Policy 11: Land Development Guidelines

Section 3

3.0 Engineering Infrastructure – Design Requirements

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3.1 Introduction

These Guidelines provide 'deemed to comply' and 'end product' criteria, which indicate the minimum standards required for the submission of Engineering Drawings and Associated Documentation for Council approval.

It is anticipated that compliance with the Guidelines will save considerable time to Consultants and Council staff. In addition it is envisaged that it will assist in the implementation of procedures to be installed for checking by approved 3rd Party Certified Consultants.

3.2 Design Requirements – Earthworks

3.2.1 General

These Guidelines provide Council's minimum standards for developments encompassing clearing, contaminated soils, filling, earth retaining structures, earthworks, topsoil and grassing.

3.2.2 Contaminated Soils and Acid Sulfate Soils

Areas that have been identified in **Section 2.2.3.1 e) – Contaminated and Acid Sulfate Soils** should be treated as required by Council Code and the Environmental Protection Agency. The design shall accommodate these requirements.

3.2.3 Compressible Soils

Existing areas, which have compressible soils and are intended to be developed for urban use (including roads and parks) will be required to be preloaded (or other approved methods) in order to achieve a suitable level of consolidation and stability.

It is the consulting engineer's responsibility to provide an appropriate design and to ensure that the quality and workmanship provided on the development are consistent with the design provisions, relevant Australian Standards and relevant codes of practice.

Council will require areas identified to be preloaded (or other approved method) to be detailed on the design engineering drawings. Prior to Council formally accepting the works 'on maintenance', certification by the consulting engineer and test results must be submitted (for standard and modified compactive effort refer to **AS1289**).

3.2.4 Erosion and Sediment Control Management Plan

Council requires an Erosion and Sediment Control Management Plan to be submitted for approval and prepared in accordance with Council's current edition of the **Erosion and Sediment Control Code**.

This code refers to the Institution of Engineers Australia (Qld) **Soil Erosion and Sediment Control Guidelines** and **Guidelines for the Control of Stormwater Pollution from Building Sites**. Another useful reference can be found in the New South Wales Department of Housing **Guidelines: Soil and Water Management for Urban Development** – Morse McVey & Associates and include:

- assessment of earthwork impact and integration with planning and design;
- the conservation of topsoil;
- diversion of clear water away from disturbed areas;
- the minimisation of areas of soil exposure, vegetation disturbance and slopes (grades and length);
- controlling topsoil and water runoff;
- stabilisation of disturbed areas;
- removal of temporary sediment control structures as soon as possible.

The performance criteria that should generally apply are:

- control of pollution by nutrients, etc. (1 year event)
- control of sediment and trash pollution (2 year event)
- soil and waste management structure stability (20 year event)

3.2.5 Clearing

Clearing shall be executed in accordance with Council's current **Standard Specification SS3 – Specification for Clearing and Grubbing for Infrastructure, Roadways and Designated Areas** and generally kept to a minimum to comply with current Regulations, By-Laws and Council's Conditions of Approval. Indicative minimum environmental considerations are detailed in **Section 9.00** of **QUDM**.

Prior to the design phase, trees and vegetation of significance (as nominated by Council) should be identified by the developer in order that damage/ disturbance can be minimised by appropriate design and practices. Trees and vegetation that form part of riparian and/or dual buffer zones along rivers, creeks, waterways or the ocean beaches are of special significance and should be clearly identified and planned for by the developer.

Prior to clearing commencing the developer shall submit for Council's approval a completed 'Application for Vegetation Management Approval' and shall comply with **GCCC Guidelines for Fauna Removal from Land Subject to Development Approval**. Council will assess the application in accordance with these requirements. Where fauna relocation is required by Council the developer shall comply with the **Habitat Permit Guidelines** in the **Nature Conservation Act**.

Where areas of development are to be dedicated under the control of Council (eg. parks) no trees or vegetation shall be damaged or removed without the prior written permission of Council. However, subject to specific written direction from Council dead dying or dangerous trees should be removed from these areas. These written instructions will have emerged from general criteria established in **Section 2.2 – Preliminary Development Layout**.

Trees on existing roads shall not be damaged or removed without the approval of Council. All such trees affected by the works are to be shown and detailed on a Layout Plan. The Plan together with proposed protection measures are to be submitted to Council for approval.

Where clearing for developments in eroded areas is proposed, the vegetation retention criteria in the Institution of Engineers Australia (Qld) **Soil Erosion and Sediment Control Guidelines** shall be considered and in particular, the following quote:

'The identification of high-value vegetation requires the advice of local experts'.

The following general criteria should be considered when developing sites in wooded areas (North Carolina SCC & DEHNR, 1993):

- **Leave critical areas (such as watercourses, floodplains, steep slopes and wetlands) with desirable trees in their natural condition or only partially cleared;**
- **Locate roadways, storage areas and parking pads away from valuable tree stands. Follow natural contours, where feasible, to minimise cutting and filling in the vicinity of trees;**
- **Select trees to be preserved before sighting roads, buildings, or other structures;**
- **Minimise trenching in areas with trees. Place several utilities in the same trench;**
- **Designate groups of trees and individual trees to be saved on the erosion and sedimentation control plan;**
- **Do not excavate, traverse, or fill closer than the drip line, or perimeter of the canopy, or trees to be saved.**

On slopes steeper than 10%, special consideration should be given to the retention of ground cover. The cost penalty for the removal of the existing ground cover should be increased requirements for the use of erosion control blankets, mulch, and/or other suitable erosion control measures. Similarly, special consideration should also be given to the retention of vegetation on shaded areas or steep slopes with a southern aspect.

Attention is drawn to the requirement for disposal of timber and refuse as set out in Council's current **Standard Specification SS3 – Specification for Clearing and Grubbing for Infrastructure, Roadways and Designated Areas**.

3.2.6 Material for Filling

Structural fill is defined as any filling, which will or may be required to support structures or pavements or for which it is intended time dependent settlement will be required.

a) Unsuitable Materials

The following are generally considered unsuitable as structural fill:

i) Organic soils;
ii) Silts;
iii) Waste material from building and demolition sites;
iv) Materials prone to dissolving or which undergo physical or chemical changes or exposure to moisture;
v) Contaminated soils including noxious, hazardous and deleterious materials.

Such material except for iv) and v) above may be confined to non-critical areas as designated and approved by Council.

Contaminants shall be dealt with in accordance with the relevant Acts, Local Laws or Regulations having jurisdiction over the Development.

b) Suitable Materials

Structural fill will generally be naturally occurring earth, soil and rock with the exceptions stated above, capable of being compacted to support commercial and/or residential developments and associated infrastructure.

Special Geotechnical consideration will be required for the use of:

i) Clays of high plasticity which may be reactive and need to be selectively placed within the filling and under strict moisture and density control;
ii) Material which, after compaction, contains large particles and may lead to difficulties in the excavation of trenches for footings or services or driving of piles or drilling of piers;
iii) Over wet materials, as may be encountered in low lying areas;
iv) Single-sized or gap graded gravels or rock fill which will not break down upon compaction, leaving voids into which finer material may subsequently migrate;
v) Saline, chemically aggressive, or polluted soils;
vi) Carbonate soils where acid disposal may occur;
vii) Acid sulfate soils;
viii) Areas of known or suspect low slope stability.

3.2.7 Cut/ Fill Batters and Earth Retaining Structures

a) Batters

Unless approved otherwise by Council cut and fill batters shall comply with the following requirements:

i) Batters Within Road Reserves

Residential, Commercial and Industrial Streets

Within these areas, cut/ fill batters are not desirable and shall be in strict accordance with Council's **Standard Drawing N^{os} 03-02-001** to **03-02-004**. Council may approve otherwise on request by a formal submission.

Park Living/ Rural Streets

Cut/ Fill Batters shall be to maximum slope of 1 in 2 in accordance with Council's **Standard Drawing N^{o} 03-02-003**. Stabilisation by vegetation shall commence immediately following completion of bulk earthworks. The batters shall be drained in an approved manner to prevent damage occurring. Council may request a full Geotechnical engineering report (prepared by a qualified and experienced Geotechnical Engineer) certifying the stability of the Cut/ Fill Batter.

ii) Batters Within Private Property

Batters shall be to a maximum slope of 1 in 2. Stabilisation by vegetation shall commence immediately following completion of bulk earthworks. Batters shall not straddle allotment boundaries or extend into existing or proposed parkland and/or bushland reserve. Batters steeper than 1 in 2 slopes shall be retained (as set out in **Section 3.2.7 b) – Retaining Structures**.

All platforms resulting from Cut/ Fill operations shall comply with standard requirements for drainage of allotments to the street at an absolute minimum slope of 1 in 150. Benching shall be required where any proposed freestanding batter height exceeds 2.5m. The minimum width of benching shall be 1.0m with a minimum slope of 1 in 100 towards the lower face. The benching shall be vegetated to prevent erosion.

The absolute maximum height of any freestanding Cut/ Fill batter with benching shall be 5.0 metres.

iii) Batters Within Public Open Space

Batters should be to a maximum slope of 1 in 6. Stabilisation and vegetation shall commence immediately following completion of bulk earthworks. Batters to a maximum slope of 1 in 2 may be approved subject to Geotechnical advice and/or acceptable landscape treatment.

iv) Batters to Waterways such as Lakes, Canals, Rivers or Streams

The maximum constructed batter slope above the high water mark that falls towards a lake, canal, river, stream or other waterway shall be 1:4.5 (V:H). The batter slope shall continue to the building line, which shall be at or above the 1:100 year flood level. The remainder of the property should fall to the street frontage. Typical details are shown on Council's **Standard Drawing N^{o} 03-04-004**. The location of Quay Lines, Waterway Regulation lines, Building Setbacks Lines and Revetment Regulation Heights are shown on Council's **Waterway Development Control Maps**. Refer to Council's **Planning Scheme**.

b) Retaining Structures

i) General

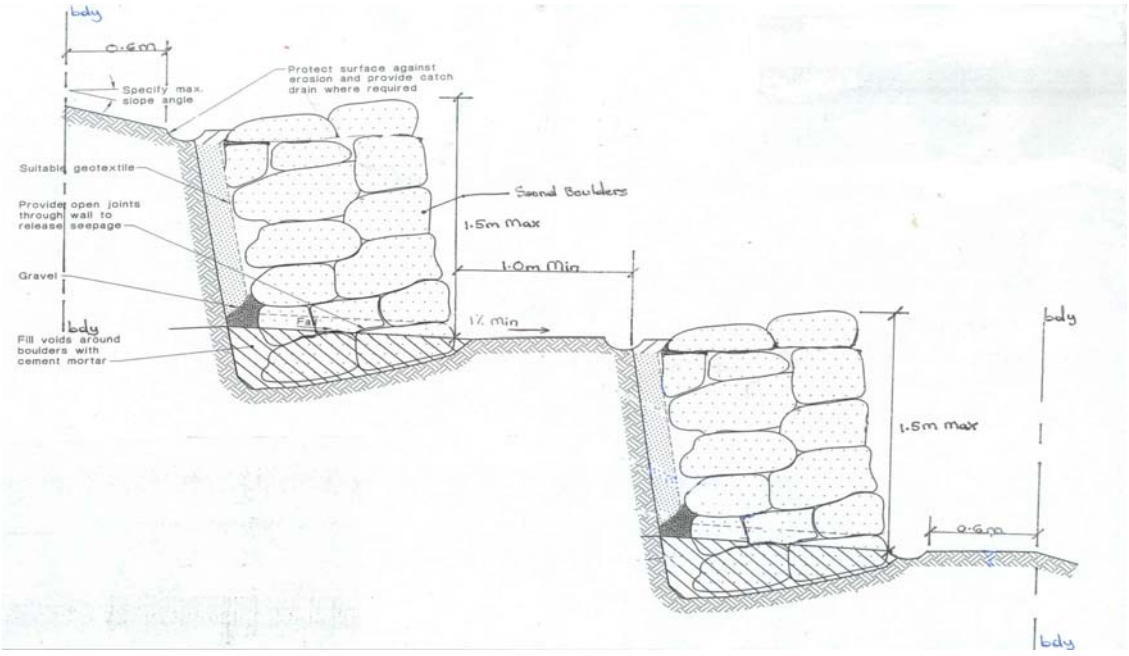
Any earth retaining structure including, but not limited to:

- boulder walls;
- gravity retaining walls;
- cantilever retaining walls;
- crib walls;
- sleeper walls (timber retaining structures are not desirable);

should be detailed on the Engineering Drawings submitted for Council's approval. These should be shown in Plan and Cross-Sectional Elevation. Each such retaining structure over 1.0 metre in height shall be covered by a Consultant's Structural Certification and submitted for Council's approval.

Unless approved otherwise by Council, the following requirements shall apply to retaining structures:

- for private property, retaining structures shall not encroach onto any adjoining property or road reserve;
- retaining structures should generally be located on the 'low side' property and positioned such that the property boundary is setback a minimum distance of 0.6 metres from the top of the rear of the retaining structure. A typical example is shown below:



- retaining structures shall be designed in accordance with the relevant Australia Standard (ie. **AS4678**);
- retaining structures shall be designed to give a neat architectural and aesthetic appearance;
- where property boundaries are located at the bottom of retaining structures, they shall be so located to provide a minimum setback distance of 0.6 metres to the 'toe' of the face of the retaining structure;
- retaining structures shall drain discharge to the street or other legal point of discharge;
- timber structures are not permitted within 1.5 metres of property boundaries to private property, public open space or road reserve.

If batters and/or earth retaining structures are not shown on Engineering Drawings, and are constructed in accordance with these guidelines, the development will not be accepted 'On Maintenance' until necessary certifications are received and approved by Council.

If batters and/or earth retaining structures are not shown on Engineering Drawings, and are not constructed in accordance with these guidelines, the development will not be accepted 'On Maintenance' until necessary certifications are received and approved by Council where the constructed structure is considered by Council to be acceptable planning outcome.

Walls shall not impose any structure loading on an adjoining structures, this includes underground utility services.

Drawings must be shown on 'as constructed' drawings.

ii) Retaining Structures Within Road Reserves

Retaining structures are not permitted within the road reserve. (It is recommended that retaining structures be located a minimum of 0.6m from the boundary). Council may approve otherwise on request by a formal submission (eg. in the median of a divided road).

iii) Retaining Structures Within Private Property

Residential, Park Living and Rural Precincts

Within these areas retaining structures over 1.5 metres in height are to be stepped 1.0 metre (horizontally) for each 1.5 metres in height to a maximum height of 3.0 metres. Council may approve otherwise on request by a formal submission, including supporting geotechnical and structural detail.

Industrial and Commercial Precincts

Retaining structures should be to a maximum height of 5.0 metres. Council may approve otherwise on request by a formal submission, including supporting geotechnical and structural detail.

iv) Retaining Structures Within Public Open Space

Retaining structures should be to a maximum height of 0.6 metre. Council may approve otherwise on request by a formal submission. Retaining structures shall be constructed to minimise maintenance requirements.

v) Retaining Structures for Ocean Beaches

No development can commence along areas of ocean beachfront until such time as the subject property has been protected by a boulder wall that is certified by an appropriately qualified and experienced Consulting Engineer to meet the requirements shown on Council's **Standard Drawing N^{os} 03-04-001** and **03-04-002**. Refer to **Section 7.5** of these Guidelines for details.

vi) Retaining Structures for Waterfront Development

Council requires that edge protection for waterways be sustainable. Riparian buffers are preferred to structural edge protection but only where an impact assessment has shown that such treatment will remain sustainable.

Where retaining structures (revetments either concrete walls or rock walls) associated with waterfront development are required they shall be designed by an appropriately qualified and experienced Consulting Engineer. Certifications of structural detail and stability shall be provided to Council for approval.

Developers and their Consultants should assess the likely performance and stability of any retaining structures for a wide range of possible waterway changes within the next sixty (60) years.

The following criteria should be considered in the design of retaining structures:

- top of wall generally no lower than RL 1.2m AHD;
- minimum foreshore erosion/ accretion envelope of 1.0m in Gold Coast tidal waters;
- changes to water quality;
- natural meandering process;
- sea level rise;
- increased boating traffic;
- increased tidal volume upstream due to future development;
- increased flows due to developed catchments;
- changed in sediment transport availability;
- other factors.

3.2.8 Treatment of Adjoining Properties

Where earthworks/retaining structures are adjacent to existing residential or commercial developments, cross-sections showing the batter or retaining wall in relation to the adjoining boundary use must be shown.

The toe of any fill batter or top of any cut batter should be a minimum 300 mm clear of the boundary line with the adjoining property.

The effects on the drainage of adjoining properties of any cut or fill operation must be considered and details shown on the Engineering Drawings. No ponding or nuisance from stormwater runoff will be accepted.

3.2.9 Treatment of Dams/ Ponds and Embankments

All works involving construction of, or alterations to dams, must be supported by engineering drawings and a cover letter/ report prepared by a suitably qualified and experienced Consulting Engineer. A Construction Bond to be agreed with Council must also be lodged for these works.

Dams and embankments must be designed to ensure that the following issues are addressed:

- embankments and associated outlet structures are not built any closer than 3 metres from property boundaries;
- all dams must incorporate a spillway at the top of the embankment allowing free surface flow (a pipe outlet may also be incorporated), to ensure that the location of the outflow is controlled for all flow rates;
- no change to the location of flows from the subject site. Spillways and outlets must be built in the same location as the natural location of overland flow;
- spillways must be designed for some allowance for a freeboard between water level and top of the embankment, ensuring the embankment is not breached and increasing the risk of erosion of the embankment;
- the Consulting Engineer must give appropriate consideration to hydrology, flow rates and spillway sizing and level, and upstream ground levels to ensure that the water surface does not intrude onto upstream properties;
- the spillway face and associated works must be designed to prevent scour and erosion;
- embankments must be designed and constructed to ensure geotechnical stability in accordance with a geotechnical report prepared by a suitably qualified and experienced Geotechnical Engineer;
- any proposal to dredge out dams for maintenance or enlarging capacity must have regard to water quality requirements;
- compliance with relevant Australian Standards, and relevant State Government (**IPA**) requirements and procedures.

In the treatment of dams/ ponds the earthworks design should address the issues related to artificial wetlands such as wildlife habitats and nutrient sinks. Refer also to **Section 2.2.1 c)**.

Where dams/ ponds are to be removed and backfilled:

i) Dams should be dewatered and all unsuitable material removed from the site and spoiled;

ii) The dam wall is to be levelled to the original ground level.

The integrity of the drainage lines to and from the dam must be ensured. An alternative drainage path should be included into the drainage design to replace the drainage path the dam provided prior to its being filled.

The backfill shall be approved selected fill compacted in layers to the requirements set out in Council's **Standard Specification SS4 – Earthworks and Imported Topsoil**.

3.2.10 Final Earthworks Presentation

Prior to grassing of all disturbed areas, the finished earthwork levels should be in accordance with the Engineering Drawings. In general, the minimum grade should be:

- 1 in 150 in clay soils
- 1 in 200 in sands

In addition to the above grading requirements, the appropriate measures to comply with the Erosion and Sediment Control Management Plan are to be implemented.

3.2.11 Topsoiling and Grassing

a) Topsoil

Topsoil to all disturbed areas including allotments and verges should be 100mm minimum compacted thickness and comply with Council's **Standard Specification SS4 – Earthworks and Imported Topsoil**.

b) Grassing

The minimum Council requirement, following the placing and spreading of topsoil to disturbed areas, should be approved grass seeding.

Where storm water drainage overland flow paths or swales, etc. are constructed, the minimum grassing requirement shall be cover turf or an equivalent treatment approved by Council.

3.3 Design Requirements – Pavements

3.3.1 General

These guidelines provide Council's minimum standards for road pavements for developments based on Council's Road Classification. They shall be read in conjunction with Council's current Standard Specifications and Drawings.

3.3.2 Procedure

a) General

Generally the minimum pavement thickness will be determined by using Council's Road Classification and relevant Vehicles Per Day (VPD) in accordance with **Section 3.3.3 a) – Road Classification – Vehicles per Day (VPD)**.

However, where deemed necessary by Council, the minimum pavement thickness for Major Traffic Routes may be determined by estimated traffic volumes based on Equivalent Standard Axles (ESA's) in accordance with pavement design manuals nominated in **Section 3.3.3 b) – Traffic Volumes – Equivalent Standard Axles – ESA's**.

Evaluation of the sub-grade for either method is required to ensure the pavement thickness chosen, is adequate for the design traffic loads.

Irrespective of the pavement design method adopted, the four day soaked CBR (test for the pavement, gravel and sub-grade) shall be the basis for determining final pavement thickness.

b) Frequency of Sub-Grade Sampling

The frequency of sampling for determination of the soaked CBR tests is to be agreed between the Consultant and Council, taking into consideration the following:

i) Generally, sampling should be randomly located in each proposed road;

ii) Sampling should be undertaken on sections of significantly different sub-grade strength and generally in the position of the outer wheel path;

iii) A sketch plan of the location of tests shall be submitted to Council with the test results for pavement design approval.

3.3.3 Minimum Pavement Thickness

a) Road Classification and Vehicles Per Day – VPD

Unless otherwise determined by Council, the Design Volumes are as shown on the Typical Cross Sections of Council's Standard Drawings.

The minimum pavement and course thickness for each Road Classification shall be as shown in **Tables 3.3-A**, **3.3-B**, **3.3-C**, and **3.3-D**.

The minimum pavement and course thickness for public car parks shall be as for Access Streets 400VPD.

b) Traffic Volumes – Equivalent Standard Axles – ESA'S

Where deemed necessary by Council the minimum pavement course thickness for Major Traffic Routes shall be determined by reference to **Section 3.3.4** and in accordance with the requirements of the current documents as follows:

- Queensland Transport **Pavement Design Manual**;
- Austroads **Pavement Design Manual** (where relevant).

3.3.4 Design Traffic – Major Traffic Routes

Where relevant, as determined by Council, design traffic for major traffic routes shall be as shown in **Table 3.3-E** below. Higher ESA values may need to be used on existing major traffic routes:

Table 3.3-E Design Traffic – ESA's

Road Classification	Design Traffic – ESA
Two Lane Road – Urban/ Rural	3.7×10^5
Four Lane Road – Urban/ Rural	$> 1.0 \times 10^7$

3.3.5 Concrete Pavements

Full depth concrete roads are generally used only on heavily trafficked roads, however a full depth concrete road maybe designed for local streets. Where such an option is adopted by the consultant, the concrete pavement must be designed in accordance with **Pavement Design – Guide to the Structural Design of Road Pavements** (Austroads). Special attention must be paid to the jointing details in regard to rideability and the provision of additional conduits for future services. If chosen, concrete pavement design for any road classification shall be submitted to Council for approval.

3.3.6 Full Depth Asphalt

Full depth pavements are not generally used for local streets. However, they maybe used in areas where speed of construction is critical, such as on major roads or narrow pavement widening. Full depth asphalt must be underlain by a minimum of 100mm thick granular working platform.

Any full depth pavement design, where proposed, must be submitted to Council for approval.

The following reference publications must be used when determining detailed design pavement depths:

- **Pavement Design Guide for Lightly Trafficked Road** (Austroads);
- **Pavement Design – A Guide to the Structural Design of Road Pavements** (Austroads); and
- **Pavement Design Manual** (Queensland Transport).

3.3.7 Treated Pavement Materials

Treated pavements, which may include cement stabilisation or other stabilisation of sub-base material and treatment of imported base course material, are acceptable to Council. However, full details of the proposal must be submitted to Council for approval. A **NATA** registered laboratory must undertake all the required testing.

i) Cement Treated Materials

The properties of a cement treated layer are influenced by the nature of the material to be stabilised, percentage and type of additive, and the efficiency of the mixing process.

Cemented materials shall be designed in accordance with the Queensland Main Roads **Pavement Design Manual**. The proposed design, together with the results of tests to be undertaken in determining the design and proving adequacy of the material to satisfy design requirements, must be submitted to Council at least two weeks prior to undertaking the work.

Table 3.3-A Residential Streets – Minimum Pavement Thickness (mm)

Refer Council's Standard Drawing N° 03-02-001

CBR of Subgrade	Road Classification		
	Access Street		Collector Street
	0 – 400 VPD	401 – 750 VPD	3000 VPD
1	660*	725*	800*
2	480	525 *	590*
3	390	420	475
4	330	360	405
5	290	320	360
6	265	285	325
7	240	260	290
8	225	245	275
9	210	225	260
10	200	220	240
11	200	205	230
12	200	200	220
13	200	200	210
14	200	200	200
15	200	200	200
Minimum Course Thickness (mm)			
Asphalt Surfacing	25	25	25
Base Course Class 1B – CBR 60	100	100	100
Sub-Base Class 2 – CBR 45	100	100	100
Below Sub-Base Class 3 – CBR 15	100	100	100

* ***The pavement thickness in this range may be reduced subject to appropriate subgrade strengthening or incorporation of a modified design utilising cement treated gravels being approved by Council.***

VPD = Vehicles Per Day

Notes:

1. CBR shall be the 4 day soaked CBR value at 100% Standard Compaction and OMC and tested using a 4.5Kg surcharge weight.

2. The total pavement thickness is in millimetres and includes the Asphalt Surfacing.

3. Notwithstanding the Minimum Pavement Thickness tabulated, it is mandatory that:

- ***If the minimum thickness of Class 2 material cannot be achieved, then Class 1 material shall be used for the full pavement depth. The same requirement applies for Class 3 material.***
- ***For pavement construction, refer to Council's Standard Specification SS7 – Unbound Pavements.***

Table 3.3-B Major Traffic Routes – Minimum Pavement Thickness (mm)

Refer Council's Standard Drawing N° 03-02-002

CBR of Subgrade	Road Classification				
	Two Lane Road			Four Lane Road	
	0 – 1000 VPD	1001 – 14000 VPD	> 14000 VPD[3]	27000 VPD	> 27000 VPD[3]
1	**	**		**	
2	705*	740*		760*	
3	580*	600*		625*	
4	490	520*		535*	
5	435	455		475	
6	390	405		425	
7	355	370		385	
8	325	340		360	
9	305	315		330	
10	290	300		310	
11	275	290		295	
12	260	270		285	
13	250	255		270	
14	250	250		255	
15	250	250		250	
Minimum Course Thickness (mm)					
Asphalt Surfacing	40	40		40	
Base Course Class 1A – CBR 80	125	125		125	
Sub-Base Class 2 – CBR 45	125	125		125	
Below Sub-Base Class 3 – CBR 15	125	125		125	

* ***The pavement thickness in this range may be reduced subject to appropriate subgrade strengthening or incorporation of a modified design utilising cement treated gravels being approved by Council.***

** ***These pavement thicknesses require special submission for approval by Council and shall include supporting documentation.***

VPD = Vehicles Per Day

Notes:

1. ***CBR shall be the 4 day soaked CBR value at 100% Standard Compaction and OMC and tested using a 4.5Kg surcharge weight.***
2. ***The total pavement thickness is in millimetres and does not include the Asphalt Surfacing.***
3. ***Pavement thickness for higher traffic volumes shall be based on the current Queensland Department of Main Roads* Pavement Design Manual.**
4. ***Notwithstanding the Minimum Pavement Thickness tabulated, it is mandatory that:***
   - ***If the minimum thickness of Class 2 material cannot be achieved, then Class 1 material shall be used for the full pavement depth. The same requirement applies for Class 3 material.***
   - ***For pavement construction, refer to Council's Standard Specification SS7 – Unbound Pavements.***
5. ***2 coat seal may be used* in lieu *of asphalt in remote rural locations subject to Council approval.***

Table 3.3-C Park Living/ Rural Streets – Minimum Pavement Thickness (mm)

Refer Council's Standard Drawing N° 03-02-003

CBR of Subgrade	Road Classification				
	Park Living Access Street		Park Living Collector Street	Rural Access Street	Rural Collector Street
	0 – 400 VPD	401 – 750 VPD	2400 VPD	150 VPD	1000 VPD
1	660*	725*	800*	660	730
2	480	525*	590*	480	530
3	390	420	475	390	425
4	330	360	405	330	365
5	290	320	360	290	325
6	265	285	325	265	290
7	240	260	290	240	265
8	225	245	275	225	250
9	210	225	260	210	230
10	200	220	240	200	220
11	200	205	230	200	210
12	200	200	220	200	200
13	200	200	210	200	200
14	200	200	200	200	200
15	200	200	200	200	200
Minimum Course Thickness (mm)					
Asphalt Surfacing	25	25	25	Note[4]	Note[4]
Base Course Class 1B – CBR 60	100	100	100	100	100
Sub-Base Class 2 – CBR 45	100	100	100	100	100
Below Sub-Base Class 3 – CBR 15	100	100	100	100	100

* ***The pavement thickness in this range may be reduced subject to appropriate subgrade strengthening or incorporation of a modified design utilising cement treated gravels being approved by Council.***

VPD = Vehicles Per Day

Notes:

1. CBR shall be the 4 day soaked CBR value at 100% Standard Compaction and OMC and tested using a 4.5Kg surcharge weight.

2. The total pavement thickness is in millimetres and includes the Asphalt Surfacing.

3. Notwithstanding the Minimum Pavement Thickness tabulated, it is mandatory that:

- ***If the minimum thickness of Class 2 material cannot be achieved, then Class 1 material shall be used for the full pavement depth. The same requirement applies for Class 3 material.***
- ***For pavement construction, refer to Council's Standard Specification SS7 – Unbound Pavements.***

4. 2 coat seal may be used* in lieu *of asphalt in remote rural locations subject to Council approval.

Table 3.3-D Industrial/ Commercial Streets – Minimum Pavement Thickness (mm)

Refer Council's Standard Drawing N° 03-02-004

CBR of Subgrade	Road Classification		
	Industrial Access Street	Industrial Collector Street	Commercial Service Laneway
1	**	**	**
2	620*	740*	570*
3	495	600*	460
4	420	520*	390
5	370	455	350
6	330	405	310
7	310	370	285
8	285	340	265
9	270	315	250
10	250	300	250
11	240	290	250
12	225	270	250
13	220	255	250
14	205	250	250
15	200	250	250
Minimum Course Thickness (mm)			
Asphalt Surfacing	40	40	40
Base Course Class 1A – CBR 80	125	125	125
Sub-Base Class 2 – CBR 45	125	125	125
Below Sub-Base Class 3 – CBR 15	125	125	125

* ***The pavement thickness in this range may be reduced subject to appropriate subgrade strengthening or incorporation of a modified design utilising cement treated gravels being approved by Council.***

** ***These pavement thicknesses require special submission for approval by Council and shall include supporting documentation.***

Notes:

1. ***CBR shall be the 4 day soaked CBR value at 100% Standard Compaction and OMC and tested using a 4.5Kg surcharge weight.***
2. ***The total pavement thickness is in millimetres and does not include the Asphalt Surfacing.***
3. ***Notwithstanding the Minimum Pavement Thickness tabulated, it is mandatory that:***
   - ***If the minimum thickness of Class 2 material cannot be achieved, then Class 1 material shall be used for the full pavement depth. The same requirement applies for Class 3 material.***
   - ***For pavement construction, refer to Council's Standard Specification SS7 – Unbound Pavements.***

3.4 Design Requirements – Roads and Bikeways

3.4.1 General

These Guidelines provide Council's minimum standards for Developments encompassing roadworks including works required to join to existing development.

3.4.2 Nominal Road Reserve Widths

Generally the road reserve widths should include:

i) Council's Typical Cross Sections as follows:

- Residential Streets — Drawing 03-02-001
- Major Traffic Routes — Drawing 03-02-002
- Park Living/ Rural Streets — Drawing 03-02-003
- Industrial and Commercial Streets — Drawing 03-02-004

ii) Provision of parking to the requirements of Council's local planning policies and the principles of **Queensland Streets**.

iii) Council's requirements for transit lanes.

iv) Council's requirements for bikeway and pedestrian network allocations.

v) Council's requirements for lot access and/or parking requirements.

vi) Public Utility Service allocations.

vii) Cut and fill slopes on Major Traffic Routes.

3.4.3 Geometric Design Standards

The Geometric Design of low traffic volume streets are based on **Queensland Streets** except as specifically varied by Council.

The Geometric Design of Major Traffic Routes shall comply with Main Roads' design manuals and the Austroads publication **Intersections at Grade**. Major Traffic Routes are Arterial Roads, Sub-Arterial Roads and Distributor Roads as defined in the Gold Coast City **Transport Plan**.

3.4.4 Design Speed

The principles of **Section 2.3 Queensland Streets** should apply to ensure compliance with the nominated Design Speed. The desirable Design Speed shall be:

i)	Residential Access Street	30 km/h*
ii)	Residential Collector Street	40 km/h*
iii)	Residential Collector Street/ Designated Bus Route	50 km/h*
iv)	Two Lane Road – Urban	70 km/h
v)	Two Lane Road – Rural	Up to 100 km/h
vi)	Four Lane Road – Urban	80 km/h
vii)	Four Lane Road – Rural	Up to 100 km/h
viii)	Park Living – Access Street	45 km/h*
ix)	Park Living – Collector Street	60 km/h*
x)	Rural – Access Street	45 km/h*
xi)	Rural – Collector Street	60 km/h*
xii)	Industrial Access Street	60 km/h*
xiii)	Industrial Collector Street	60 km/h*
xiv)	Commercial Service Laneway	40 km/h

* Consultants should note that notwithstanding the 50km/h legal speed limits sign posted within residential precincts, Council's nominated Design Speeds apply where traffic calming devices are incorporated in the design in accordance with **Queensland Streets**.

3.4.5 Horizontal Alignment and Intersection Design

Horizontal Alignment and Intersection Design shall generally comply with **Queensland Streets**, Main Roads' Design Manuals and the Austroads publications, and general criteria established in **Section 2.2 – Preliminary Development Layout** of the Guidelines.

Superelevation shall be required for roads classified Major Traffic Routes as per Main Roads current design requirements.

To optimise the objectives of lower design speeds and pedestrian/ bikeway safety, the horizontal and vertical alignments should approximately coincide to provide better safety at crests and sags.

The documents referenced are not to be used to justify minimum conditions that are taken out of context.

3.4.6 Grades

Notwithstanding the grading for all kerb and channel set out in **Queensland Streets**, Main Roads and Austroads publications, the minimum and maximum grading shall be as follows unless otherwise approved by Council.

	Desirable	Absolute
i) **Residential, Park Living, Rural and Commercial Streets**		
Minimum Grading	1%	0.5%
Maximum Grading	10%	16%[1]
ii) **Industrial Streets**[2]		
Minimum Grading	1%	0.5%
Maximum Grading	5%	6%
iii) **Major Traffic Routes**		
Minimum Grading	1%	0.5%
Maximum Grading	5%	8%

Notes:

1. ***Short sections (20m max) of grade up to 20% may be considered in Park Living and Rural precinct areas to avoid earthworks disturbances.***
2. **Cul-de-sac *heads shall have an absolute minimum grading of 1%.***

3.4.7 Vertical Alignment

A vertical curve of parabolic form shall be provided at every change of grade where the algebraic change of grade exceeds 1%.

Every effort should be made to provide vertical curves as long as possible for improved appearance. However, the minimum lengths shall be:

i)	Residential Streets, Park Living and Rural Streets	20m
ii)	Major Traffic Routes (Two Lane Road – Urban), Industrial and Commercial Streets	35m
iii)	Major Traffic Routes (Four Lane Road – Urban)	60m
iv)	Major Traffic Routes (Two and Four Lane Roads – Rural)	As per Main Road's requirements
v)	At intersections (excluding Major Traffic Routes)	10m

Notwithstanding the minimum vertical curve lengths nominated, Consultants shall consider the requirements of **Section 2.10** of **Queensland Streets** for Sight Distance and Headlight Sight Distance.

3.4.8 Crossfalls

Notwithstanding the carriageway crossfalls set out in **Queensland Streets**, Main Roads and Austroads publications, the following minimum crossfalls shall apply:

i) Carriageways with asphalt surfacing 3%
ii) Carriageways with concrete segmental paving 3%
iii) Carriageways with 2 coat chip seal 3%

At intersections and *cul-de-sac* heads Council requires a contoured detail to demonstrate that there is no ponding of water. Where minimum crossfalls cannot be achieved the longitudinal grades may be used to shed the water.

3.4.9 On-Street Parking

For indented parking requirements in access streets:

- refer to **Queensland Streets Sections 2.4** and **10.5**;
- indented parking to be provided as follows:
  - for lot frontages ≥ 17.0m Nil
  - for lot frontages ≥ 12.0m to < 17.0m 0.3 spaces per lot
  - for lot frontages < 12.0m 0.75 spaces per lot
- lot frontages measured at the projection of the lot to the kerb line;
- round up spaces to full spaces;
- stagger on both side of street.

3.4.10 Footpath Verge Allocation

The verge width to be adopted shall be in accordance with the general criteria established in **Section 2.2 – Preliminary Development Layout** and **Section 3.4.2 – Nominal Road Reserve Widths**. The adopted verge width and public utility allocations shall be generally as per Council's **Standard Drawing N^{o} 03-02-005**.

3.4.11 Kerb and Channel

Concrete kerb and channel shall be provided on both sides of all carriageways unless approved otherwise by Council in accordance with Council's **Standard Drawing N^{os} 03-02-101**, **03-02-102**, **03-02-103** and **03-02-104**.

Unless otherwise approved by Council, the standard kerb and channel for streets and roads shall be 'Barrier' type kerb and channel. However, roll top kerb and channel may be used in an 'Access Street', if approved by Council.

For Major Traffic Routes, the standard kerb and channel shall be Barrier Kerb and Channel.

A full height kerb adaptor shall also be provided in the kerb and channel 400mm minimum from the projected low-side property boundary of every Residential lot.

The connection shall be a Council approved Kerb Entry Adaptor, (not uPVC) and the end shall be formed to suit the kerb profile. Connection to the kerb and channel shall be in accordance with Council's **Standard Drawing N^{o} 03-02-006**.

Barrier and Mountable Kerb Sections shall be used at roundabouts, traffic islands and off street parking bays as required by Council.

Barrier Kerb and Channel is preferred at bus stops to assist passenger movements.

Where proposed construction adjoins existing kerb and channel Council shall decide whether the existing profile is to be extended or whether the new construction will be tapered smoothly to the existing kerb and channel.

Kerb Edge Restraints may be used in Residential Precincts on one-way crossfalls only.

Kerb marking for underground Public Utility Services shall be provided as per Council's Standard Drawings.

Generally, kerb grading shall comply with **Section 3.4.6 – Grades**. However, unless demonstrated otherwise to Council, no low points shall be located on a kerb turnout. Council requires that low points be located on the straight abutting the Tangent Point.

3.4.12 Road Shoulders (No Kerb and Channel)

Council may consider road shoulders and swale/ table drains as an alternative to Kerb and Channel in approved locations.

Generally road shoulder and swale/ table drains shall comply with the following:

i) Residential, Park Living, Industrial and Commercial Precincts

- road shoulders shall be 1.0 metre minimum width sealed formation;
- road shoulders shall be of the same approved pavement material and depth as used in the carriageway;
- the minimum longitudinal grading of the swale/ table drains shall be 1 in 200.

Marking for underground Public Utility Services shall be provided as per Council's Standard Drawings.

ii) Major Traffic Routes

- the design shall follow the requirements of Main Roads design manuals;
- road shoulders shall be 2.0 metres minimum width sealed formation for use as a bike lane/ breakdown lane;
- road shoulders should be the same approved pavement material and depth as used in the carriageway.

iii) Rural Precincts

For rural areas, kerb and channel is not normally required, however, kerb and channel shall be provided through cuttings to reduce maintenance and prevent water ponding on the carriageway edge.

3.4.13 Turning Area Horizontal Geometry

Council's preferred turning area facility is a *cul-de-sac*, however where a full turning circle is not achievable Council will consider a 'Three Point Turn' in accordance with the criteria established in **Section 2.2.3.3 d) – General Planning Principles**.

a) *Cul-de-Sac*

The turning areas of *culs-de-sac* in streets shall be designed in accordance with **Queensland Streets**. Notwithstanding the kerb radii set out in **Queensland Streets**, Council's minimum radii shall be:

i) Residential Precincts

	Desirable	Minimum
Approach curve tangential to the turning circle	20m	15m
Kerb radius	10m	9m

When the desirable minimum kerb radius cannot be achieved, the following should apply:

- additional off-street parking to be provided in accordance with **Section 2.2.3.3 d) – General Planning Principles**;
- off-street parking areas shall have a minimum pavement thickness not less than that of the adjacent street;
- a 'No Parking' delineation line shall be provided within the turning area (100mm wide continuous yellow line) adjacent to the lip of kerb.

ii) Industrial and Commercial Precincts

Turning areas at the ends of *culs-de-sac* shall be full turning circles based on criteria nominated by Council for the specific application.

Approach curve	30m
Kerb radius	12.5m

b) Three Point Turns

Three point turns shall be generally designed in accordance with **Section 2.12** of **Queensland Streets** and the criteria established in **Section 2.2.3.3 d) – General Planning Principles** as follows:

- provision of additional off-street parking;
- off-street parking areas shall have a minimum pavement thickness not less than that of the adjacent street;
- a 'No Parking' delineation line shall be provided within the turning area (100mm wide continuous yellow line) adjacent to the lip of kerb.

c) Access Lanes

Access lanes shall be generally designed in accordance with the criteria established in **Section 2.2.3.3 d) – General Planning Principles** as follows:

- provision of additional off-street parking;
- the access lane shall be designed and constructed as a concrete pavement in accordance with **Pavement Design – A Guide to the Structural Design of Road Pavements (Austroads)**, with the minimum thickness of concrete being 150mm. The access land is also to have the appearance of a driveway, the profile complying with Council's **Standard Drawing N^{os} 03-02-301** to **03-02-304** for the first 6.0 metres from the kerb of the through street. Beyond this point the width of the access lane is to be 5.5 metres (to cater for on-street parking and access to lots, unless approved otherwise by Council). The gradient shall comply with **Section 3.4.6 – Grades** of these Guidelines.

3.4.14 Pavement Tapers

Pavement tapers to existing construction shall be designed in accordance with the current Main Roads and Austroads design manuals based on the design speed. Detailing should include lengths, typical sections, line marking and signing. Tapers shall be constructed to the same standard as the proposed full road pavements.

3.4.15 Service Conduits

Service conduits shall be provided at all road crossings of Public Utility Services and traffic signals, etc. They shall be located as shown on the approved services and Engineering Drawings.

3.4.16 Traffic Calming

The geometric design of Residential Precincts should generally limit vehicle speeds by physical design elements with a **minimal** use of approved speed control devices referred to in **Queensland Streets Section 2.13**.

Council may consider other innovative designs for speed control devices, which achieve the design speed and horizontal and vertical alignment criteria as set out elsewhere in these Guidelines.

Preliminary designs should be discussed with Council for approval in principle prior to proceeding with detail design.

Appropriate reference documents are:

- Austroads **Guide to Traffic Engineering Practice: Local Area Traffic Management: Part 10: 1988**;
- **Towards Traffic Calming**.

3.4.17 Entry Treatment/ Threshold Treatment

Council will consider the use of entry treatments and threshold treatments to road surfaces to reinforce the relative traffic importance and the priority of streets at intersections and point of entry to a low speed urban environment.

Feature walls and civil structures must be included in the Engineering Drawings for approval by Council, and may be classified as building works subject to the **Building Act**. Design considerations for civil structures relate to:

- pedestrian safety and convenience;
- vehicle safety (sight distance);
- access to services and utilities;
- aesthetics and visual amenity;
- economy (low maintenance, anti-graffiti materials);
- water conservation principles.

Contrasting carriageway surface treatments may be considered by Council to assist in reinforcing the road and street priorities.

For example:

- Through roads unchanged surface
- Minor street (branch) contrasting band or areas across entrances

In any event, all entry treatments and threshold treatments proposed for road surfaces must comply with Council's **Entry Statement Policy**.

3.4.18 Asphalt Surfacing

Asphalt surfacing (in accordance with Council's **Standard Specification SS8 – Asphalt Surfacing**) is the preferred wearing surface in all residential, park living, industrial/ commercial precincts and major traffic routes. However, 2 coat aggregate seals may be considered by Council in outlying and rural areas.

3.4.19 Surface Treatment – Excluding Asphalt

a) Concrete Segmental Paving

Concrete Segmental Paving may be approved as an entry treatment/ threshold treatment in accordance with relevant Council requirements (Local Planning Policy).

Council has adopted the **Concrete Masonry Association of Australia Guidelines** for use of Concrete Segmental Pavers in Subdivisional Roadways, subject to any amendments set out in these Guidelines.

b) Stencilled Concrete

Stencilled concrete may be approved in site specific locations subject to:

i) The concrete shall be Grade N32;
ii) A two (2) coat protective sealer over the surface;
iii) A skid resistance after sealing to satisfy **AS3661.1**;
iv) The manufacturers specifications and recommendations being adopted.

3.4.20 Signs and Pavement Markings

Standards

Signs and pavement marking shall conform with the provisions of the **Manual of Uniform Traffic Control Devices**, and the **Queensland Traffic Regulations**.

Residential, Park Living and Rural, Industrial and Commercial Streets

Council considers that amenity is a major consideration, and a proliferation of traffic signs and pavement marking is certainly not in keeping with the ideals of visual amenity.

While some traffic signs and pavement marking may be required for safety, the emphasis should be on designing correct traffic operation into the street system, and keeping the use of signage and marking to the essential minimum.

As an example, it should never be necessary to erect regulatory speed signs, as the appropriate speed limitation is applied by the geometric design of the street. A T-intersection does not require any signage, as the **Traffic Act** establishes priority without any need for a 'Give Way' sign.

For the street system, improved visual amenity and safer less confusing signing and line marking may be achieved by the discretionary use of control devices. The discretionary use of traffic control devices shall be approved by Council where the criteria, as set out in **Section 13** of the **Manual of Uniform Traffic Control Devices**, is satisfactorily achieved.

Major Traffic Routes

On Major Traffic Routes, the full range of appropriate signs and pavement marking shall be provided. Traffic signs should be kept to a minimum but not compromise statutory requirements or road safety.

3.4.21 Flexibeam Guardrails

For major traffic routes flexibeam guardrails shall be located in accordance with Main Roads **Urban Road Design Manual** and Council's requirements.

In residential and industrial/ commercial precincts they should generally be located at steep embankments and roadside obstacles and hazards in accordance with **Austroads Safety Barriers – 1987 NAASRA**.

The fabrication and installation of guardrails shall comply with **Queensland Department of Main Roads Standard Drawings**.

3.4.22 Road Edge Guide Posts

Road edge guide posts shall be provided at all locations where concrete kerb and channel is not constructed, eg. half road construction, tapers, rural roads and ends of roads, etc. They shall comply with Council's **Standard Drawing N^{o} 03-02-502**.

3.4.23 Bikeways

For the purpose of this section of the Guidelines, the following definitions regarding 'Bikeways', 'Bike lanes' and 'Bike paths' shall apply:

Bikeway	a designated route or corridor for bikes
Bike lanes	a designated section of on road pavement used as a bike path
Bike path	the actual facility on which bikes travel off road

Bikeway allocations shall be in accordance with the general criteria established in **Section 2.2.3.3 f) – Bikeway Network**.

Special Bikeway design consideration should be applied at the following locations:

- pinch points;
- traffic calming devices;
- roundabouts;
- high speed/ high volume traffic interfaces.

Consideration shall be given to the effect of various bikeway surface treatments at change of directions under wet conditions.

For bikeway design details Council has adopted the Austroads **Guide to Traffic Engineering Practice – Bicycles Part 14** (**Austroads**). In particular, the following requirements of bike lane widths should apply to new developments:

i)	Exclusive Bike Lanes, on road (No car parking or restricted at peaks)	2.0 metres **Clause 4.3.4** of **Austroads**
ii)	Wide Kerbside Lanes, on road (No car parking or restricted at peaks)	4.0 metres to 4.5 metres **Clause 4.3.2** of **Austroads**
iii)	Shared Bicycle/ Car parking Lanes, on road	4.0 metres to 4.5 metres **Clause 4.3.1** of **Austroads**
iv)	Exclusive Off-street (2 way)	2.5 metres to 3.0 metres **Clause 6.3.1** of **Austroads**
v)	Exclusive Off-street (1 way)	1.5 metres to 2.5 metres **Clause 6.3.1** of **Austroads**
vi)	Regional Shared or Dual-use Paths within Open Space Reserves (Pedestrians and Cyclists)	3.5 metres to 5.0 metres **Clause 6.3.2** of **Austroads**

Where bikeways are located on the footpath verge, a 1.0 metre setback from the nominal kerb line is required to provide clearance from car doors and kerb returns at driveways. Refer to **Clause 6.2** and **Figure 6.3** of **Austroads**.

For a Local dual-use bikeway (Pedestrian and Bicycle) within the street verge width, the required minimum width is 2.0 metres with a 1.0 metre clearance to the property boundary (refer **Figure 2.8B** in **Queensland Streets**).

On Major Traffic Routes Council may require a minimum width of 2.5 metres (refer **Section 4.4** in **Queensland Streets**).

Design and construction of the bike path shall comply with Council's **Standard Drawing N^{o} 03-02-401** and **AS1742.9**.

For bicycle parking provisions Council has adopted as a minimum requirement the recommended bicycle parking provisions according to land use as specified in Austroads **Guide to Traffic Engineering Practice: Bicycles Part 14: Table 5.1** as summarised in **Table 3.4-A**:

Table 3.4-A Bicycle Parking Provisions

Land Use	Employee/ Resident Parking Spaces	Class	Visitor/ Shopper Parking Spaces	Class
Cafe	1 per 25 m^2 public area	2	2	3
Drive-in Shopping Centre	1 per 300 m^2 sales floor	1	1 per 500 m^2 sales floor	3
Light Industry	1 per 1, 000 m^2 GFA	1 or 2		
Office	1 per 200 m^2 GFA	1 or 2	1 per 750 m^2 over 1, 000 m^2	3
Service Industry	1 per 800 m^2 GFA	1		
Service Premises	1 per 200 m^2 GFA	1		
Shop	1 per 300 m^2 GFA	1	1 per 500 m^2 over 1, 000 m^2	3
Take-Away	1 per 100 m^2 GFA	1	1 per 50 m^2 GFA	

3.4.24 Bus Routes

Roads in new Developments that are designated local or regional bus routes shall be designed with appropriate lane widening and set-down facilities conforming to the provisions of Main Roads and Austroads publications.

A minimum carriageway width of 10 metres shall be required for proposed bus routes.

3.4.25 Service Roads

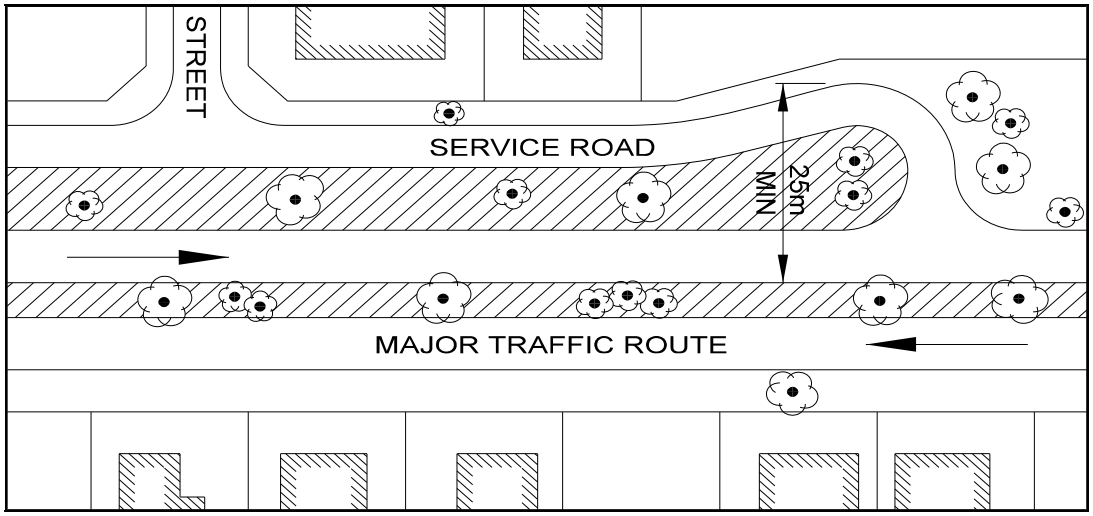
Where the noise environmental capacity of a street is exceeded, the use of Service Roads to provide noise attenuation may be approved by Council (refer to **Queensland Streets Clause 3.7**).

Figure 3.4-A details an indicative arrangement that could be used to:

- provide sufficient set-back to dwellings for noise amenity;
- improve streetscape/ landscaping;
- provide pedestrian/ bike path connections;
- allow a mix of land uses adjacent to high volume traffic roads.

Figure 3.4-A Service Road Design Speed Max 60km/hr

As Determined by Council



3.4.26 Road Bridge and Major Culvert Structures

a) General

Road bridges and major culverts (the structures) as defined in the **Bridge Inspection Manual** issued by the Queensland Department of Main Roads, Transport Technology Division, shall be designed by a Consulting Engineer, (ie. culverts that have an opening span, height or diameter greater than 1.8 metres and a waterway area in excess of 3.0 square metres).

Roads that are classified as Declared Main Roads shall have the structures designed by a Consulting Engineer approved by Council and Queensland Department of Main Roads. Structures associated with railway underbridges, railway overbridges and structures adjacent to railways shall satisfy the requirements of Queensland Rail.

In submitting designs of structures to Council for approval, Consultant's shall take into consideration the following to minimise Council's future maintenance responsibility:

- timber shall not be used for structural components;
- custom profiled galvanised steel pipes shall not be used in waterways or aggressive soils without concrete lining;
- concrete block structures are not permitted without prior written approval from Council (refer **QUDM Section 5.13** for Pipe and Material Standards);
- material and construction specifications shall be compatible with Standard Specifications, Volume 1 and 2 – Queensland Department of Main Roads.

Prior to the commencement of detailed design and documentation, the Consultant shall submit a design report, including general arrangement drawings of the proposed structure to Council for 'Approval in Principle'. The design report and general arrangement drawings shall include:

- horizontal and vertical design geometry;
- hydrologic and hydraulic data and;
- statements on environmental impact, aesthetics and future maintenance.

b) Horizontal Clearance

The horizontal alignment of the structure shall be determined from Council's requirements based on the application of the General Planning Principles (refer **Section 2.0**) and should include:

i) Council's Typical Cross Section (refer **Section 3.4.2 – Nominal Road Reserve Widths**);
ii) Provision for pedestrian walkways on both sides of the structure;
iii) Provision for bikeways in accordance with **Section 3.4.23 – Bikeways**;
iv) Provision for bus route lanes in accordance with **Section 3.4.24 – Bus Routes**;
v) Provision for Public Utility Service allocations.

c) Vertical Clearance

The vertical clearance of the structure shall be determined by Council based on the requirements for:

i) Road Clearance

The clearance shall comply with **Section 1.3.4** of Austroads **Bridge Design Code**.

ii) Waterways Clearance
   - Flood immunity clearance
   - Waterway navigation freeboard

d) Hydraulic Design

Consultants should seek Council's requirements to determine an appropriate serviceability design flood associated with the hydraulic design of proposed structures. Generally the design flood shall be calculated in accordance with **Section 3.5.7 – Drainage Design Criteria** of these Guidelines.

Road bridges shall be designed to withstand the ultimate design flood for a 2000 year Average Recurrence Interval (ARI) including impact loading from large objects within the watercourse.

e) Structural Design

Road Bridges shall be designed in accordance with the following:

- **1992 Austroads Bridge Design Code – Sections 1, 2, 4, 5 and 6**;
- **1992 Austroads Bridge Design Code – Railway Supplement**;
- **AS/NZS3845: Road Safety Barrier Systems**;
- **Queensland Department of Main Roads Standard Drawings**.

In addition, Culverts shall be designed to:

- **AS3725 – Loads on Buried Concrete Pipes**;
- **AS1597 – Pre-cast Reinforced Concrete Box Culverts:**
  - **Part 1: Small Culverts**
  - **Part 2: Large Culverts**

f) Calculations

The Consulting Engineer shall submit hydraulic and structural calculations together with the documents required by Council for approval.

g) Drawings

All detail required to construct the proposed structure shall be included in drawings.

The following details for the maintenance of the structure shall also be included in the drawings:

- borehole locations and logs with design parameters;
- serviceability flood, velocity and level, existing ground or riverbed profile, allowable excavation or scour depths at each pier and abutment;
- serviceability wind speed, design traffic loading and design dead loads on deck;
- design bearing pressures and pile capacities;
- design maximum and minimum temperatures;
- exposure classification of the structure;
- replacement or repair procedures for elements, which have a theoretical life less than 100 years.

h) Bridge Identification

A date plate made in accordance with Council's **Standard Drawing N^{o} 03-02-607** shall be cast into the upstream side of the bridge abutment at a location determined by Council.

i) 'As Constructed' Drawings

'As constructed' information shall be provided to Council in accordance with the requirements of **Section 10.0** of these Guidelines.

Any changes to construction drawings made by the consultant or contractor shall be as shown in 'as constructed' drawings. Reasons for these changes shall be included.

The following reports or documents shall also be included:

- the completion certificate from the Consultant;
- actual ground levels of the construction area before and after construction, actual locations of pile and anchors, footing and pipe tip levels, locations and levels of underground services and drainage outlets;
- Geotechnical Engineer's Report;
- summary of concrete, pile and any other testing reports.

j) On Maintenance Inspection

Level 2 inspection according to **Bridge Inspection Manual** of Department of Main Roads shall be carried out to Council's satisfaction. A paper and electronic copy of the report shall be submitted before on maintenance inspection and shall be included with the 'as constructed' drawings. The electronic copy of the report should be compatible with Council's bridge asset management software 'Bridge Offsider' developed by Assets Management Services – Queensland Department of Main Roads.

k) Off Maintenance Inspection

All defects identified during the on maintenance period. Photographs shall support rectifications carried out in areas where there is no easy access.

3.4.27 Pedestrian Bridges

Pedestrian bridges shall be designed in accordance with Austroads **Bridge Design Code** (latest edition) and other relevant Council requirements given in **Section 3.4.26 a)** to **e**) of these Guidelines. In addition, geometric design shall comply with the following requirements:

- **AS1428 – Design for Access and Mobility**;
- **A Guide to Traffic Engineering Practice AP - 11.13 – Pedestrian** and **AP - 11.14 – Bicycles**.

Notwithstanding the above requirements, Council's minimum clear width for pedestrian bridges shall be 2.5m except where deemed necessary by Council for access associated with maintenance vehicles, in which case the minimum clear width shall be 3.5m.

Bridges incorporating timber elements shall be designed in accordance with **AS1720 – Timber Structures Design Code** and incorporate Termite Management Systems, which satisfy **AS3660**. Timber design, detailing and construction shall be undertaken to achieve a 50 year design life.

It shall be a Council requirement that pedestrian bridges be designed for a 5.0kPa live load and a 20KN concentrated load.

Prior to the commencement of detailed design and documentation, the Consultant shall submit a design report, including general arrangement drawings of the proposed structure to Council for 'Approval in Principal'. The design report and general arrangement drawings shall include:

- horizontal and vertical design geometry:
- hydrologic and hydraulic data; and
- statements on environmental impact, aesthetics and future maintenance.

3.4.28 Allotment Access Design

Council requires that every allotment has satisfactory vehicular access taking into account the following:

- physical constraints;
- sight distances;
- access, verge and allotment grading/ cross section;
- street design/ layout;
- minimum depth of cover requirements to underground services;
- the functional road hierarchy of the road being accessed.

The design details and subsequent construction of vehicular access shall be submitted to Council for approval where:

- particularly restrictive physical constraints exist;
- legal access is by way of combined access, eg. battleaxe.

3.4.29 Driveway Design

The geometric design of entry and exit driveways across the verge shall conform with **Standard Drawing N^{os} 03-02-203**, **03-02-303**, **03-02-304** and **03-02-301**. For driveways and off street parking within Private property, refer to **Section 7** of these guidelines.

3.4.30 Street Names

Street names submitted for Council approval should be easy to pronounce, consist of one word and be socially acceptable. The designation 'Court', 'Crescent', 'Street', 'Road', etc. shall be consistent with the future road hierarchy.

Specific street names are to be submitted to Council for approval prior to the submission of Engineering Drawings. All Engineering Drawings shall display the approved street names.

3.4.31 Streetscape Planting

Streetscape planting shall be used to further Council's objectives of creating a sub-tropical image for parts of the city by using species compatible with naturally occurring local vegetation to improve natural land values.

In assessing planting requirements, the Consultant shall comply with Council's **Landscape Strategy Part 2 – Landscaping Documentation Manual**.

3.4.32 Kerb Numbering

Kerb numbering shall be installed on all new urban residential, commercial, industrial and park living developments in accordance with Council's **Standard Drawing N^{o} 03-02-105** prior to the development being accepted off maintenance.

To obtain kerb numbers, a copy of the sealed plan of the development shall be submitted to Council's Property **Section** Supervisor, Financial Services Directorate, who will return the copy of the plan with the kerb numbers marked thereon.

3.5 Design Requirements – Stormwater Drainage

3.5.1 General

These guidelines provide Council's minimum standards for Developments encompassing stormwater drainage including works required to join with existing and adjoining drainage systems.

QUDM shall be the basis for the design of stormwater drainage, except as amended by these Guidelines. **The references listed throughout this Section of the Guidelines for Stormwater Drainage are to clause or table numbers in QUDM unless stated otherwise**.

3.5.2 Aim

The aim of this Guideline is to provide Developers and their Consultants with Council's general criteria for stormwater drainage design, which meet the goals and objectives of the **Urban Drainage System** listed in **Section 2.0** of **QUDM** and as summarised in **Section 2.2 – Preliminary Development Layout** of these Guidelines.

3.5.3 Extent of Drainage Works

Council is currently developing a **Total Management Plan (TMP)** associated with stormwater drainage and catchment management for the entire city.

The **TMP** will provide an overall management strategy including priority of importance for:

- Master Drainage Schemes (MDS); and
- Stormwater Management Plans (SMP).

The requirements of such plans will be clearly defined within each document. Council acknowledges that a number of issues within **Section 3.5** may require further consideration and consultation with the development industry and other interested bodies. In the interim, in regard to processing development applications, consultation with the relevant assessment manager is encouraged to resolve any particular issue related to individual development on a site-specific basis.

With regard to the extent of drainage works, Council requires that the Developer meet the full cost of providing an appropriate drainage system, with capacity sufficient to pass through the Development, the design runoff from all upstream catchments (when such catchments are fully developed) in accordance with Council's **Strategic Plan**.

The Drainage system shall be designed to minimise impact of any kind to any upstream or downstream property(ies). The applicant must demonstrate that such discharge would in no way, adversely affect any land, drainage system or watercourse (refer **Section 3.0 QUDM**).

The requirement for the drainage system to have capacity sufficient to pass runoff from all upstream catchments when fully developed, applies only when a Master Drainage Scheme (MDS) for the catchment does not exist. When a Master Scheme exists, the drainage system for the development shall comply with the requirements of that Scheme.

If a Master Drainage Scheme for the Catchment does not exist, the Developer may undertake such a Scheme and forward it to Council for consideration.

All development applications are to include a Stormwater Management Plan (SMP) demonstrating the feasibility and function of the proposed drainage system(s) within the site, its compliance with any relevant Master Drainage Scheme and connection to the legal point of discharge.

In general, the minimum stormwater drainage works to be constructed by the Developer include:

a) Urban Areas

Residential Precincts and Industrial and Commercial Precincts.

i) Minor Drainage System
   a) Kerb and Channel on both sides of all roads.
   b) Gully pits at locations such that the flow in the channel does not exceed specified limits.
   c) Roof and allotment drainage systems. In particular, drainage from lots that front waterways shall be discharged to the street unless topographical constraints determine otherwise.
   d) Full piped drainage from all gully pits and other inlets to discharge at the boundary of the Development at a legal point of discharge approved by Council. Where the piped system traverses private property an easement of minimum width of 3 metres shall be dedicated in favour of Council.

ii) Major Drainage System:

   An overland flow system for runoff in excess of the capacity of the pipe system, such that the design flow is carried through the Development clear of allotments (ie. via Road or Drainage Reserve).

b) Park Living Precincts

The minor and major drainage system is to generally consist of open natural watercourses within allotments and full piped drainage within road reserves, with:

i) Generally Kerb and Channel on both sides of all roads.

ii) Gully pits at locations such that the flow in the channel does not exceed specified limits.

iii) Full piped drainage from all gully pits and other inlets, to discharge into defined natural watercourses or at a legal point of discharge approved by Council.

iv) Stabilised overland flow paths/ watercourses where required for scour and erosion protection.

v) Pipe or pre-cast concrete box culvert structures (including drainage aprons) should be located at road crossings of all natural watercourses and shall extend to the limits of the road reserve. Cross drainage design shall take into account the possible debris load from the catchment and in this regard the provision of pre-cast reinforced concrete box culverts is Council's preferred option. Masonry block construction is not permitted.

c) Rural Precincts

The minor and major drainage system is to generally consist of Open natural watercourses, with:

i) Generally gravel shoulders without Kerb and Channel on all roads.

ii) Pipe or pre-cast concrete box culverts, bridges or concrete causeways should be located at road crossings of all natural watercourses and extend to the limits of the road formation. Easements shall be provided either side of the reserve to allow necessary scour protection works to be undertaken and future maintenance works as required. These easements shall be a minimum of 5m in length, encapsulate the watercourse and allow machine access to either side of the watercourse from the road reserve. Depth of flow indicators and delineator posts shall be used to better define the areas of more frequent inundation. Cross drainage design shall take into account the possible debris load from the catchment and in this regard the provision of reinforced concrete box culverts is Council's preferred option. Masonry block construction is not desirable.

iii) Earth table drains and catchdrains in road reserves are to be stone pitched or concrete lined where required for scour protection.

iv) Rural access pipe crossings for entry to all allotments in accordance with Council's Standard Drawings.

d) Public Open Space Areas

Refer to **Section 3.5.6 – Standards for Drainage and Open Space Areas** of these Guidelines.

3.5.4 Existing Drainage

This section is to be read in conjunction with **QUDM Section 3**. The design of the proposed drainage system (both major and minor) and earthworks for the development shall be such that the upstream drainage is not adversely affected and that the downstream drainage system is capable of adequately catering for the discharge of any additional flow produced as a result of the development. If the downstream system is not capable of carrying the increased discharge the Consultant shall indicate what measures are proposed to ensure the downstream system is capable of carrying the increased discharge. Such measures should include, but not be limited to, investigation of upgrading the existing downstream system, onsite detention and regional detention facilities.

The Consultant shall provide a certificate of compliance in accordance with **Section 8 – Engineering Drawings and Document Presentation** of these Guidelines.

3.5.5 Downstream Drainage Requirements

a) General

At the time of the relevant approval, Council will determine if one or more of the following is required:

i) All downstream drainage paths have easements/ reserves as appropriate in favour of Council.

ii) Written approval from adjoining property owners adversely impacted by the Works is required from the development site to the legal point of discharge. (For the legal point of discharge, refer to **Section 3.02 QUDM** and additional requirements nominated in **Section 3.5.5 b)** below.)

iii) Hydraulic calculations are required from the Consultant indicating that post development stormwater flows do not adversely affect downstream properties or increase flood heights.

b) Legal Point of Discharge

In addition to the above requirements, Council will determine which one or more of the following is required as a lawful point of discharge:

i) To concrete kerb and channel, gullies, natural watercourse or existing enclosed stormwater drainage system abutting the development. The applicant must obtain approval from Council for any connection to Council Infrastructure.

ii) To the road reserve provided the concentration of stormwater does not adversely affect the drainage capacity of the road and/or adjoining properties.

iii) Through adjoining private property providing written permission is obtained from the relevant adjoining property owner/ s and this written permission is contractually binding to the property and its future owners.

iv) To an existing enclosed drainage system within 100 metres of the site provided the system has the capacity required. Calculations must incorporate future upstream developments.

v) To concrete kerb and channel and then to a new stormwater inlet to be provided by the Developer at a location removed from the site.

vi) To kerb and channel or existing enclosed drainage system higher than the development from a drainage pit within a site by pumping. This method will only be considered on merit when all other alternatives have been exhausted. The pumping infrastructure will remain the asset of the site owner, and will not form part of Council's drainage scheme. The applicant is to clearly demonstrate in this instance that the alteration to catchment boundaries will not cause a worsening of any kind to existing drainage systems, property or public safety.

c) Easements (refer QUDM 3.04)

Notwithstanding the requirements of **QUDM Section 3.04 h) i)** regarding easement widths, Council's requirement is for a minimum easement width of 3.0m for single pipes up to 1050mm diameter. For pipe sizes larger than 1050mm diameter, multi cell pipe drainage and/or box culverts, Council requires minimum easement widths in accordance with **QUDM** unless approved otherwise. Construction within an existing drainage easement, near or over existing stormwater infrastructure is not permitted and Consultant's should refer to the requirements of Council's **Building Near or Over Council Water, Sewer or Stormwater Services** policy (refer to **Section 7.7**).

3.5.6 Standards for Drainage Reserves in Public Open Space

The design of the road and lot layout established in **Section 2.2 – Preliminary Development Layout** of these guidelines incorporates the dedicated open space and drainage systems. Planning for draining in open space must be integrated within the whole planning process.

Planning Scheme Policies provide Council's guidelines for open space and recreation facilities and broad planning strategies (refer **Section 6** of these Guidelines, **Policy 13** and **Policy 16**). For public safety purposes, all public buildings and community facilities with amenities (ie. toilets and/or food preparation facilities) are to be located 300mm above Q100 water levels where in overland flow paths.

The drainage standards must be considered within the context of planning strategies, and in particular, to the nature of the intended function and constraints of the land.

- general open space areas with a low to high need for access by pedestrians and cyclists;
- passive areas with a low to high visitation;
- active areas in low to high tourist significant areas;
- natural watercourses with low to high ecological significance.

Appropriate drainage standards for particular areas will be approved by Council with respect to consideration of the following:

- major flood capacity;
- convenience flood capacity – minor event in terms of interval event and the time to drain ponded sites;
- maintenance costs, eg. batter slopes between 1 in 4 and 1 in 6;
- safety, eg. maximum velocity 2 m/sec;
- stability factors, eg. resistance to scour, slip;
- ecological considerations, eg. preserving valuable areas, and appropriate planting in waterway areas, minimum impact on existing riparian/ aquatic ecosystems.

3.5.7 Drainage – Design Criteria

3.5.7.1 Hydrologic Methods (refer 5.01.3 (d) QUDM)

Time-Area Runoff Routing, eg. ILSAX

It is to be noted that reference to adjusting the hydrograph to conform with the peak discharge derived from the same catchment using the Rational Method is not always correct and could give a misleading result.

The catchment shape and rainfall pattern can have a major impact on the peak discharge and designers are to be aware of this when adjusting the hydrograph obtained via ILSAX (or similar programmes) where flow data is not available.

3.5.7.2 Coefficient of Runoff (refer 5.04 QUDM), etc

Council has prepared **Table 3.5-A** below for Runoff Coefficients vs Development Categories which replace **QUDM Tables 5.04.1** and **5.04.2**.

Table 3.5-A C_{10} vs Development Category

Development Category		C_{10}		
		Slope < 1%	**1% ≤ Slope < 5%**	**Slope ≥ 5%**
Central Business, Commercial and Industrial Precincts		0.95	0.95	0.95
Urban Residential Precincts				
(Including Roads) Res D & E Res B & C	High Density	 0.90 0.80	 0.90 0.85	 0.90 0.85
Res A (Average Lot Size)	Low Density < 600m^2 > 600m^2 < 1000m^2 > 1000m^2 < 4000m^2	 0.80 0.75 0.65	 0.85 0.80 0.70	 0.90 0.85 0.75
Park Living and Rural Precincts				
Bare Rock		0.82	0.88	0.94
Rocky Clayey Soil		0.68	0.78	0.90
Open Forest/ Grassed/ Crops		0.47	0.62	0.80
Average Grassed/ Timbered		0.39	0.52	0.70
Heavily Timbered		0.30	0.40	0.58
Bare Sand		0.15	0.25	0.40
Open Space and Parks, etc.		0.55	0.65	0.75

3.5.7.3 Standard Inlet Times (refer 5.05.4 QUDM)

The use of standard inlet times shall not apply in the Gold Coast City Council area and designers are directed to use the methods outlined in **Clause 5.05.5** of **QUDM**. The minimum time of concentration shall be 5 minutes.

3.5.7.4 Overland Flow (refer 5.05.5 (c) QUDM)

Kinematic Wave Equation for Overland Sheet Flow Time

In addition to the requirements of **QUDM**, the Consultant should be aware that the time adopted for travel in a large pervious area such as a major park or urban forest, must recognise the limits of the overland flow phenomenon. It is a matter of field observation that 'sheet' flow rarely progresses more than 50 metres before entering a runnel or rill, with travel in the latter mode falling into the 'natural channel' category.

Council's preferred option is to use the Kinematic Wave Equation for the determination of overland sheet flow times. This equation takes into account that for the more intense and higher return periods the run-off occurs more rapidly.

3.5.7.5 Design Storms – Average Recurrence Interval (refer 5.06 QUDM)

Table 3.5-B below modifies **QUDM Table 5.06.1**.

Table 3.5-B Table of Recommended Design Average Recurrence Intervals

(i) Major System Design ARI (years)		**100**
(ii) Minor System Design ARI (years)		
Development Category		
Central Business, Commercial and Comprehensive Development		10
Industrial		2
Urban Residential High Density, Special Facilities, Special Purposes – greater than 20 dwelling units/ha		10
Urban Residential Low Density, Local Shopping – greater than 5 & up to 20 dwelling units/ha		2
Highway Development * as per surrounding zones but minimum of 2 years		2*
Tourist and Entertainment * as per surrounding zones but minimum of 2 years		2*
Rural and Park Living – 2 to 5 dwelling units/ha		2
Open Space Excluding Recreation Parks and Sports Parks		1
Major Road – Major Traffic Routes	Kerb & Channel Flow	10[1]
Refer GCCC **Standard Drawing N^{o} 03-02-002**	Cross Drainage (Culverts, Bridges)	50[2]
Minor Road	Kerb & Channel Flow	Refer to relevant development category
Refer GCCC **Standard Drawing N^{os} 03-02-001**, **03-02-003**, **03-02-004**	Cross Drainage (Culverts)	10[2]

Notes:

1. ***The design ARI for the minor drainage system in a major road shall be that indicated for the major road, not that for the Development Category of the adjacent area.***
2. ***Culverts under roads should be designed to accept the full flow for the minor system ARI shown. In addition, the consultant must ensure that the 100 year ARI backwater does not enter properties upstream. If upstream properties are at a relatively low elevation it may be necessary to install culverts of capacity greater than that for the minor system ARI design storm to ensure flooding of upstream properties does not occur. In addition, the downstream face of the causeway embankment may need scour protection where overtopping is likely to occur.***
3. ***The terms used in this table are described in the Glossary and/or* Table 5.06.*2 (*QUDM*).***

Notwithstanding the above, Council may require a higher recurrence intervals based on particular locality considerations, that might generally include:

- ability to accommodate the major event (**QUDM**);
- MRD flood requirements;
- afflux considerations;
- future strategic planning considerations;
- counter disaster planning consideration;
- connections with a history of interruption in flash flooding events;
- safety considerations in flood events;
- the ability to access isolated or single entry communities.

Council may consider the acceptance of lower recurrence intervals where the upgrading of sections of the road are not feasible in isolation and the development has provided compensatory elements that will assist the improvement of the road system in the future.

3.5.7.6 Intensity – Frequency – Duration Data (refer 5.07 QUDM)

A considerable volume of additional rainfall data has been collected since the analysis of rainfall data published in **Volume 2** of **Australian Rainfall and Runoff (Institution of Engineering Australia, 1987)**. In 1998, Council carried out a substantial review and reanalysis of the rainfall data available as at the end of 1997 for the Gold Coast City Region.

The results of the analysis of the available data indicates significant departures from **Maps 1.5**, **2.5**, **3.5**, **4.5**, **5.5**, **6.5**, **7C**, **8** and **9** of **Volume 2, Australian Rainfall and Runoff**. The use of design rainfall parameters derived from the Maps in **Volume 2** of **Australian Rainfall and Runoff** is no longer acceptable to Council and the maps in **Table 3.5-C** are to be used to determine design rainfall parameters and intensities using the procedures in **Section 2**, **Volume 1** of **Australian Rainfall and Runoff**. Reduced copies (A4 size) of the following standard drawings are included in this section, noting that the Standard Drawing is to be referenced when extracting information.

Table 3.5-C Table of Rainfall Maps for Use in Gold Coast City

Factor		Standard Drawing	Superseded ARR Map
Design Rainfall Isopleths			
Duration Hours	**ARI**		
1	2	59317	1.5
12	2	59318	2.5
72	2	59319	3.5
1	50	59320	4.5
12	50	59321	5.5
72	50	59322	6.5
Average Regional Skewness (ARI ≤ 100 Adopt Skew = 0)		59323	7c
Geographical Factor F2		59324	8
Geographic Factor F50		59325	9

Notes:

1. ***Skew coefficients from* Map N^{o} 7C *of* Australian Rainfall and Runoff, 1987*, should be used for estimation of design rainfall parameters for average recurrence intervals above 100 years and up to the 500 year limit of applicability of* Chapter 2 *of* ARR*.***
2. **Standard Drawings 59317 – 59325 *are reproduced at A3 size in the* Roadworks and Drainage Standard Drawings, 2001 Edition*.***

Following the review and reanalysis of Rainfall data, Council reassessed the Temporal Patterns applicable to flood studies for the Gold Coast City Region.

The results of the reanalysis of temporal patterns indicates significant departures from the temporal patterns quoted for **Zone 3 Figures 3-4 (a)** and **3.4 (b)** and **Table 3.2** of **Volume 2**, **Australian Rainfall and Runoff (1987) Edition**. Council requires that all flood studies requiring the use of temporal patterns use the temporal patterns in **Attachment 3.5-D** of these Land Development Guidelines.

3.5.7.7 Major Drainage System (refer 5.08.2 QUDM)

Further to the requirements of **QUDM**, Consultants should note that major underground piped drainage systems are not permitted unless prior approval is obtained from Council.

Where such an approval is provided by Council because an overland flow path is either impractical or unacceptable (ie. overland flowpath obstructed) then a major underground piped drainage system shall be provided. Notwithstanding the requirements of **QUDM Section 5.10.2**, where major underground piped drainage is required, inlet capacities shall be designed for Q100 flows with a 50% blockage factor.

In addition to the requirements of **QUDM**, Consultants should be aware it is a Council requirement that overland flowpaths through private property and/or easements are not permitted and pathways used for overland flows shall be dedicated as drainage reserve.

3.5.7.8 Flow Depth and Width Limitations (refer Table 5.08.1 QUDM)

Notwithstanding the freeboard nominated in **QUDM**, Council has adopted the following:

a) Major System Design Criteria

Freeboard not less than 300mm below Floor Level of an adjacent building where the building is located above street level.

Note: ***The minimum Floor Level is to be the greater of:***

- ***300mm above the Q100 Flood Level as nominated by Council; or***
- ***300mm above the Flood Level for the major flood event within the road reserve.***

The Floor Level controls must be nominated on the stormwater drainage plans or asset register.

b) Minor System Design Criteria

The total flow for the minor flood event shall be contained within the drainage easement or drainage reserve provided through an open space. This may include low flow pipes (minimum size 375mm diameter) subject to Council approval.

3.5.7.9 Gully Inlet Types (refer 5.10.1 QUDM)

In addition to the three types of gully inlet nominated in **QUDM** and Council's standard drawings, Council will allow alternative inlet systems approved by Council, noting that these systems shall comply with **Standard Specification SS5 – Stormwater Drainage Construction**.

Inlet capacity charts for the standard inlet types shall be adopted as follows:

i) Council's Standard Side Inlet Gully (Standard Drawing N^{os} 03-03-001 and 03-03-002)

Council has recently completed full scale hydraulic testing (in conjunction with other Authorities) of Lip 'n' Line Gully Pit configurations. Accordingly, the inlet capture charts shown on **Standard Drawing N^{os} 03-03-501** to **03-03-504** and **03-03-601** to **03-03-604** provide inlet capacity rates for a kerb in line IMEAQ (similar) pit. The charts have been produced for barrier and roll top kerb profiles for on grade and sag configurations. Appropriate reduction factors in accordance with **QUDM** have been included and are to be applied to the on-grade capacity charts for the Lip 'n' Line Gully Pit configuration.

No reduction factor is to be applied to the sag capacity charts. As a result of the hydraulic testing program, modified freeboard requirements shall be used for the Lip 'n' Line gully pit. Refer to **Section 3.5.7.19 – Start Hydraulic Grade Level** of these Guidelines.

The maximum depth of the side inlet gully is 1.5 metres in accordance with Council's **Standard Drawing N^{os} 03-03-001** and **03-03-002**.

Hydraulic capture charts have been included in A4 format following **Section 3.5.9.10 – Intersections** of these Guidelines, however the charts are reproduced in A3 size in the **Roadworks and Drainage Standard Drawings**, **2005 Edition**. Additional on-grade equations are also produced in A3 size only and included in the **Roadworks and Drainage Standard Drawings**, **2005 Edition**. The A3 size standard drawings should be referenced when extracting any information.

ii) Pre-cast Stormwater Inlet System (Council's Standard Drawing N^{o} 03-03-003)

The pre-cast stormwater drainway inlet system is an alternative pre-cast gully manhole inlet configuration that can be utilised where the Consultant prefers this type of inlet and pipe configuration as detailed in **Section 3.5.7.15 – Drainline Location** of these Guidelines.

Refer to **QUDM Volume 2**, **Appendix 3** for inlet capacity charts.

Where deemed appropriate by Council, the use of cast *in situ* gully manholes maybe approved where the Consultant can demonstrate that approved proprietary products cannot be utilised.

iii) Council's Standard Field Inlet (Council's Standard Drawing N^{o} 03-03-008)

The standard field inlet size and depth requirements are shown on Council's **Standard Drawing N^{o} 03-03-008**. Field inlet capacity charts are shown in **Section 3.5.7.11 – Field Inlets** of these Guidelines.

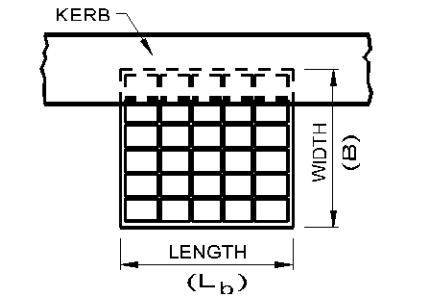
3.5.7.10 Intersections (refer 5.10.3(d) QUDM)

Council will only approve anti-ponding gully inlets within kerb turnouts in special circumstances. Consultants should refer to **Sections 3.4.7 – Vertical Alignment** and **3.4.11 – Kerb and Channel** of these Guidelines.

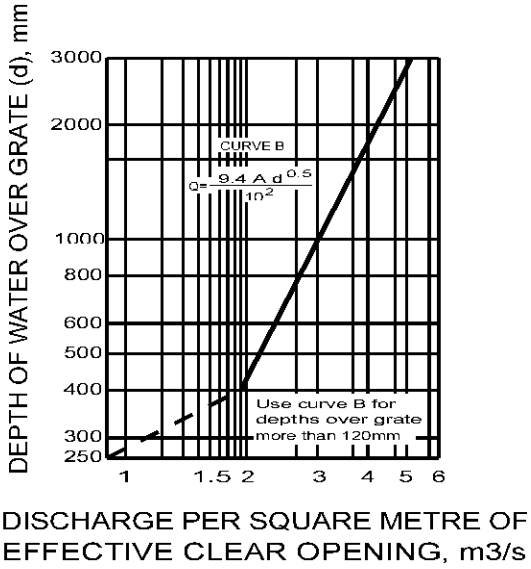
3.5.7.11 Field Inlets (refer 5.10.4 QUDM)

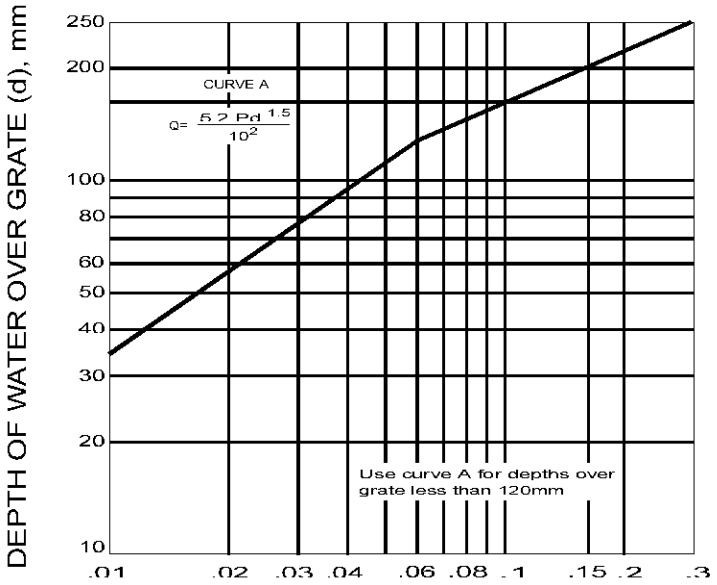
Field Inlet Capacity Charts are provided in **Figure 3.5-A** below for various sizes of gully and depth of ponding over the grate. The allowable depth of ponding depends on location, 250mm being an average maximum.

Figure 3.5-A Field Inlet Capacity



$P=2B+L_b$
OR
$P=2(B+L_b)$ WITHOUT KERB
A=AREA OF CLEAN OPENING IN GRATE





3.5.7.12 Manholes (refer 5.11.1 QUDM)

In addition to the requirements of **QUDM**, Council also requires manholes to be installed directly upstream of revetment walls as shown on Council's **Standard Drawing N^{o} 03-03-204**.

Pre-cast manholes from Council's **Approved Product List for Stormwater Drainage** may be used provided they are installed in accordance with the manufacturer's recommendations. The diameter of the manhole access opening and cover to converter slab must conform to Council's standards.

3.5.7.13 Manhole Tops (refer 5.11.2 QUDM)

Where drainage manholes are located in flood prone areas or where the design hydraulic grade line is above the top of the manhole, bolt down manhole tops shall be provided as directed and/or approved by Council.

3.5.7.14 Reduction in Pipe Size (refer 5.11.4 QUDM)

Consultants should note that where a pipe size reduction is allowed in **QUDM** and these guidelines, the manhole outlet should be 'bell mouthed' to the same size as the upstream pipe diameter through the wall of the manhole to the downstream pipe.

3.5.7.15 Drainline Location (refer 5.12 QUDM)

Council's standard drainline location is as follows:

a) Cast *In Situ* Gully Inlet (refer Council's Standard Drawing N^{os} 03-03-001 and 03-03-002)

Council will allow gully-to-gully piped systems where pipes are connected between gully pits instead of manholes with both the inlet and outlet pipes connected to the gully pit walls provided the following criteria are met:

- maximum gully to gully connection pipe is 600mm diameter or less;
- gullies are constructed in accordance with Council's standard drawings;
- acute angles in connecting pipes are avoided to minimise head losses;
- potential interferences with other utility services and guardrails on the footpath is to be avoided;
- the main drainage line (spine) of the gully system is to be constructed on one side of the road only. The number of gully-to-gully connections is unlimited unless specified otherwise in these Guidelines. Any gullies on the opposite side of the road shall be connected directly (as close to 90° as possible) across the road;
- a maximum of three (3) gully to gully to MH connections is allowed on the 'non-spine' side of the drainage system prior to connecting across the road.

Once the maximum requirements of the gully-to-gully system have been reached, the gullies are to be connected to a conventional herringbone drainage pattern.

b) Pre-cast Stormwater Inlet System (refer Council's Standard Drawing N^{o} 03-03-003)

Pre-cast Stormwater drainway inlet/ gully manhole systems are generally accepted for general use by Council. The alignment of the pipe system shall be in accordance with the details as noted on Council's **Standard Drawing N^{o} 03-03-003**.

The standard alignment for drainlines, other than gully-to-gully connections, is 2.0 metres measured towards the road centreline from the nominal face of kerb. For standard width access streets, as shown on Council's **Standard Drawing N^{o} 03-02-001**, the drainline alignment shall be on the centreline of the street. The pipework layout, should in most cases, be the conventional herringbone layout. Refer to **Section 3.5.7.17 – Roof and Allotment Drainage System** for allotment drainage location.

3.5.7.16 Pipe and Material Standards (refer 5.13 QUDM) and Structural Design of Pipelines and Manholes (refer QUDM 5.14)

a) General

Council requires that in locations where the drainage system will be subjected to a salt water environment and/or aggressive ground water conditions, Consultants should liaise with the relevant suppliers for an appropriate product designed to comply with the current Australian Standard and to meet the specific site conditions.

b) Pipes

Pipes and pipe laying shall generally comply with the requirements of **QUDM**, **Table 5.13.1** except that spigot and socket rubber ring jointed pipes shall be used irrespective of ground conditions for sizes up to 600mm diameter. Consultants should note the requirements of Council and **QUDM** where spigot and socket rubber ring joint pipes are required for all sizes of pipe in unstable ground, when pipes are laid in sand and other special circumstances. Refer **QUDM Section 5.13.3.**

In addition to the requirements of **QUDM**, Council also requires the use of spigot and socket rubber ring joint pipes for all pipe sizes in the following circumstances:

- where the drainage pipeline is located in Private property; and
- where the pipeline is subject to any tidal influence.

Notwithstanding the minimum pipe size requirements of **QUDM Section 5.13** and excluding roof and allotment drainage systems, a minimum pipe size of 600 mm diameter is to be adopted for drainage systems within Private property where the drainage system conveys stormwater from any external public property, eg. roads, parks, etc.

c) Box Sections

It is a Council requirement that box sections shall only be constructed from pre-cast reinforced concrete box culvert sections.

d) Structural Design

The structural design of drainage pipelines shall be carried out in accordance with **AS3725 – Loads on Buried Concrete Pipes**.

Council's minimum strength class for concrete drainage pipes shall be Class 2.

Consultants should refer to **QUDM Section 5.14** for further detail regarding the consideration of adequate cover over pipes for imposed loads during construction. Consultants should liaise with the relevant suppliers for an appropriate product designed to comply with current Australian Standards and meet the specific site conditions.

Consultants should note that fibre reinforced pipes are Council's preferred option for situations where pipelines maybe subject to tidal waters.

Council requires that engineering drawings submitted for approval must show the following information for each drainage line:

- type and class of pipe;
- installation and bedding details;
- construction method (backfill layer thickness, compaction equipment, etc.)

3.5.7.17 Roof and Allotment Drainage System (refer Table 5.18.3, Table 5.18.4 and Table 5.18.6 QUDM)

The level of inter allotment drainage required will be as follows (refer **QUDM Table 5.18.3**):

Land Use	Drainage Level
Residential A (Low Density), Special Residential	III
Residential B, C, D & E (High Density), Commercial and Industrial	III, IV, V

For design recommendations associated with the '**Rear of Allotment Drainage System**' (refer **Table 5.18.4 QUDM**), the following minimum pipe sizes should be adopted:

Item	Level Applicable				
	I	II	III	IV	V
Minimum Pipe Size (mm)	NA	NA	225*	375	375

Note:

* ***The minimum diameter pipe size for level III will be as shown above except in some waterfront developments where a smaller size may be approved by Council.***

Typically the alignment of the allotment drainage shall be central to the drainage easement. When a stormwater allotment pipe shares an easement with a sewerage line, the stormwater pipe shall be 1m offset from the boundary line.

For design criteria associated with Inter Allotment Drainage, refer **QUDM** '**Level III Rear Allotment Drainage System**' **Table 5.18.6**. **Consultants should note that the nominal pipe diameter of 150mm is not acceptable.**

3.5.7.18 Hydraulic Calculations (refer 5.21 QUDM)

The hydraulic gradeline calculations must take into consideration the impact of a gross pollutant structure where one is identified as a requirement in the MDS, SMP or as otherwise deemed appropriate by Council.

3.5.7.19 Start Hydraulic Grade Level (refer 5.21.6 QUDM)

Where an urban piped drainage system discharges to tidal waters, start HGLs for the locations listed in **Table 3.5-D** below must be adopted:

Table 3.5-D Start Hydraulic Grade Lines (HGL)

Tidal Waters	Description	Water Level AHD
Pacific Ocean		0.90m
Southport Broadwater	All direct connected canals Coombabah-d/s Oxley Dve Bridge Biggera Ck-d/s GCHwy Bridge Loders Ck-d/s Stevens St Bridge Gardiners Ck-d/s Radford St Bridge Nerang River-d/s Bundall Rd Bridge Little Talle Ck-d/s Monaco Bridge	0.90m
Coombabah Creek	Oxley Dve to Gold Coast Hwy Bridges	1.00m
Biggera Creek	GCHwy Bridge to Central St Culvert	1.00m
Loders Creek	Stevens St to Johnson St	1.00m
Nerang River	Bundall Rd to Ross St Bridges (include direct connected canals)	1.00m
Little Tallebudgera Creek	Monaco St to T E Peters Dve Bridges T E Peters Dve to Hooker Blvd Bridges u/s Hooker Blvd Bridge	1.00m 1.00m 1.20m
Tallebudgera Creek	All direct connected canals d/s Pacific Hwy Bridge	1.00m
Currumbin Creek	d/s Pacific Hwy	1.00m
Cobaki Broadwater	Tweed Heads	1.20m

Note:

1. ***The above start HGLs do not include any allowance for tidal or flood surge effects. Greenhouse Effect should also be considered. Refer to* Section 7.0 *of* QUDM, Section 3.5.7.22 – Discharge to Tidal and Other Waterways *of these Guidelines and Council.***
2. ***TWL's for systems with obverts above the nominated start HGL's are to be calculated, with the obvert of the outlet the minimum TWL.***

Consultants should seek Council's requirements for start HGL's associated with non-tidal waters or other waterways not specified above.

3.5.7.20 Pipe Capacity (refer 5.21.7 QUDM)

Calculations for stormwater pipe capacity flowing full may also be based on Colebrook-White using K = 0.6 minimum.

3.5.7.21 Freeboard at Inlets and Junctions (refer 5.21.5 QUDM)

Notwithstanding the requirements of **QUDM Table 5.21.1** regarding minimum freeboard recommendations for gully inlets and manholes, **Table 3.5-E** below provides Council's requirements for gully inlets on grade. All other freeboard requirements for gully inlet in sag, field inlet and manhole or junction structure shall be in accordance with **QUDM Table 5.21.1**.

Table 3.5-E Gully Inlet – Freeboard (mm)

Longitudinal Road Grade	Lintel	
	S	M) + L
≤ 3%	150	150
> 3%	150	350

S = Small Lintel 2.4m M = Medium Lintel 3.6m L= Large Lintel 4.8m

Freeboard measured from lowest side of channel invert.

3.5.7.22 Discharge to Tidal and Other Waterways (refer 7.00 QUDM)

Consultants should seek Council's requirements to determine an appropriate allowance for Storm Surge and Greenhouse Effect (refer **QUDM Sections 7.02** and **7.03**) when establishing tailwater levels for outfalls to tidal and non-tidal waters in accordance with current Council Policy. Some start hydraulic grade levels for tidal waters have been listed in **Section 3.5.7.19** of these Guidelines.

For particular requirements associated with Design and Protection of Tidal and Non-Tidal Outlets and Siltation (refer to **QUDM Sections 7.07**, **7.08** and **7.09**). Notwithstanding these requirements of **QUDM**, the lowest invert level of the drainage system at the outlet shall not be lower than MLWS or the standing water level of the receiving waterway/ lake or water course.

Drainage outlets should not be permanently submerged.

Consultants should liaise with Council prior to commencing detail design.

It should be noted however, that in relation to Non-Tidal Outlets, appropriate consideration should be given to design and protection for locations of outlets where discharge is directed over surfaces that have not been subjected to concentrated flows previously and where significant scour and erosion may result.

Drainage works which require physical alterations to a natural watercourse and/or its flow regime require Department of Natural Resources approval in accordance with the **Water Resources Act 1989**.

Notwithstanding Department of Natural Resources approval, open drains and watercourses, either natural or manmade, shall be protected from scour and erosion as directed or approved by Council.

Note: ***All construction within the tidal zone requires Section 86 approval under the Harbours Act.***

Refer to **Section 3.6 – Design Requirements – Waterfront Developments** of these Guidelines.

3.5.7.23 Swale/ Table Drains

Swale/ table drains may be considered by Council in urban areas as part of an integrated stormwater quality management system where:

- total catchment does not exceed 2 ha;
- top width to depth ratio 6:1 or greater;
- side slopes 1:4 (H:V) or flatter;
- design flow velocity is less than 2m/sec;
- underlying soils have high permeability;
- sub-soil drainage is included in the proposed swale where longitudinal grade of the swale is less than 1:200;
- adequate road reserve is provided to accommodate other verge elements.

3.5.8 Stormwater Quality Improvement Devices

Stormwater Quality Improvement Devices (SQIDS) are one of a number of devices used to improve the quality of stormwater run off from developed urban areas which form part of the stormwater 'treatment train' associated with a stormwater management strategy.

SQIDs work by reducing the amounts of pollutants that enter Council's waterways, creeks, estuaries and the ocean beaches.

Types of SQIDs that are typically constructed to form part of a 'treatment train' include:

- Gross Pollutant Traps (GPTs);
- trash racks/ litter control devices;
- constructed (artificial) wetlands;
- Gully Pit Baskets and Nets;
- Chemical/ Biological Pollutant Devices.

SQIDs are not the only way that stormwater quality can be improved to protect downstream receiving environments. Other options include non-structural measures (ie. education, enforcement strategies) and **Water Sensitive Urban Design** (**WSUD**) elements such as porous paving, grass swales, infiltration areas, etc.

Developers and their Consultants should refer to Council's current document on **Stormwater Quality Management Guidelines for Development Applications**.

The document provides detail in relation to:

- when SQUIDS are required;
- key design criteria;
- water quality objectives; and
- preparation of maintenance plans.

3.5.9 Gross Pollutant Control Devices

3.5.9.1 Introduction

A Gross Pollutant Control Device (GPT) is any structure or facility intended to remove solid type pollutants 2 mm and larger and floatable pollutants 25mm and larger.

Gross Pollutant Control Devices do not include:

a) Wetland design to remove physical, chemical or biological pollutants and fine sediments less than 2 mm and colloidal material.

b) Water quality structures intended to remove chemical or biological pollutants from industrial/ commercial sites, carparks and road surfaces (ie. oils, etc).

3.5.9.2 Source and Type of Pollutant

All forms of development and land use generate gross pollutants of one kind or another.

In residential areas, the bulk of the volume of pollutant could be grass clippings, etc., with only small volumes of plastic, bottles, cans, etc. Residential areas also contribute pollutants as a result of household activities such as renovation works, painting, pet droppings, detergents and oils from car washing. Studies and logic indicate that a significant proportion of gross pollutants discharged to waterways is generated by residential land, as this type of development constitutes a significant proportion of the land use in most catchments.

In tourist areas and general commercial and office areas, the type of pollutant is more likely to be floatables (ie. cans, cigarette butts, paper, food wrappers, etc) and motor vehicle generated pollutants (eg. oils, brake linings, etc). These items, when discharged to waterways are highly visible to the public. The volume of pollutant may be small in comparison with pollutants generated elsewhere in the system, but degrade the appeal of the waterway.

Industrial areas are more likely to generate gross pollutants such as polystyrene, wood particles, cardboard, wrappings, etc. Industrial sites are also more likely to generate spills of oil, chemicals and similar liquid contaminants, which are not generally trapped by physical gross pollutant control devices.

Shopping centre developments are more likely to concentrate pollutants related to food, packaging and motor vehicles (parked vehicles leak oils, cars deposit brake linings, etc).

Park Living and Rural developments are likely to generate volumes of organic matters (ie. grass, leaves, etc) and chemical pollutants associated with farming type land use.

In assessing the source of type of pollutant to be collected, consideration needs to be given to potential change in pollutant source and type of pollutant which may occur as a catchment develops or is redeveloped.

3.5.9.3 Safety

All proposed Gross Pollutant Control Devices must be fitted with suitably designed lockable access covers approved by Council, which prevent entry of unauthorised persons.

3.5.9.4 Maintenance

The recurrent cost of maintenance/ cleanout of the Gross Pollutant Control Device is significant to Council and the maintenance/ cleanout procedure to be adopted for the Gross Pollutant Control Device will need to utilise plant and equipment currently used by Council's maintenance operations.

3.5.9.5 Location of Gross Pollutant Control Devices

The location for installation of Gross Pollutant Control Devices should be based on an assessment of the stormwater drainage catchment both upstream and downstream of the proposed siting.

The assessment should:

a) Identify the size, hydrological and hydraulic response of the catchment; and

b) Identify the source and type of pollutants likely to be generated by the catchment both present and in the future.

Gross Pollutant Control Devices are to be located such that a downstream overland flow path through public road or open space is available to carry any surcharge flows which may occur by blockage of the Gross Pollutant Control Device or other causes.

A downstream overland flow path through private land or easement is not appropriate.

Gross Pollutant Control Devices should only be located at sites where access for inspection and maintenance can be carried out using Council's standard maintenance vehicles. Provision for maintenance vehicles off the road carriageway must be provided in the form of a hardstand area adjacent to the Gross Pollutant Control Device. Access requirements should be similar to the layout as shown on Council's **Standard Drawing N^{os} 03-07-401** and **03-07-402**.

The location of Gross Pollutant Control Devices in swampy areas, at the bottom of embankments or other inaccessible locations is not permitted.

Where practicable, Gross Pollutant Control Devices should be located adjacent to sewers, and not be located near electrical equipment.

3.5.9.6 Gross Pollutant Control Device Design Recurrence Interval

An assessment of the required design recurrence interval for the sizing of Gross Pollutant Control Device has established:

- Gross Pollutant Control Devices should be sized to treat a storm event having a minimum recurrence interval of 1 in 3 month;
- Gross Pollutant Control Devices sized to treat the 1 in 3 month storm event will treat about 85 percent of the total volume of flow in the drainage system.

The use of an empirically derived flow rate based on a rainfall excess applied over the catchment is not acceptable (ie. first flush is 20mm of rainfall).

Design rainfall for sizing of the gross pollutant control device is to be based on the Intensity Duration Data in **Clause 3.5.7.6** and the following table for calculation of rainfall less than one (1) in one (1) year, ARI unless otherwise approved.

Table of Proportions for Determination of Rainfall for ARI's less than 1 in 1 year.

Design ARI	1 month	2 month	3 month	4 month	6 month	9 month	12 month
Proportion of 1 in 1 year ARI	0.25	0.40	0.50	0.60	0.75	0.9	1.0

At specifically defined locations it may be necessary to design GTP'S to treat flows from a recurrence interval greater than the 1 in 3 month event. This requirement will be based on an assessment of the capacity of the receiving waterway downstream of the GPT to accept a pollutant load and the hydraulics of the drainage system.

3.5.9.7 Hydraulics at Gross Pollutant Control Devices

Detailed hydraulic calculations will need to be prepared to establish the hydraulic response of the drainage system downstream and upstream of the Gross Pollutant Control Devices as follows:

New Drainage – Gross Pollutant Control Devices to be installed

Where a Gross Pollutant Control Devices is to be installed on a new drainage system, the full hydraulic losses through the device are to be assessed and the drainage system and Gross Pollutant Control Devices sized accordingly to prevent surcharge at the pit/ manholes located upstream of the device during a Q2 event.

New Drainage – Gross Pollutant Control Devices to be retrofitted at some future date

Hydraulic loss through Gross Pollutant Control Devices equal to 1.5 times the velocity head at the potential site for a Gross Pollutant Control Devices, or at the outlet of the system for a Q2 event.

3.5.9.8 Existing Drainage – Retrofitting

Where it is proposed to retrofit a Gross Pollutant Control Devices on an existing stormwater drainage system, the hydraulic assessment will need to consider:

- potential surcharge flows;
- potential overland flowpaths;
- upsizing of Gross Pollutant Control Devices to reduce hydraulic losses;
- impacts on road, reserves and private lands upstream and downstream of the Gross Pollutant Control Device.

3.5.9.9 Acceptable Gross Pollutant Control Devices

There are a number of Gross Pollutant Control Devices available from industry suppliers for installation on stormwater drainage systems.

3.5.9.10 Alternative Gross Pollutant Control Device Designs

Where a submission and/or design for a Gross Pollutant Control Device proposes a device which is not on Council's approved product list the design will need to be submitted to Council to assess:

- the performance, efficiency and suitability of the device; and
- the potential cost of maintenance of the device.

Detailed calculations and test results (laboratory and field) will need to be submitted to provide verification of the claims being made as to performance, efficiency, suitability and maintenance costs for the device proposed.

Submissions to Council shall include:

i) Catchment plan together with hydrological and hydraulic calculations. Calculations should generally commence at the outlet of the drainage system to a waterway under the control of Council or other location nominated.

ii) Sketches of the proposed Gross Pollutant Control Device.

iii) Facts detailing the performance of the Gross Pollutant Control Device.

iv) Details of the verification procedure to be applied by Council to confirm that the Gross Pollutant Control Device is performing as stated by the designers.

v) Copies of reports on the performance of the device from laboratory and/or field trials.

vi) Details of locations where similar Gross Pollutant Control Device have been constructed, including name of authority and contact telephone number of person who can provide verification as to the performance of the Gross Pollutant Control Device in service.

vii) Details of cleanout/ maintenance procedures to be adopted. Cleanout/ maintenance will need to utilise plant and equipment currently in use by council. Requirements for use of specialised equipment not currently available to Council's maintenance operations may preclude the use of the Gross Pollutant Control Device.

viii) Structural calculations showing the device, the roofs and access covers are designed for a W7 traffic load. Council prefers access covers to be of checker plate or similar construction. Access covers are to be large enough to enable vertical removal of components where required.

ix) Inspection/ maintenance access lids shall be provided to Gross Pollutant Control Device. The lids shall be 900mm x 600mm in size and shall have recessed hinges and padlocks. The inspection access lids are required to all chambers and chamber areas where separated by dividing walls or weirs.

x) Maintenance drop boards are required to isolate the device from upstream and downstream flows. The drop boards must stay with the device and designed to be lowered in position within Workplace Health and Safety lifting requirements.

xi) No confined space entry is permitted for regular maintenance cleanouts.

xii) Details of guarantees as to the long term performance of the device.

For a design to be acceptable, it will need to satisfy the following minimum requirements:

- treat a minimum design flow of 1 in 3 month ARI;
- capture a minimum of 90 percent of solid type pollutants 2mm and larger at the design ARI;
- capture a minimum of 75 percent of floatable pollutants having dimensions of 25mm in length, 10mm in width and 10mm in depth at the design ARI;
- prevent resuspension of captured pollutants during flows in excess of the design ARI;
- recapture a minimum of 90 percent of pollutants resuspended by back flushing;
- have a mechanism for self cleansing to prevent blockage of grills/ mesh;
- does not increase the hydraulic gradeline in an existing stormwater drainage system at the first pit/ manhole upstream of the device by more than 150mm at a flow equal to the Q2 flow from the catchment;
- does not create surcharge at the pit/ manhole immediate upstream of the device unless there is an acceptable overland flowpath in public road, park or reserve;
- is suitably located in public road, park or drainage reserve;
- provides for hydraulic isolation of the device during cleanout;
- when located in areas where tidal backflow is present, the downstream drain includes provision of a tide gate to prevent tidal inflow.

Attachment 3.5-D Temporal Patterns for Gold Coast City Council

(Based on Reanalysis of Rainfall Data for Gold Coast City Council)

10 MINUTE DURATION in 2 PERIODS OF 5 MINUTES

Period	1	2
ARI ≤ 30 Years	39.9%	60.1%
ARI > 30 Years	45.1%	54.9%

15 MINUTE DURATION in 3 PERIODS OF 5 MINUTES

Period	1	2	3
ARI ≤ 30 Years	32.3%	45.3%	22.4%
ARI > 30 Years	33.0%	39.6%	27.4%

20 MINUTE DURATION in 4 PERIODS OF 5 MINUTES

Period	1	2	3	4
ARI ≤ 30 Years	19.9%	38.3%	27.5%	14.3%
ARI > 30 Years	22.0%	32.5%	26.6%	18.9%

25 MINUTE DURATION in 5 PERIODS OF 5 MINUTES

Period	1	2	3	4	5
ARI ≤ 30 Years	13.7%	33.6%	24.5%	18.4%	9.8%
ARI > 30 Years	16.2%	28.0%	22.9%	19.1%	13.8%

30 MINUTE DURATION in 6 PERIODS OF 5 MINUTES

Period	1	2	3	4	5	6
ARI ≤ 30 Years	13.2%	29.8%	22.5%	17.2%	10.1%	7.2%
ARI > 30 Years	14.6%	24.6%	20.6%	17.2%	12.5%	10.5%

45 MINUTE DURATION in 9 PERIODS OF 5 MINUTES

Period	1	2	3	4	5	6	7	8	9
ARI ≤ 30 Years	6.2%	9.7%	11.2%	24.3%	18.6%	13.5%	7.7%	4.9%	3.9%
ARI > 30 Years	7.6%	10.5%	11.4%	19.7%	16.5%	12.8%	8.7%	6.7%	6.1%

1 HOUR DURATION in 12 PERIODS OF 5 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12
ARI ≤ 30 Years	4.0%	7.5%	9.6%	13.4%	13.2%	21.2%	8.5%	6.3%	5.3%	4.6%	3.4%	3.0%
ARI > 30 Years	5.1%	8.0%	9.4%	12.3%	11.7%	17.0%	8.7%	7.0%	6.2%	5.6%	4.6%	4.4%

1.5 HOUR DURATION in 18 PERIODS OF 5 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ARI ≤ 30 Years	2.9%	4.4%	8.3%	9.0%	16.5%	13.1%	6.6%	6.3%	5.8%	5.1%	3.7%	4.1%	3.3%	2.6%	2.4%	2.1%	2.0%	1.8%
ARI > 30 Years	3.5%	4.9%	8.0%	8.2%	13.1%	11.3%	6.6%	6.4%	6.1%	5.6%	4.3%	4.7%	3.9%	3.2%	3.0%	2.7%	2.4%	2.1%

2 HOUR DURATION in 24 PERIODS OF 5 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ARI ≤ 30 Years	2.0%	2.6%	5.5%	14.3%	11.4%	6.7%	7.9%	6.1%	4.5%	3.9%	3.5%	3.2%	3.0%	2.4%	2.7%	3.3%	2.5%	2.9%	2.2%	2.1%	1.9%
ARI > 30 Years	2.5%	3.2%	5.5%	11.2%	9.7%	6.2%	7.0%	5.9%	4.6%	4.1%	3.7%	3.6%	3.4%	3.1%	3.2%	3.6%	3.2%	3.4%	2.8%	2.6%	2.2%

3 HOUR DURATION in 12 PERIODS OF 15 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12
ARI ≤ 30 Years	4.4%	16.5%	23.0%	10.8%	7.0%	6.1%	5.2%	7.0%	10.2%	3.9%	3.3%	2.6%
ARI > 30 Years	5.4%	14.5%	18.5%	10.1%	7.5%	6.8%	6.1%	7.3%	10.0%	5.0%	4.7%	4.1%

4.5 HOUR DURATION in 18 PERIODS OF 15 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ARI ≤ 30 Years	8.5%	6.2%	4.4%	7.2%	4.8%	5.4%	3.6%	9.3%	17.7%	12.7%	4.0%	2.6%	2.3%	2.1%	1.4%	2.9%	3.2%	1.7%
ARI > 30 Years	8.2%	6.4%	4.9%	7.2%	5.3%	5.7%	4.3%	8.5%	14.1%	11.0%	4.6%	3.2%	2.9%	2.7%	1.5%	3.6%	3.8%	2.1%

6 HOUR DURATION in 12 PERIODS OF 30 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12
ARI ≤ 30 Years	3.9%	4.5%	5.9%	10.8%	22.9%	8.0%	16.2%	6.9%	5.2%	3.2%	9.9%	2.6%
ARI > 30 Years	5.0%	5.5%	6.6%	10.1%	18.4%	8.3%	14.2%	7.4%	6.1%	4.5%	9.8%	4.1%

9 HOUR DURATION in 18 PERIODS OF 30 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ARI ≤ 30 Years	2.6%	3.2%	1.7%	2.3%	4.1%	3.7%	5.4%	7.1%	10.8%	10.2%	17.5%	6.9%	5.2%	4.6%	2.9%	1.9%	6.4%	3.5%
ARI > 30 Years	3.3%	3.9%	1.8%	2.8%	4.7%	4.3%	5.7%	6.8%	9.3%	9.3%	13.9%	6.8%	5.7%	5.1%	3.6%	2.3%	6.5%	4.2%

12 HOUR DURATION in 24 PERIODS OF 30 MINUTES

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ARI ≤ 30 Years	1.8%	1.2%	1.5%	1.7%	2.3%	2.4%	2.9%	4.0%	4.8%	3.9%	4.8%	11.1%	5.7%	14.9%	6.8%	5.5%	4.3%	3.3%	3.5%	2.1%	2.6%
ARI > 30 Years	2.3%	0.3%	1.2%	2.0%	2.9%	3.0%	3.5%	4.3%	4.7%	4.3%	4.9%	9.5%	5.3%	11.8%	6.0%	5.3%	4.5%	3.8%	4.0%	2.7%	3.2%

18 HOUR DURATION in 18 PERIODS OF 1 HOUR

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ARI ≤ 30 Years	2.5%	1.8%	1.4%	3.7%	4.1%	7.5%	12.8%	18.5%	5.3%	8.4%	7.1%	5.2%	5.8%	4.6%	3.4%	2.7%	3.1%	2.1%
ARI > 30 Years	3.2%	2.2%	1.5%	4.4%	4.7%	7.2%	11.1%	14.7%	5.7%	7.6%	7.1%	5.6%	5.9%	5.1%	4.1%	3.4%	3.8%	2.7%

24 HOUR DURATION in 24 PERIODS OF 1 HOUR

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ARI ≤ 30 Years	2.4%	1.0%	1.5%	1.0%	1.8%	3.4%	4.5%	5.5%	3.6%	4.8%	6.8%	7.9%	16.2%	3.7%	7.5%	9.4%	3.7%	3.2%	2.1%	2.6%	1.9%
ARI > 30 Years	3.1%	0.4%	1.7%	0.8%	2.3%	4.0%	4.8%	5.5%	4.0%	5.0%	6.7%	7.1%	12.9%	4.1%	7.1%	8.1%	4.1%	3.8%	2.6%	3.2%	2.4%

30 HOUR DURATION in 15 PERIODS OF 2 HOURS

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ARI ≤ 30 Years	2.4%	2.0%	1.6%	2.9%	3.2%	5.5%	5.9%	10.6%	9.1%	22.6%	14.5%	7.3%	4.0%	3.3%	5.1%
ARI > 30 Years	3.3%	2.9%	2.5%	3.8%	4.0%	6.0%	6.2%	9.8%	8.9%	18.1%	12.6%	7.4%	4.7%	4.0%	5.8%

36 HOUR DURATION in 18 PERIODS OF 2 HOURS

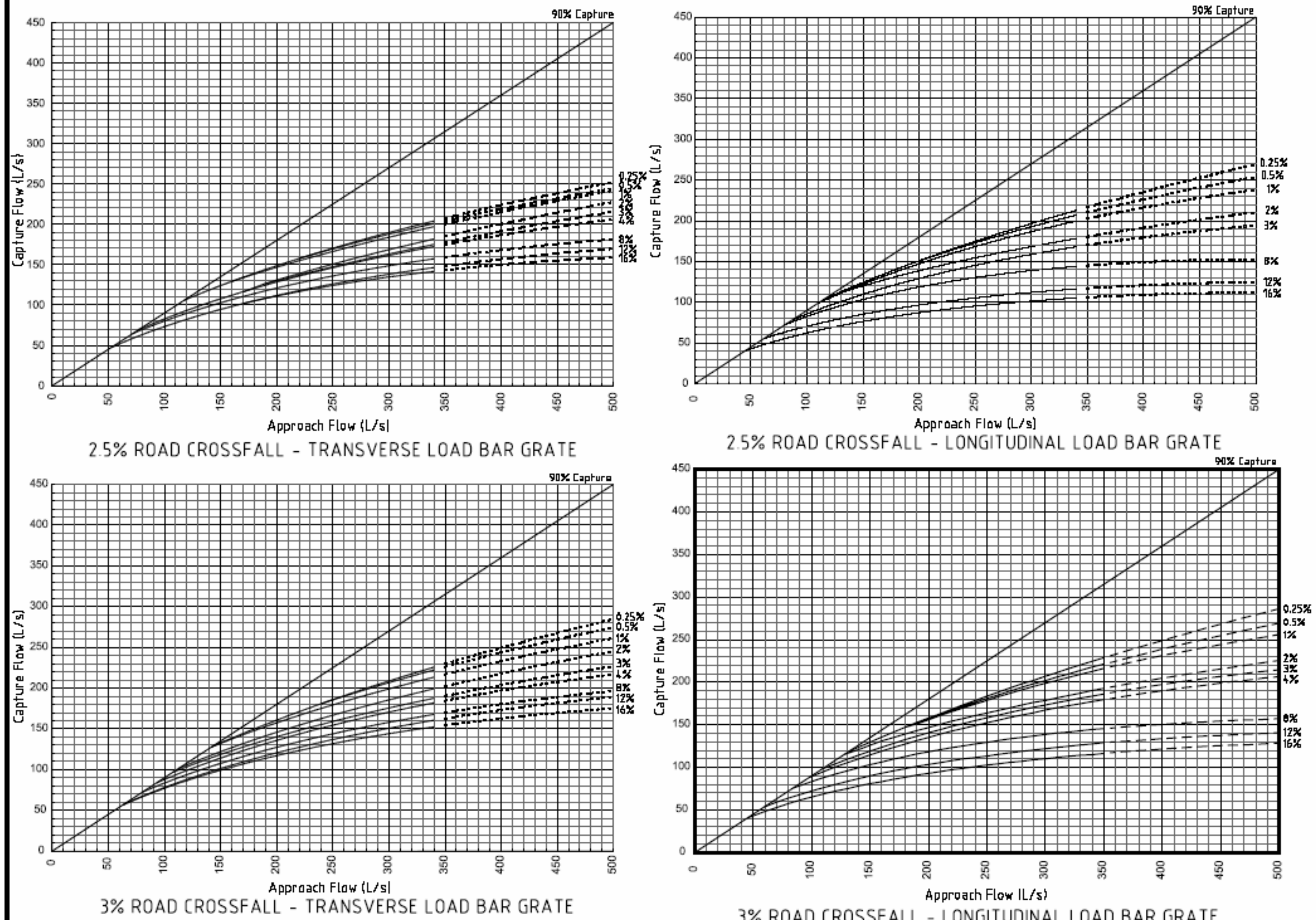
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ARI ≤ 30 Years	1.7%	0.9%	1.2%	2.0%	2.3%	6.9%	3.6%	4.3%	5.6%	3.2%	20.9%	11.4%	9.4%	13.4%	6.0%	3.1%	2.6%	1.5%
ARI > 30 Years	2.3%	1.3%	1.7%	2.6%	3.0%	7.0%	4.1%	4.8%	6.0%	3.8%	16.7%	10.5%	9.1%	11.7%	6.2%	3.8%	3.3%	2.1%

48 HOUR DURATION in 24 PERIODS OF 2 HOURS

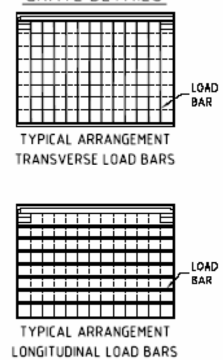
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ARI ≤ 30 Years	1.7%	1.4%	1.5%	1.6%	2.5%	2.7%	1.8%	3.0%	2.2%	3.5%	3.3%	5.4%	19.4%	10.8%	6.9%	3.7%	5.8%	9.8%	3.3%	3.9%	2.0%
ARI > 30 Years	2.3%	1.8%	1.9%	2.1%	3.1%	3.3%	2.3%	3.6%	2.8%	3.9%	3.7%	5.5%	15.4%	9.3%	6.6%	4.0%	5.7%	8.9%	3.8%	4.1%	2.6%

72 HOUR DURATION in 18 PERIODS OF 4 HOURS

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ARI ≤ 30 Years	5.3%	2.0%	3.5%	6.3%	3.8%	2.4%	12.6%	17.2%	25.0%	6.3%	3.1%	2.6%	2.3%	1.8%	1.6%	1.5%	1.4%	1.3%
ARI > 30 Years	5.5%	2.7%	4.0%	6.1%	4.1%	3.0%	11.6%	15.0%	20.0%	6.4%	3.6%	3.1%	3.0%	2.5%	2.4%	2.4%	2.3%	2.3%



GRATE DETAILS



NOTES

1. THESE CHARTS ARE TO BE USED FOR STANDARD GCCC INLET GULLY DWG 05-03-001
2. A 10% BLOCKAGE FACTOR HAS BEEN APPLIED TO THIS CHART (REFER QUDM 5.10.2).
3. EXTRAPOLATION BEYOND THE LIMITS OF THE CHARTS SHOULD NOT BE UNDERTAKEN.
4. THE DATA IN THIS CHART WAS PRODUCED BY THE URBAN WATER RESOURCES CENTRE, UNIVERSITY OF SOUTH AUSTRALIA (REPORT JULY 2001).
5. TESTING WAS BASED ON CROSSFALLS OF 1 IN 30 AND 1 IN 40.
6. GULLY INLET FREEBOARD REQUIREMENTS:-

LONGITUDINAL GRADE	LINTEL 2400	3600	4800
≤3.0%	150mm	150mm	150mm
>3.0%	150mm	350mm	350mm

LEGEND

__%. KERB AND CHANNEL LONGITUDINAL SLOPE (S_L)
———— BASED ON ACTUAL DATA
------------ EXTRAPOLATED DATA

Gold Coast City Council
GOLD COAST CITY COUNCIL PO BOX 5042 GOLD COAST MC 9729

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CONTROLLED DOCUMENT

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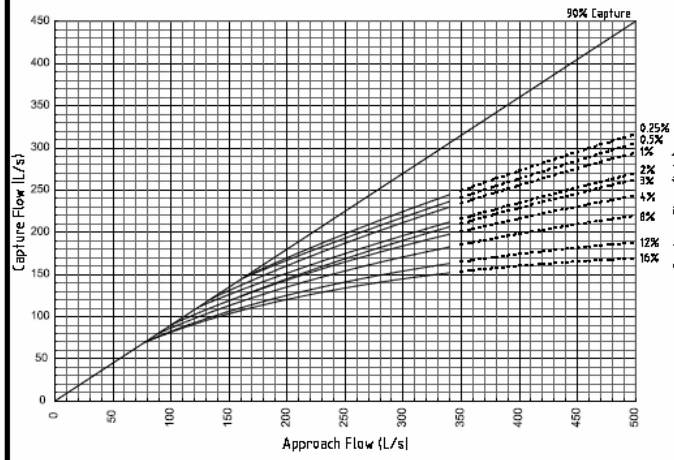
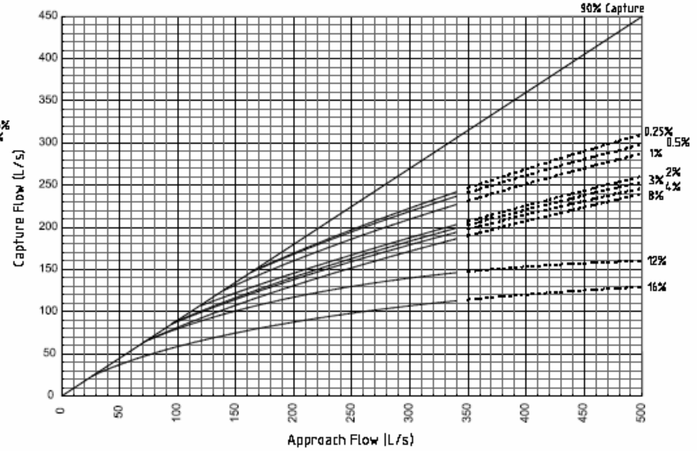
PASSED: 18/03/04
APPROVED: 18/03/04

STANDARD DRAWING
HYDRAULIC CAPTURE CHARTS
BARRIER KERB AND CHANNEL
LIP IN LINE, 2400 LINTEL

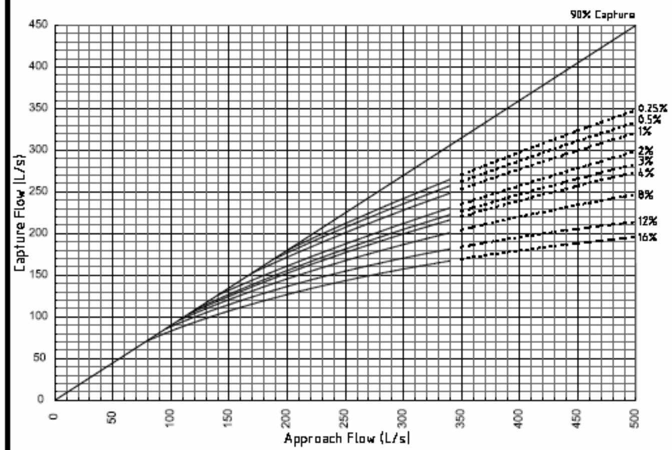
MICROFILMED
STANDARD DRAWING No. 05-03-501
ISSUE 2005 EDITION



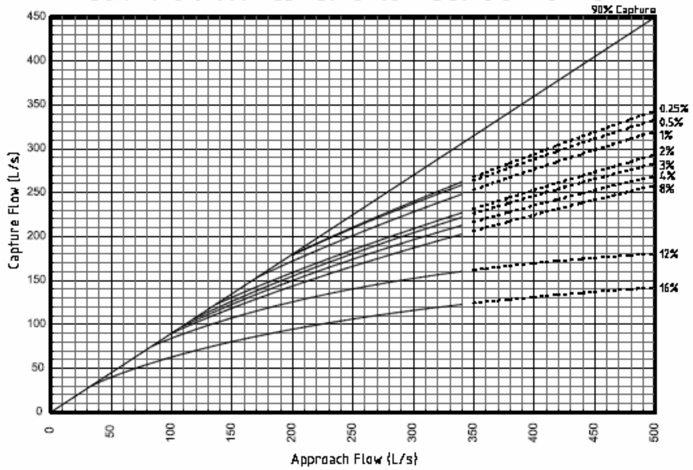
2.5% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE



2.5% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

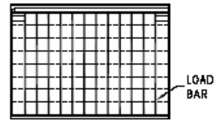


3% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE



3% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

GRATE DETAILS



TYPICAL ARRANGEMENT
TRANSVERSE LOAD BARS

TYPICAL ARRANGEMENT
LONGITUDINAL LOAD BARS

NOTES

1. THESE CHARTS ARE TO BE USED FOR STANDARD GCCC INLET GULLY DWG 05-03-5D01
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6. GULLY INLET FREEBOARD REQUIREMENTS:-

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>3.0%	150mm	350mm	350mm

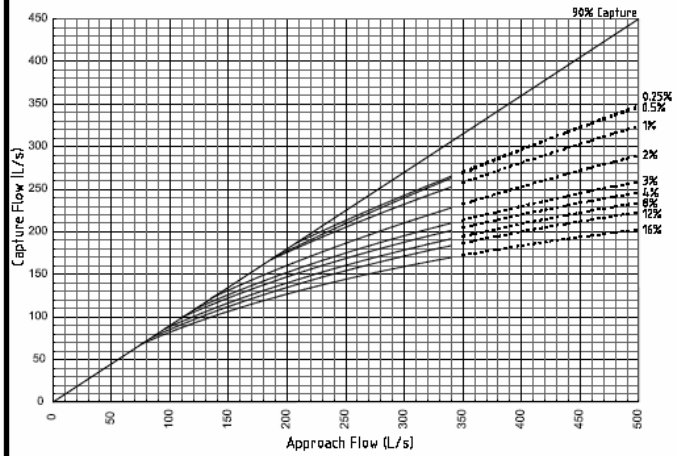
LEGEND

__%. KERB AND CHANNEL LONGITUDINAL SLOPE (S_x)
——— BASED ON ACTUAL DATA
- - - - - EXTRAPOLATED DATA

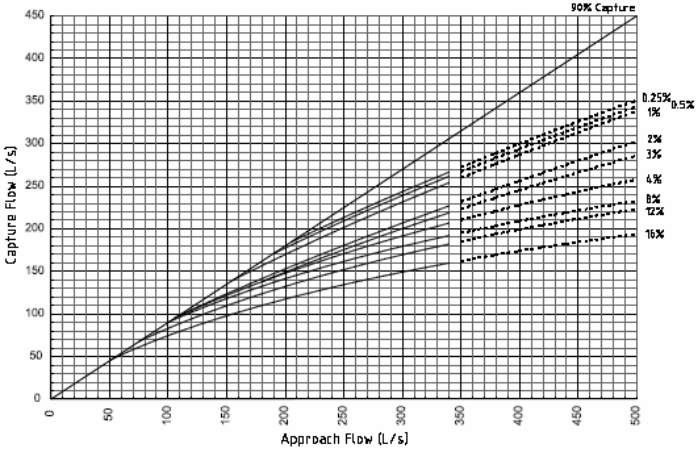
Gold Coast City Council GOLD COAST CITY COUNCIL PO BOX 5042 GOLD COAST MC 9729	THIS DRAWING IS NOT TO BE AMENDED WITHOUT REFERENCE TO STANDARDS COMMITTEE	CONTROLLED DOCUMENT	DO NOT SCALE TAKE FIGURED DIMENSIONS ONLY	MICROFILMED
	No. / AMENDMENT / APPROVED / DATE / ISSUED		DRAWN BY: TECHNICAL SERVICES BRANCH PASSED 18/03/04 APPROVED 18/03/04	STANDARD DRAWING No. 05-03-502 ISSUE 2005 EDITION

STANDARD DRAWING

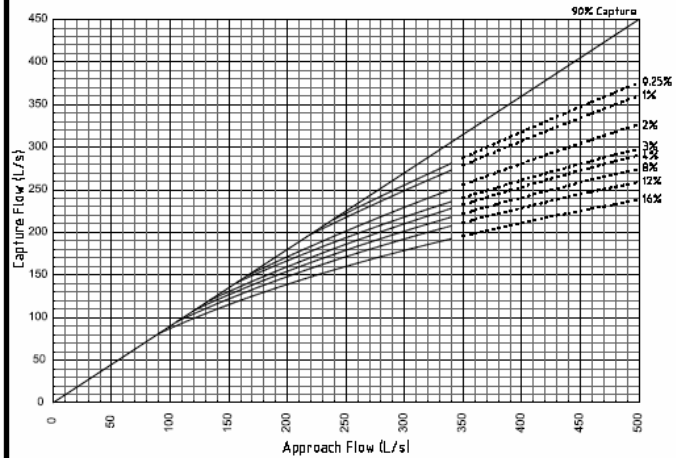
HYDRAULIC CAPTURE CHARTS
BARRIER KERB AND CHANNEL
LIP IN LINE, 3600 LINTEL



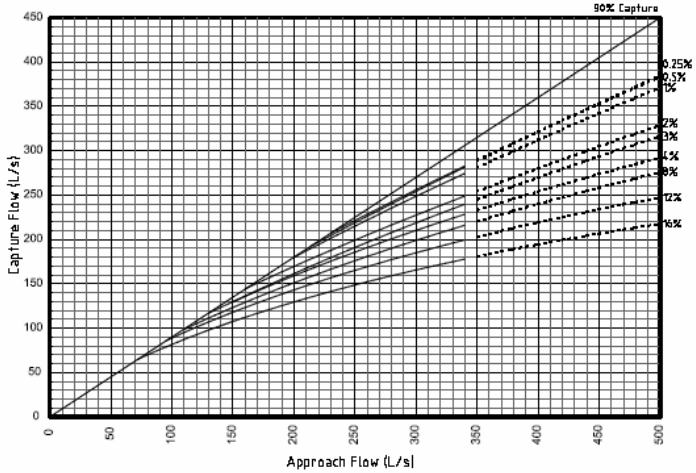
2.5% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE



2.5% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

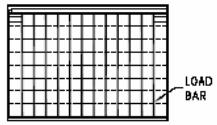


3% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE

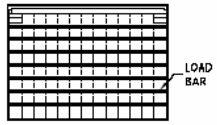


3% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

GRATE DETAILS



TYPICAL ARRANGEMENT
TRANSVERSE LOAD BARS



TYPICAL ARRANGEMENT
LONGITUDINAL LOAD BARS

NOTES

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5. TESTING WAS BASED ON CROSSFALLS OF 1 IN 30 AND 1 IN 40.
6. GULLY INLET FREEBOARD REQUIREMENTS:-

LONGITUDINAL GRADE	LINTEL		
	2400	3600	4800
≤3.0%	150mm	150mm	150mm
>3.0%	150mm	350mm	350mm

LEGEND

__%. KERB AND CHANNEL LONGITUDINAL SLOPE (S_o)
——— BASED ON ACTUAL DATA
---------- EXTRAPOLATED DATA

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TECHNICAL SERVICES BRANCH
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APPROVED 18/03/04

No.	AMENDMENT	APPROVED	DATE	ISSUED

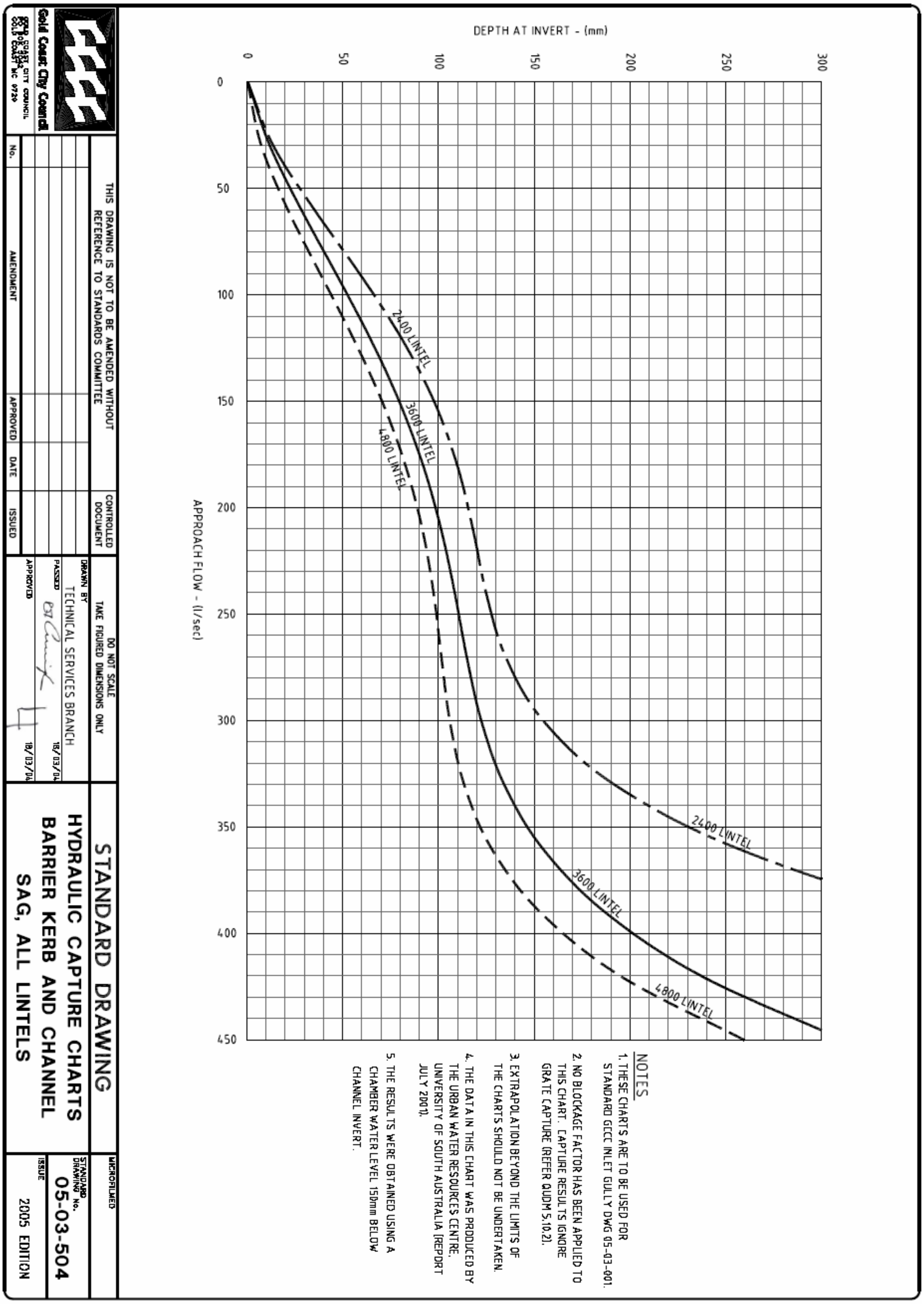
STANDARD DRAWING

HYDRAULIC CAPTURE CHARTS BARRIER KERB AND CHANNEL LIP IN LINE, 4800 LINTEL

MICROFILMED

STANDARD DRAWING No.
05-03-503

ISSUE
2005 EDITION


DEPTH AT INVERT - (mm)
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50
100
150
200
250
300
APPROACH FLOW - (l/sec)
0
50
100
150
200
250
300
350
400
450
2400 LINTEL
3600 LINTEL
4800 LINTEL
NOTES
1. THESE CHARTS ARE TO BE USED FOR STANDARD GCCC INLET GULLY DWG 05-03-001.
2. NO BLOCKAGE FACTOR HAS BEEN APPLIED TO THIS CHART. CAPTURE RESULTS IGNORE GRATE CAPTURE (REFER QUDM 5.10.2).
3. EXTRAPOLATION BEYOND THE LIMITS OF THE CHARTS SHOULD NOT BE UNDERTAKEN.
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5. THE RESULTS WERE OBTAINED USING A CHAMBER WATER LEVEL 150mm BELOW CHANNEL INVERT.
Gold Coast City Council
No.
AMENDMENT
APPROVED
DATE
ISSUED
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CONTROLLED DOCUMENT
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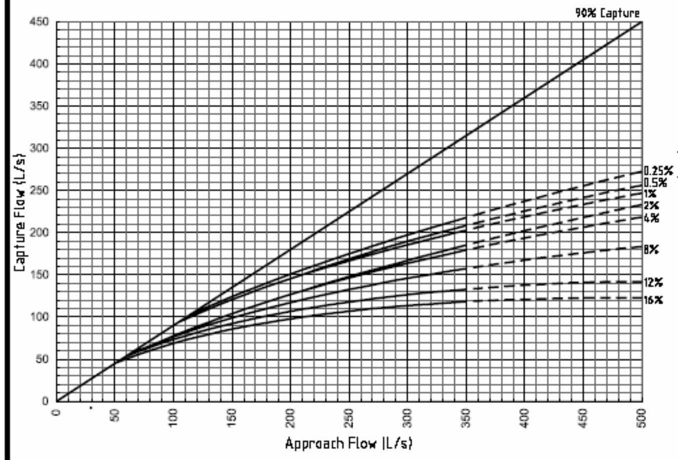
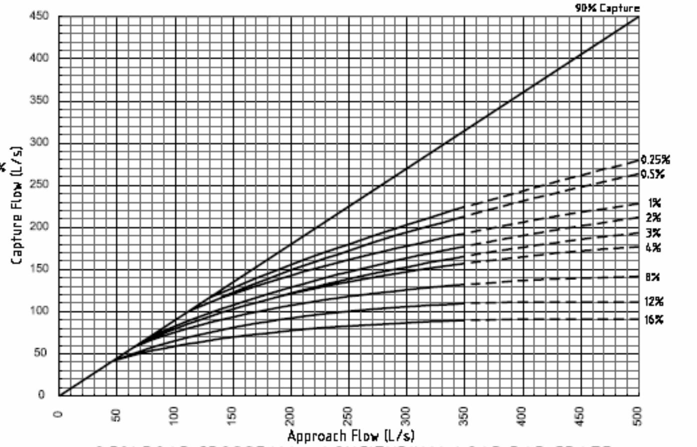
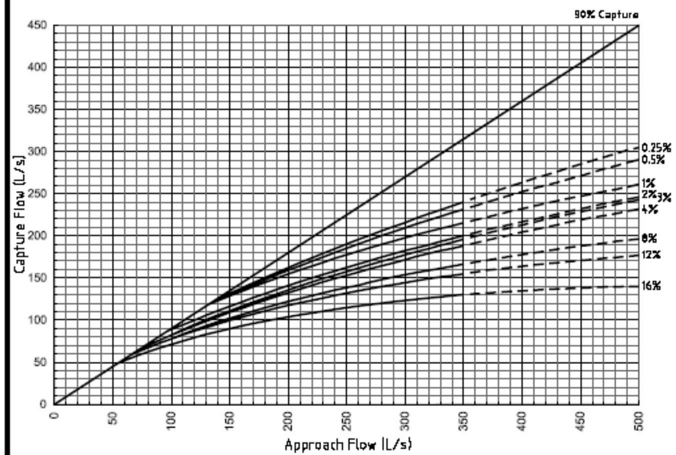
TECHNICAL SERVICES BRANCH
PASSED
18/03/04
APPROVED
18/03/04
STANDARD DRAWING
HYDRAULIC CAPTURE CHARTS
BARRIER KERB AND CHANNEL
SAG, ALL LINTELS
MICROFILMED
STANDARD DRAWING No.
05-03-504
ISSUE
2005 EDITION



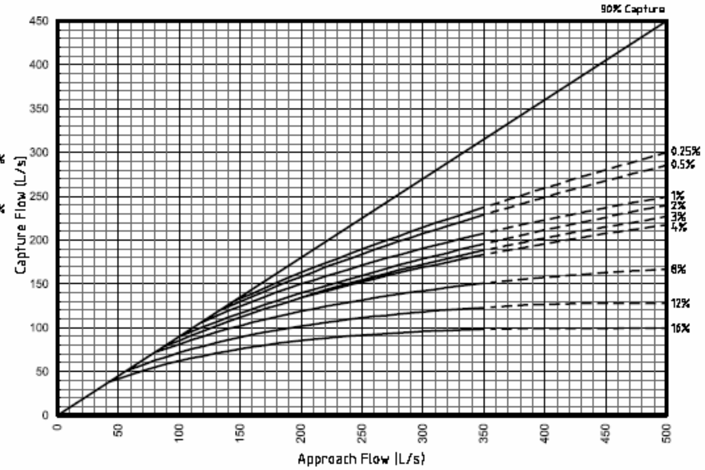
2.5% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE



2.5% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

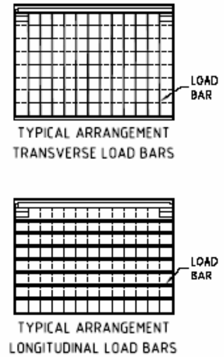


3% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE



3% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

GRATE DETAILS



NOTES

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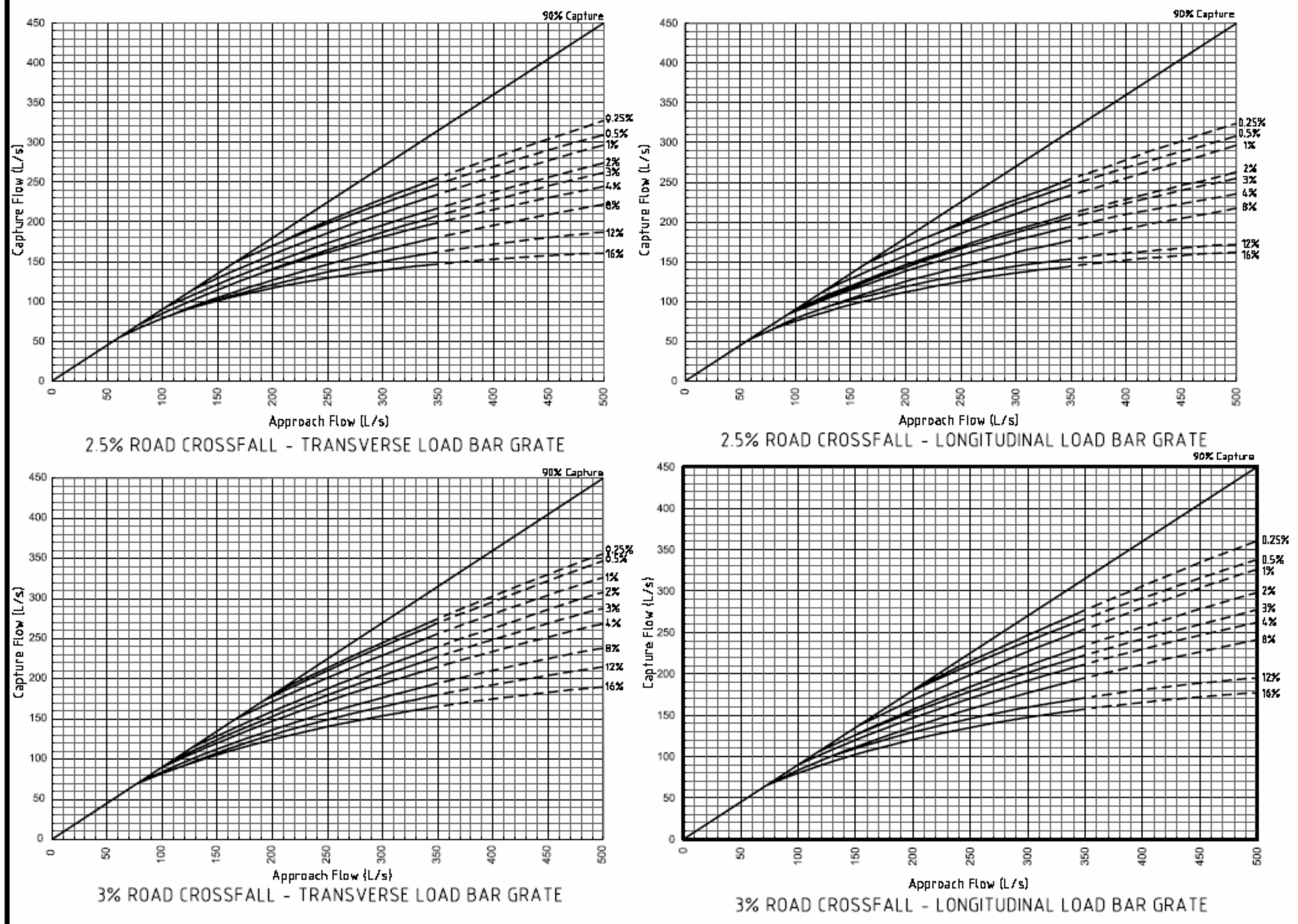
LONGITUDINAL GRADE	LINTEL 2400	LINTEL 3600	LINTEL 4800
≤3.0%	150mm	150mm	150mm
>3.0%	150mm	350mm	350mm

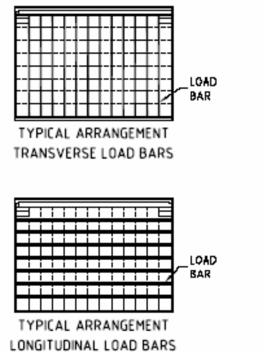
LEGEND

__%. KERB AND CHANNEL LONGITUDINAL SLOPE (S_L)
———— BASED ON ACTUAL DATA
------------ EXTRAPOLATED DATA

Gold Coast City Council GOLD COAST CITY COUNCIL PO BOX 5042 GOLD COAST MC 9729	THIS DRAWING IS NOT TO BE AMENDED WITHOUT REFERENCE TO STANDARDS COMMITTEE	CONTROLLED DOCUMENT	DO NOT SCALE TAKE FIGURED DIMENSIONS ONLY	MICROFILMED
	No. / AMENDMENT / APPROVED / DATE / ISSUED		DRAWN BY TECHNICAL SERVICES BRANCH PASSED 18/03/04 APPROVED 18/03/04	
			STANDARD DRAWING HYDRAULIC CAPTURE CHARTS ROLL TOP KERB AND CHANNEL LIP IN LINE, 2400 LINTEL	STANDARD DRAWING No. 05-03-601 ISSUE 2005 EDITION



GRATE DETAILS



NOTES

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LEGEND

__%. KERB AND CHANNEL LONGITUDINAL SLOPE (S_L)
———— BASED ON ACTUAL DATA
----------- EXTRAPOLATED DATA

Gold Coast City Council
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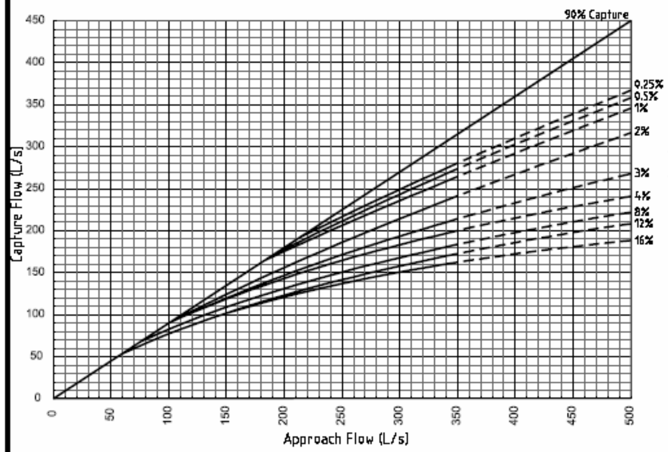
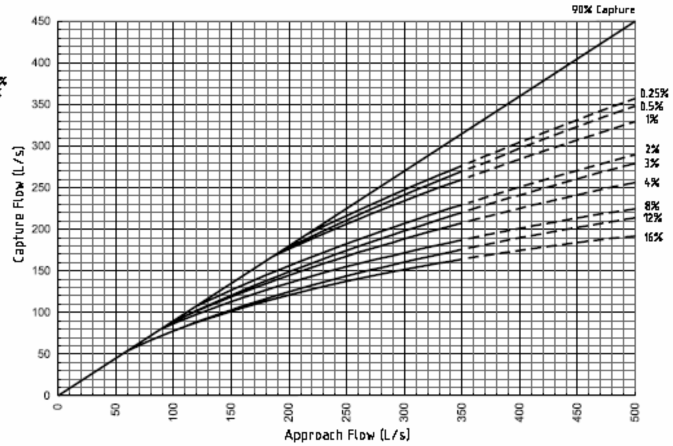
STANDARD DRAWING
HYDRAULIC CAPTURE CHARTS
ROLL TOP KERB AND CHANNEL
LIP IN LINE, 3600 LINTEL

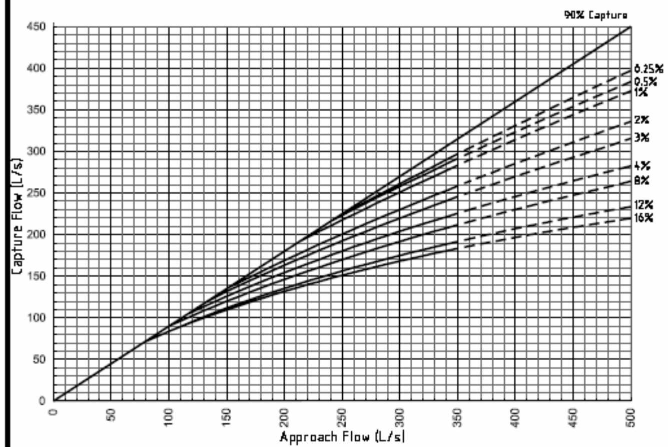
MICROFILMED
STANDARD DRAWING No. 05-03-602
ISSUE 2005 EDITION



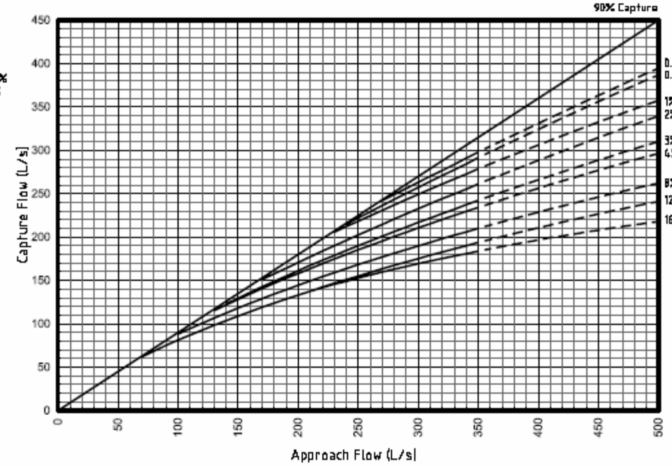
2.5% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE



2.5% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

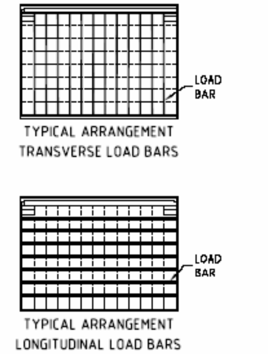


3% ROAD CROSSFALL - TRANSVERSE LOAD BAR GRATE



3% ROAD CROSSFALL - LONGITUDINAL LOAD BAR GRATE

GRATE DETAILS



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>3.0%	150mm	350mm	350mm

LEGEND

__%. KERB AND CHANNEL LONGITUDINAL SLOPE (S_o)
——— BASED ON ACTUAL DATA
----------- EXTRAPOLATED DATA

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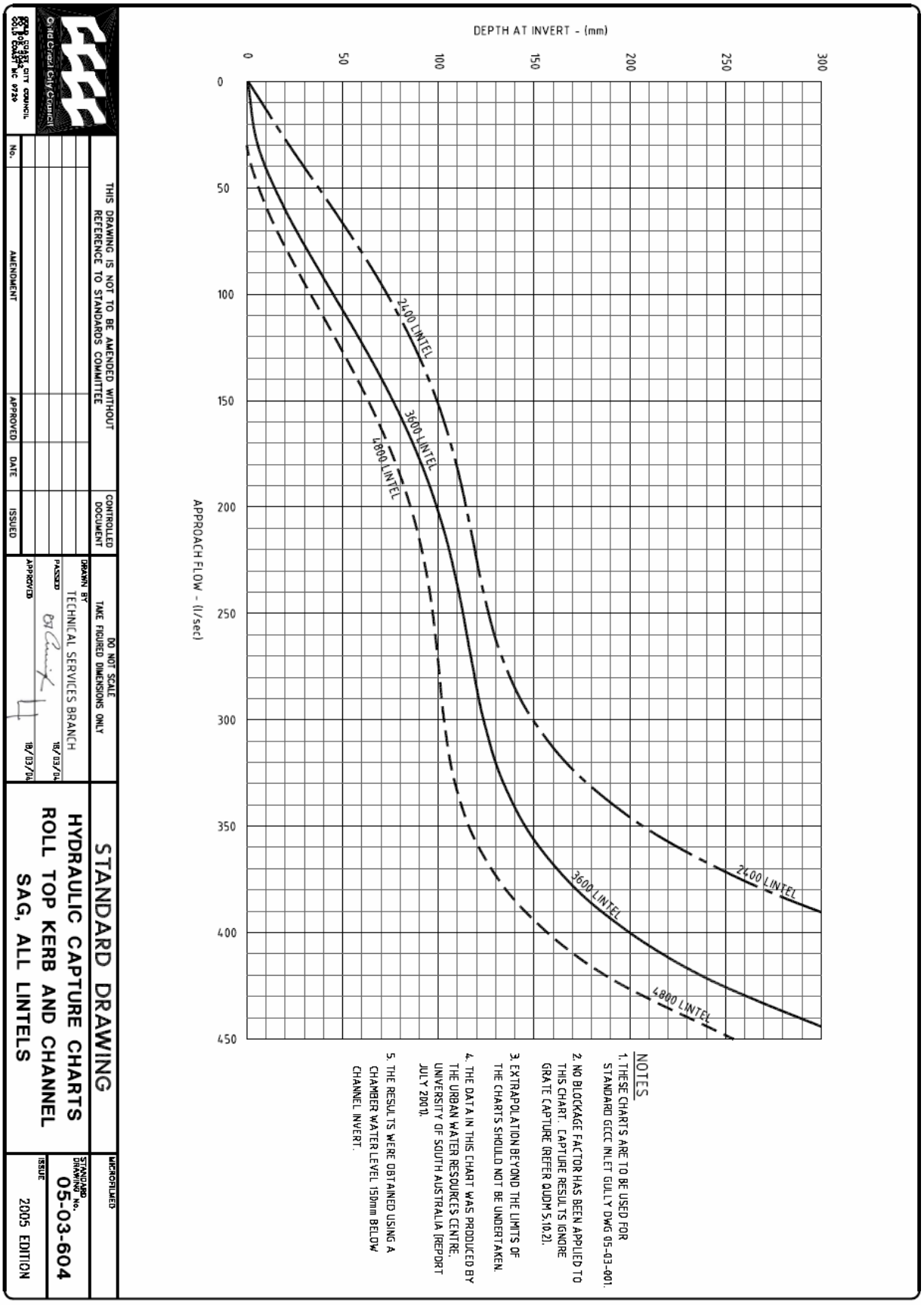
	No. / AMENDMENT / APPROVED / DATE / ISSUED		DRAWN BY TECHNICAL SERVICES BRANCH PASSED [signature] 18/03/04 APPROVED [signature] 18/03/04	HYDRAULIC CAPTURE CHARTS ROLL TOP KERB AND CHANNEL LIP IN LINE, 4800 LINTEL	STANDARD DRAWING No. 05-03-603 ISSUE 2005 EDITION


DEPTH AT INVERT - (mm)
APPROACH FLOW - (l/sec)
0
50
100
150
200
250
300
350
400
450
2400 LINTEL
3600 LINTEL
4800 LINTEL
NOTES
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CONTROLLED DOCUMENT
No.
AMENDMENT
APPROVED
DATE
ISSUED
DO NOT SCALE
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DRAWN BY
TECHNICAL SERVICES BRANCH
18/03/04
PASSED
APPROVED
18/03/04
STANDARD DRAWING
HYDRAULIC CAPTURE CHARTS
ROLL TOP KERB AND CHANNEL
SAG, ALL LINTELS
MICROFILMED
STANDARD DRAWING No.
05-03-604
ISSUE
2005 EDITION
Gold Coast City Council
GOLD COAST CITY COUNCIL
P.O. BOX 5042
GOLD COAST MC 9729

3.6 Design Requirements – Waterfront Development

3.6.1 General

These guidelines provide Council's minimum standards for Developments with Water frontages, ie. natural waterways, lakes, canals; and shall be read in conjunction with the **General Planning Principles** set out in **Section 2.0** and **Batters to Waterways** in **Section 3.2.7 a) iv**) of these Guidelines, together with Council report requirements as set out in **Section 8.3** of these Guidelines.

3.6.2 Waterways (Canals, Lakes, Tidal Waters, Creeks, Rivers and Other Waterways)

All development near waterways should only proceed where it can be demonstrated that the development will result in a sustainable waterway system. A waterways report (in accordance with **Section 8.3.4** of these Guidelines) will be required when considered necessary to demonstrate the sustainability of the development proposal.

i) All allotments should fall to the street frontage for drainage purposes, the embankment slope to the canal shall be minimised. Subsequent building development drainage should discharge to the street drainage system. All waterbodies shall be designed in accordance with **Section C2** of the Institution of Engineers Australia (Qld) **Soil Erosion and Sediment Guidelines**.

ii) Suitable access shall be provided to the canal to enable maintenance activities to be undertaken. An acceptable level of waterway access for maintenance purposes would consist of a maintenance boat ramp constructed within waterfront park and at a rate of approximately 3 per suburb.

iii) Due consideration shall be given to the layout of the ends of the canals to ensure adequate allocation to waterway area, for each allotment by using the prolongation of side boundaries.

iv) The location of Quay Lines Waterway Regulation Lines, Building Setback Lines and Revetment Regulation Heights shall comply with the requirements shown on Council's **Standard Drawing N^{o} 03-04-004** and the Waterway Development Control Map or a report demonstrating the sustainability of an alternate layout shall be produced (refer to **Section 8.3.4** of these Guidelines.

v) Where the location of Quay Lines, Waterway Regulation Lines, Building Setback Lines or Revetment Regulation Heights are not shown on Council's Waterway Development Control Maps, then the developer shall propose a location for these lines and demonstrate the sustainability of the proposal in a report. (refer to **Section 8.3.4** of these Guidelines).

3.6.3 Constructed Lakes

All lakes require approval in accordance with **Section 8.2** of the **Local Government (Planning and Development) Act** (which is currently called up under the **Integrated Planning Act 1997**) and shall generally be designed in accordance with the requirements of:

i) **Section C2** of the Institution of Engineers Australia (Qld) **Soil Erosion and Sediment Guidelines**; and

ii) **Section 3.6.2** herein.

3.6.4 Natural Waterways (Creeks, Rivers and Streams)

Unless approved otherwise by Council for any development fronting natural waterways, a suitable revetment wall shall be constructed to protect the site from erosion. If a revetment is required it shall be constructed to the following requirements:

i) The outside face of revetment (reinforced concrete wall or rock wall) shall align with the allotment RP Boundary;

ii) Reinforced concrete walls should be designed, with a minimum design life of 40 years;

iii) The footing of the wall shall be located below LAT for the site.

3.6.5 Tidal Waters

In tidal waters, in addition to the requirements of **Sections 3.6.2** and **3.6.4**, approval under **Section 86** of the **Harbours Act** shall also be required.

3.6.6 Ocean Beaches

For all sites fronting an ocean beach (as indicated on the **Foreshore Seawall Line Maps**), before any development (or redevelopment) can commence, an approved foreshore rockwall is required to be constructed, by the property owner, to protect the property from erosion. Refer to **Section 7.5** of these Guidelines.

3.7 Design Requirement – Street Lighting

3.7.1 General

The Guidelines have been prepared for the guidance of Developers and their Consultants to ensure Council's requirement for street lighting to Council controlled streets and roads is achieved. For Public Open Space Lighting, refer to **Section 6.15** of these Guidelines.

3.7.2 Objectives

The objective of Street Lighting is to increase the safety and amenity of pedestrians and to improve traffic operations at intersections and hazardous locations.

The relative significance of these objectives vary between Major Traffic Routes and Minor Streets.

On Major Traffic Routes the lighting is referred to as Route Lighting and is classified in **AS/NZS1158** as Category V lighting.

On Minor Streets the lighting is classified in **AS/NZS1158** as Category P lighting.

Council requires that the Developer shall appoint a Principal Consultant to liaise with Council. The Principal Consultant shall be Council's only contact for the design and construction of street lighting.

In keeping with these objectives, the Principal Consultant shall complete the 'Application for Approval of Street Lighting' form (refer **Appendix D**).

Street lighting (and electrical reticulation) drawings are to be submitted to Council for approval at the same time the civil works drawings are submitted. This is required to ensure that services do not conflict and comply with these Guidelines, Council's standard drawings and specifications.

3.7.3 Relevant Standards

The provision and detailed design of street lighting installations are to be generally in accordance with the following standards, except as otherwise specified in this Guideline, or as directed by Council:

- **Guide to Traffic Engineering Practice – Part 12, Roadway Lighting – Austroads**;
- **AS/NZS1158, Public Lighting Code – Standards Association of Australia**;
- **Energex Policies and Standards**.

3.7.4 Street Lighting Classification

For the purpose of street lighting design in accordance with the above standards, the relevant Lighting Category, generally applicable for each of Council's standard street and road classifications, are as follows:

i) Major Traffic Routes

a) Urban

- 2 Lane road up to 5000 VPD — P3
- 2 Lane road over 5000 VPD — V5
- 4 Lane Road — V3

b) Rural

Major traffic routes in rural areas are only required to be lit to Urban Standards at points of conflict (eg. access driveways, intersections, hazardous locations, possible pedestrian crossing points, on/off ramps, etc).

ii) Minor Streets

a) Residential

- Residential Access Street — P4
- Residential Collector Street — P3
- Car parks — P11
- Disabled or pram use spaces — P12

A higher category is appropriate where there are land uses such as retailing or entertainment.

Category V5 is required where pedestrian and cyclist volumes are deemed high by Council.

b) Industrial/ Commercial

- Access Street — P4
- Collector Street — P4
- Car parks — P11

Category V4 is required where pedestrian and cyclist volumes are deemed high by Council.

c) Park Living

Council requires street lighting at intersections and hazardous locations only, and the lighting shall be aeroscreen lanterns only.

d) Rural Areas

Generally street lighting is not required. However, special lighting at traffic hazards may be required by Council if electrical reticulation is available.

iii) Specific Requirements

a) Electricity is to be provided underground, however, overhead supply in Rural Areas is permitted subject to Council approval.

b) Notwithstanding the above, Council may vary the required street lighting category for any street or road in consideration of special circumstances or require additional lighting in the following situations:

- intersections;
- roundabouts;
- sharp bends;
- traffic control devices;
- pedestrian crossings;
- *culs-de-sac*;
- bridges (minimum Category V5 at abutments and minimum Category P3 on deck);
- night time accident locations;
- frequently used night time bus stops;
- areas that may generate pedestrian traffic or vehicle night traffic.

3.7.5 Energex Tariff

For new developments, street lighting poles and luminaries are to be standard Energex equipment, which will be supplied and maintained by Energex at Standard 'Rate 2' Tariff. The installation of 'Rate 3' street lighting will only be considered in special circumstances and will require approval of Council.

3.7.6 Luminaries

Luminary types, (eg. mercury or high pressure sodium), are subject to Energex guidelines, which, as a result of ongoing research and new technology, may change over time. The most economical luminary type available (and acceptable) to Energex should be used as follows:

- Category P4 & P5 – Mercury Vapour 50 watt lamps;
- Category P3 – HPS 70 watt lamps (minimum mounting height of 6.5m);
- Category V5 to V1 – HIPS 100 watt and above lamps.

3.7.7 Pole Location

In general, street lighting poles are to be located opposite common allotment boundaries, to minimise potential interference with vehicle access, and glare complaints from residents. It is desirable that poles not be located opposite boundaries of 'battle axe' allotments due to a higher potential for vehicle collision.

Pole location should avoid likely vehicle conflict points to minimise the risk of damage to both poles and vehicles and injury to vehicle occupants. Consideration should be given to potential paths of vehicles accidentally leaving the carriageway, and also to the swept path of oversize vehicles which may need to leave the carriageway to manoeuvre, (eg. at *cul-de-sac* turning areas, speed control devices, bends, and intersections).

Where poles are in vulnerable locations, (eg. in small islands or roundabouts), consideration should be given to the use of frangible type poles.

3.7.8 Roundabouts

The preferred option for the street lighting of roundabouts is for the light poles to be located on the approach side of each intersection street without poles in the central median island. Lighting poles should be located as far as practical from the intersection. If the road pavement cannot be lit from the outside then central island lights may be considered provided the poles are cantilever (pivot arm) type or similar design such that Energex will accept the installation under 'Rate 2' Tariff.

Where central island lighting is proposed detailed design information (ie. civil, landscaping and lighting design) will be required to be submitted.

3.7.9 General

a) External roads connecting to new Development roads, may require upgrading of street lighting to appropriate standards. Where such roads are declared roads, the approval of Main Roads is required.

b) Design and location of street and park lighting should have regard for the principles for crime prevention through environmental design.

3.8 Design Requirements – Irrigation Systems

3.8.1 General

These guidelines provide Council's minimum standards and design criteria for irrigation systems where Council agrees to inherit the asset and responsibility for the ongoing maintenance.

Prior to installing an irrigation system as an asset Council will assess the proposed system design to ensure that it complies with Council's:

- environmental considerations;
- irrigation system requirements;
- minimum design life expectancy;
- requirement that the system is practical and economical to operate and maintain.

3.8.2 Environmental Considerations

The Consultant shall liaise with Council to ascertain whether an adequate water supply main and/or effluent line is available that can be utilised to provide connection for the irrigation system.

Where Council approves connection from an effluent line, the Consultant shall ensure that the irrigation system discharge complies with the requirements of the current EPA guidelines for discharging of effluent.

3.8.3 Irrigation System Requirements

Irrigation systems shall be designed in accordance with Council's current technical manual – **Irrigation System Requirements Specification**.

In general the minimum irrigation system requirements include:

- a design life expectancy of 10 years;
- irrigation controllers shall be compatible with Council's centrally controlled system (Irrinet).

3.8.4 Vandalism

The design shall consider the likelihood of vandalism and the options available for the location and protection of irrigation components such as pumps and controller equipment.

3.8.5 'As Constructed' Requirements

All 'as constructed' requirements shall comply with **Section 10** of these Guidelines and any addendums.

3.8.6 Operation and Maintenance Manual

Provide an Operations/ Maintenance Manual including instructions and a recommended maintenance schedule for all items supplied and installed along with details of model (reference numbers or similar), manufacturer and/or supplier.