5.0 STORMWATER DRAINAGE

5.1 AIMS, OBJECTIVES AND DESIGN PHILOSOPHY

The aims, objectives and design philosophy shall be in accordance with The Queensland Urban Drainage Manual (QUDM - latest edition as amended) for urban drainage design and shall be in accordance with the Queensland Department of Main Roads - Urban Road Design Volume 2 for Culvert Design (Section 10-1800 to 10-2080) for rural road cross drainage provisions.

5.1.1 Consultants are responsible for conferring with Council to determine particular local design requirements. Council shall require Consultants to certify that the Drainage Design and Report documentation for the designed urban stormwater systems are in accordance with the QUDM. Consultants shall also certify that an overview has been undertaken of the drainage proposal for the development to ensure the development does not impact adversely on adjacent properties and within the development future owner and community expectations in regard to drainage shall be met and that drainage considerations of future stages and adjacent developments (both proposed and existing) have been addressed and included in the report documentation.

5.1.2 Council may require a site inspection with the Consultant on receipt of the Design and Report documentation to clarify site specific issues. Consultants are encouraged to arrange a site inspection with Council prior to commencing design.

5.1.3 The drainage design shall include investigation of the adequacy of the downstream drainage system to cater for the altered runoff from the development site. Upgrading of the downstream system to cater for any increased runoff due the development shall be at no cost to Council.

5.1.4 The proposed drainage system within the development site shall take into account the whole catchment area. It shall allow for the future development of the upstream catchments consistent with the preferred dominant land use identified in the Strategic Plan.

5.2 LAWFUL POINT OF DISCHARGE

With each submission for development construction approval, the Consultant shall address the issues of “lawful point of discharge”, downstream drainage nuisance, easements and drainage reserves. Discharge approvals are generally not acceptable.

5.3 URBAN DRAINAGE

5.3.1 Notwithstanding the QUDM guidelines, it is the responsibility of the designer to ensure each subcatchment flow is determined using a suitable co-efficient of runoff. Council may set specific C values from time to time and designers should confer with Council prior to commencing design works.

5.3.2 Fraction impervious coefficients, C_{10} figures, Frequency Factors, time of concentration calculations, Standard Inlet Time, Pipe and Channel Flow calculations and the like shall be in accordance with the QUDM.

5.4 RURAL ROAD DRAINAGE

i) The drainage design should minimise the longitudinal runoff by means of turnouts and/or cross drainage provisions. The turnouts shall be located at maximum spacing of 200m on grades up to 4%. Where the grades exceed 4%, the spacing need to be reduced.

ii) On high side of cut batters, catch drains (or diversion banks, depending on the soil type) shall be provided on top of the batters to protect the batters.

iii) The cross drainage shall be located along the natural gullies where possible.

iv) The inverts for cross drainage are generally set at ground levels where possible.

v) In steep terrains, where outlet velocities can cause scour problems, designers need to select appropriate cross drainage inverts and grades to minimise outlet scouring. Anti scour measures at outlets are not necessary always acceptable.

vi) Headwater control for the cross drainage is to be nominated on the drainage analysis sheet and the structural type, chainage location and reduced level shall be specified on the working plan and the drainage plan. Copy of the drainage analysis sheet (Culvert Design Form) is attached in the Appendix 5.1.

5.5 DESIGN STORMS - AVERAGE RECURRENCE INTERVAL

5.5.1 Tables 5.5 (I) , 5.5 (II) and 5.5 (III) show the recommended minimum design ARI for major and minor rainfall events. Council may vary the design ARIs shown in Table 5.5 (I) to suit site specific local conditions.

TABLE 5.5 (I) TABLE OF RECOMMENDED DESIGN AVERAGE RECURRENCE INTERVALS

LONGITUDINAL ROAD DRAINAGE		
	Minor System	**Major System**
Central Business & Commercial	10 years	100 years with d.v. ≤ 0.6 50 years with d.v. ≤ 0.4
Industrial	5 years	100 years with d.v. ≤ 0.6 50 years with d.v. ≤ 0.4
Urban Residential (Res A, B, C)	5 years	100 years with d.v. ≤ 0.6 50 years with d.v. ≤ 0.4
Park Residential	2 years	100 years with d.v. ≤ 0.6 50 years with d.v. ≤ 0.4
* Rural Residential, Village Residential & Rural (generally no k&c)	10 years (Roads not overtopped)	100 years with d.v not applied 50 years with d.v. ≤ 0.6 applied @ prop. access points

Notes of Use of Table 5.5(I)

* The longitudinal road drainage system in Rural Residential, Village Residential and Rural developments generally shall consist of unlined tabledrains. The ARI Minor Storm flow shall not encroach on the through road pavement (travel lanes).

1. The "d.v" criteria specified shall not be the only design constraint. Flow width and depth limitations shall be in accordance with the QUDM and other criteria specified within this document.

2. Proposed departures from the QUDM Guidelines and the requirements specified herein shall be submitted to Council for approval.

TABLE 5.5 (II) TABLE OF RECOMMENDED DESIGN AVERAGE RECURRENCE INTERVALS

ROAD CROSS DRAINAGE		
	Minor System	**Major System**
Rural Residential, Village Residential and Rural	Roads 5 years with no overtopping above top of batter Property Accesses 2 years with no overtopping of prop. Accesses ; AND 5 years with overtopping of access allowable if no encroachment on through road pavement with $d.v \leq 0.6$	50 years with overtopping allowed such that $d_{max} \leq 300mm$ AND $d.v \leq 0.6$
URBAN (all except Arterial & Sub-Arterial; but incl. Park Res)	10 years with no overtopping	50 years with overtopping allowed such that $d_{max} \leq 300mm$ and $d.v \leq 0.4$
URBAN (Arterial & Sub-Arterial)	50 years with no overtopping	100 years with overtopping allowed such that $d_{max} \leq 300mm$ and $d.v. \leq 0.4$

Notes on use of Table 5.5 (II)

1. The design and construction of pipe property accesses shall ensure that water flow from the property can not reach the through road pavement via the property access.

TABLE 5.5. (III) TABLE OF RECOMMENDED DESIGN AVERAGE RECURRENCE INTERVALS

OPEN DRAIN NETWORKS		
	Minor System	**Major System**
Rural, Rural Residential, Village Residential	N/A	100 years with d.v. not applicable
Urban, Res A,B,C, Park Residential Commercial & Industrial	Low flow pipe or lined channel Q1 capacity	100 years with d.v. not applicable

5.5.2 For the ARI specified for the Major System flows the following criteria shall be met:-

(a) In URBAN areas, safety of residences and allotments from inundation **and** the major system flows confined to road reserves and/or drainage reserves;

(b) In RURAL areas, safety of residences and/or building sites from inundation, ie. portions of large allotments may be permitted to be inundated in the Major System flows provided residences and/or building sites are flood free; such building site areas shall be so designated.

5.5.3 Council may direct from time to time that certain developments be designed for greater or lesser immunity than those outlined. The flow depth and flow spread shall be limited by the "d.v." and flow depth criteria specified in the above tables together with the criteria outlined in the QUDM.

5.5.4 The "d.v. ≤ 0.6" shall be imposed where vehicle safety only is affected.

5.5.5 The demarcation between 'longitudinal road drainage" and "road cross drainage" may be unclear particularly in urban situations where both systems are interconnected. The underground piped drainage within a residential urban subdivision shall generally be regarded as all "longitudinal road drainage" irrespective of a number of short reaches of small diameter pipes across roads used to collect road flows. Generally in urban drainage, the "road cross drainage" in Table 5.5 II will apply to collector roads upwards.

5.5.6 Rainfall intensities are shown in Table 5.5 (lV) and 5.5 (V).

TABLE 5.5 (lV)
RAINFALL INTENSITY IN MM/HR - YEPPOON AREA

AVERAGE RECURRENCE INTERVAL(yrs)	**1**	**2**	**5**	**10**	**20**	**50**	**100**
DURATION(hrs)							
0.083	117	151	193	220	255	303	341
0.100	109	141	182	207	241	286	322
0.167	90.3	117	150	171	199	236	266
0.333	67.4	87.1	111	126	146	173	195
0.500	55.5	71.6	91.5	104	120	142	160
1.000	38.0	49.2	63.2	71.8	83.5	99.2	112
2.000	24.9	32.4	42.3	48.4	56.7	68.0	76.9
3.000	19.1	25.0	33.1	38.2	45.0	54.3	61.7
6.000	12.1	16.0	21.7	25.4	30.2	37.0	42.4
12.000	7.78	10.4	14.4	17.1	20.6	25.6	29.6
24.000	5.08	6.83	9.74	11.7	14.3	18.0	21.0
48.000	3.28	4.45	6.54	7.99	9.87	12.6	14.9
72.000	2.45	3.36	5.02	6.21	7.73	10.0	11.9

TABLE 5.5 (V)
RAINFALL INTENSITY (I) IN MM/HR - MARLBOROUGH AREA

AVERAGE RECURRENCE INTERVAL(yrs)	**1**	**2**	**5**	**10**	**20**	**50**	**100**
DURATION(hrs)							
0.083	108	139	179	203	235	279	314
0.100	101	130	167	190	221	262	295
0.167	83.6	108	138	156	181	215	242
0.333	63.0	81.1	103	116	133	157	176
0.500	52.0	66.8	84.2	94.7	109	128	143
1.000	35.4	45.4	57.4	64.6	74.4	87.6	98.0
2.000	22.5	29.1	37.2	42.2	48.9	58.0	65.1
3.000	16.9	22.0	28.4	32.4	37.8	45.1	50.9
6.000	10.3	13.5	17.8	20.6	24.3	29.3	33.4
12.000	6.35	8.38	11.3	13.3	15.8	19.3	22.1
24.000	4.02	5.34	7.36	8.68	10.4	12.9	14.9
48.000	2.53	3.38	4.74	5.64	6.82	8.52	9.89
72.000	1.84	2.49	3.53	4.23	5.15	6.49	7.57

5.6 ROOF AND ALLOTMENT DRAINAGE

5.6.1 Roof and allotment drainage shall generally be provided where:-

(a) Allotments fall away from the street and roof drainage can not effectively drain to the street;

(b) Where the proportion of impervious area within a development is high eg. Industrial, commercial and multi-unit residential developments;

(c) Where zonings allow construction on adjacent properties which may block or concentrate flow paths.

5.6.2 The standard of roof and allotment drainage to the provided shall be as follows:-

Residential A	Level II*
Residential B & C	Level IV
Park Residential	Nil
Commercial	Level IV
Industrial	Level IV

*Level III may be required by Council in particular sections of a system if undue nuisance is likely due to topography considerations. Level I may be permitted by Council in circumstances where soil conditions and/or adjacent features such as drainage reserve, creek, parkland and/or limited allotment numbers ensure future nuisance arising from roofwater discharge is very unlikely.

5.6.3 Council may specify a higher level of roof and allotment drainage depending on impervious site coverage area and adjacent features such as drainage reserves, creek, parkland etc. Consultants are encouraged to confer with Council prior to commencing design.

5.6.4 Easements shall be required over roof / allotment drainage pipes where more than one (I) allotment discharges into the system. The width of the easement shall be contingent on the pipe size and depth. Refer to Section 3 for proposed drainage easement provisions.

5.7 PIPES AND PITS

The minimum pipe class shall be Class 2. Saltwater cover pipes or FRC pipes shall be used in tidal areas, ie where the invert is below RL3.0. Pipe laying shall generally be accordance with the IMEAQ standard drawings. Pipes shall generally be flush jointed, bandaged in an approved manner, in accordance with the pipe manufacture's requirements. In unstable ground where pipe movement is possible, the pipes shall be rubber ringed spigot and socket jointed or be laid in and backfilled with cement stabilised material. Further to Section 5.10.3 of QUDM all gully inlets, pre entry boxes and transitions are to be located beyond any kerb return tangent points.