required design detail and justification.

Pipes designated for intra pavement drains with crushed rock sub-bases having layer thicknesses exceeding 200 mm 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.

5.3 Filter material

~~The types of filter material covered by this Guideline include:~~

~~(a) Type A filter material for use in subsoil, foundation and sub-pavement (Trench) drains and for Type B drainage mats;~~

~~(b) Type B filter material for use in subsoil, foundation and sub-pavement (trench) drains;~~

~~(c) Type C filter material comprising crushed rock for use in Type A drainage mats; and~~

~~(d) 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 Construction standard C230 – Subsurface drainage – general.~~

The type of filter material specified ~~to~~for backfilling the sub-surface drainage trenches (subsoil, foundation and sub-pavement drains) shall depend on the permeability of the pavement layers and/or sub-grade and the expected flow rate.

General filter material can either be;
a) 20mm no fines Concrete
b) Single size drainage aggregate of 20mm or 10mm particle size with a maximum of 5% passing the 0.150 mm test sieve.

The selected filter material should be sized such that the in-situ material does not clog the filter material, the filter material does not cause blockage of pipe and is sufficiently permeable. Reference to the appropriate reference specification is required.

The filter material to backfill subsurface drainage tranches within playground softfall treatment shall be certified softfall sand. Softfall sand must be min. 100mm over subsurface drain in accordance with relevant standard drawing.
~~Generally, Type A filter material is used for the drainage of highly permeable sub-grade or pavement layers such as crushed rock or coarse sands, while Type B filter material is used for the drainage of sub-grade and pavement layers of lower permeability such as clays, silts or dense graded gravels.~~

~~Further guidance to the selection of appropriate filter material is contained in ARRB Special Report 35.~~

5.4 Geotextile

To provide separation (i.e. prevent infiltration of fines) between the filter material in the trench and the sub-grade or pavement material, geotextile may be designated to encapsulate the filter material. ~~The~~

~~geotextile shall comply with the requirements included in Construction standard C230 – Subsurface drainage – general.~~

Geotextile shall also be designated for both sheet filters, drainage mats and filter blankets in accordance with the relevant standards.~~Type A and Type B Drainage Mats.~~ Geotextile material shall be wrapped tightly around the trench ensuring minimum overlap requirements are being implemented as per manufactures recommendations.

An acceptable solution exists for strip filter drains where they shall be a suitable proprietary product, comprising a plastic core of nominal thickness not less than 40 mm, encased by a non-woven geotextile which complies with the provisions of MRTS27. The strip filter drain shall permit the passage of high water flows along the drain and shall have a crush strength not less than 200 kPa.

Textile sleeves shall be either seamless knitted proprietary products or be formed from woven geotextiles. The geotextile material in formed sleeves shall comply with the provisions of MRTS27.

6 Documentation

6.1 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 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 Guideline shall be submitted to Council with the drawings.

All drawings and documentation to be submitted to Council for approval shall conform to the requirements of Council's Drawings and documentation guidelines. A copy of these Guidelines will be made available upon request.

Drawings and Documentation submitted to Council shall be signed and certified by the Designer who is a suitably qualified professional engineer holding appropriate RPEQ certifications.

Failure to comply with Council's Drawings and documentation guideline may result in the drawings and/or documentation being returned to the designer without consideration by Council.

Design procedure of subsurface pavement drains shall be in accordance with AUSTROADS Guide to Pavement Technology, Part 10: Subsurface Drainage.