

- Appendix C

Proposed mitigation

Table 6.2 Mitigation Measures (including Town Centre)

1% AEP Flood Levels (MSL) at the Nodes						
Future Mitigated with Town Centre						
Node Name	Design Fill Level	Existing	Future Mitigated	Future Mitigated (including Town Centre)	Minimum Channel Width (m) downstream of node at 1% AEP flood level	Minimum Channel Area (m²) downstream of node at 1% AEP flood level
	m	m	m	m		
60		31.9	31.8	31.7		
65			29.7	29.7		
70	26.0	25.4	25.4	25.5	60	120
75	24.7			24.2	100	150
80	24.5	24.0	23.9	24.0		
130		20.0	19.9	19.9		
150		12.8	12.7	12.7		
160		11.7	11.5	11.7		
165		11.7	11.4	11.6		
170		10.3	10.3	10.3		
180		5.7	5.6	5.7		
220		4.0	4.0	4.0		
230		2.1	2.1	2.1		
Channel Flows downstream of the Node						
Node	Link Name (Future Model)	Existing	Future Mitigated	Future Mitigated (including Town Centre)		
		m³/s	m³/s	m³/s		
60	B60	80	79	77		
65	B60b		76	80		
70	B70A	99	95	98		
75	B70B			101		
80	B80	85	79	88		
130	B130	72	66	70		
150	B150	75	70	73		
160	A160	87	81	85		
165	Dam	79	77	79		
170	A170	80	75	79		
180	A180	82	77	80		
220	A220	148	138	141		
Notes:						
1. Modelling carried out with 0.5m contour data only. Flood levels are therefore indicative only and cannot be relied on for design. For better local definition of the floodplain, a site-specific survey should be undertaken to estimate the local hydraulic conditions.						
2. Town Centre inclusive of Nodes 70 to 80						
3. Part of B11 subcatchment diverted from node 130 to node 70 in the future mitigated scenario						

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Table 6.3: Peak Channel Flows (m³/s) from XPSWMM Model

		Peak Channel Flows (m ³ /s)										
		100 Year ARI		50 Year ARI		10 Year ARI		5 Year ARI		2 Year ARI		
U/S Node ¹	D/S Node ¹	Existing	Future Mitigated	Existing	Future Mitigated	Existing	Future Mitigated	Existing	Future Mitigated	Existing	Future Mitigated	Comments
10	20	14.4	12.3	11.8	10.5	7.8	7.2	5.4	4.8	2.7	2.5	
20	160	22	18.3	17.5	14.4	10.4	8.3	8.0	5.8	4.8	3.1	
30	60	38	36	32	30	20	19.5	15.2	14.2	8.4	7.9	
40	50	19.1	17.4	15.8	13.9	10.5	9.3	7.9	6.9	4.5	3.9	
50	60	34	35	28	29	18.8	17.8	12.4	10.6	7.2	6.2	
60	70	80	77	62	61	34	32	22	21	11.6	8.2	
70	80	99	98	78	76	46	42	31	27	17.5	10.6	Includes diversion of flow from future subcatchment B11B which was draining into Node 130 in the existing scenario.
80	130	85	88	67	68	39	38	26	23	13.1	9.4	Includes upstream diversion of flow from future subcatchment B11B into Node 70 which was draining into Node 130 in the existing scenario.
90	100	21	19.8	17.0	16.5	11.4	10.9	7.1	6.5	4.6	3.5	
100	120	31	33	25	26	15.5	14.4	10.0	8.3	6.7	5.2	
110	120	9.0	9.2	7.1	7.6	4.9	4.6	3.7	2.7	2.0	0.62	
120	130	37	39	30	31	17.7	16.7	11.7	10.5	6.1	4.2	
130	150	72	70	55	53	33	31	24	22	13.9	10.4	
140	150	8.6	3.8	7.1	3.2	4.7	2.1	3.2	1.4	1.8	0.66	Part of flow from existing subcatchment D1 draining into Node 140 in the existing scenario is now diverted into Node 150 as part of future subcatchment D2A.
150	160	75	73	57	55	34	33	25	23	14.4	11.1	Includes part of flow from existing subcatchment D1 which was draining into Node 140, but now diverted into Node 150 as part of future subcatchment D2A.
160	165	87	85	67	65	41	38	28	27	15.9	12.6	
165	170	79	79	67	65	40	38	28	27	15.9	12.7	
170	180	80	79	68	65	41	39	29	27	16.2	13.1	
180	220	82	80	69	67	43	40	30	28	16.7	13.5	
190	210	12.9	12.5	10.6	10.2	7.0	6.1	4.9	3.7	2.7	1.0	
191	195	10.3	10.9	8.7	9.3	6.4	6.9	5.3	5.7	3.4	3.9	
193	195	8.0	8.2	7.3	7.5	6.0	6.5	4.6	4.9	3.6	3.3	
195	197	25	25	20	21	11.2	11.9	10.0	10.2	6.6	7.5	
197	199	35	35	29	29	17.8	18.4	14.6	15.1	8.5	9.4	
199	200	60	62	51	52	33	35	25	24	14.7	12.9	
200	210	57	58	48	49	32	33	24	25	14.5	15.7	
210	220	68	67	55	56	34	34	24	25	13.0	12.9	
220	230	148	141	120	115	76	71	53	49	29	26	

¹ Refer to Map 8 for node locations

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Table 6.4: Subcatchment Tributary Peak Flows and Stormwater Management Devices (Study Area Only)

Subcatchment ¹	Subcatchment Peak Flows		Stormwater Management Devices								Remarks
	Existing Q ₁₀₀ m ³ /s	Future Mitigated Q ₁₀₀ m ³ /s	Type of Pond: Online / Offline	Area served by Ponds ha	Water Quality Volume m ³	Extended Detention Volume m ³	Flood Detention Volume m ³	Total Pond Volume m ³	Pond Q ₁₀₀ Inflow m ³ /s	Pond Q ₁₀₀ Outflow m ³ /s	
A1A	1.6	1.3	Offline	10.0	1800	2500	3500	7800	2.5	1.3	
A1B	0.64	0.44	Offline	4.0	700	1100	1700	3500	1.1	0.44	
A1C	11.5	10.7	na	63.8	na	na	na	na	na	na	Low Intensity - apply low impact design / Protected Riparian Area
A2A	4.5	4.0	Online	37.5	6400	9400	10300	26100	6.5	4.0	
A2B	0.37	0.15	Offline	3.4	700	900	1900	3500	0.95	0.15	
A2C	0.54	0.63		4.7	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
A3A	2.4	2.3	Online	20.0	3300	5000	5900	14200	3.8	2.3	
A3B	7.3	4.0	Online	46.4	7900	11600	18800	38300	8.9	4.0	
A3C	2.0	3.0	na	19.7	na	na	na	na	na	na	Urban Park. No treatment required.
B10A	3.0	2.4	Online	19.9	3500	5000	7300	15800	5.1	2.4	
B10B	1.3	1.1	Offline	8.4	1300	2100	2300	5700	1.9	1.1	
B10C	1.5	1.4	Offline	10.0	1800	2600	2900	7300	2.2	1.4	
B10D	5.4	5.6	na	31.7	na	na	na	na	na	na	Low Intensity - apply low impact design / Protected Riparian Area
B11A	5.7	5.0	Online	51.8	8700	13000	28900	50600	7.3	5.0	
B11B	5.2	4.7	Offline	47.1	8100	11800	12900	32800	7.4	4.7	
B12A	2.3	2.5	na	19.4	na	na	na	na	na	na	Urban Park. No treatment required.
B13A	0.93	0.66	Offline	7.1	1300	1800	3100	6200	1.8	0.66	
B13B	1.9	1.7	na	14.8	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
B1A	16.6	15.9	na	92.3	na	na	na	na	na	na	Low Intensity - apply low impact design / Protected Riparian Area
B2A	2.3	1.8	Offline	12.5	2300	3200	4500	10000	3.5	1.8	
B2B	19.4	18.5	na	107.5	na	na	na	na	na	na	Low Intensity - apply low impact design / Protected Riparian Area
B3A	2.7	2.0	Offline	14.9	2700	3800	5100	11600	3.9	2.0	
B3B	0.94	0.78	Offline	5.5	900	1400	1500	3800	1.4	0.78	
B3C	3.7	2.7	Offline	21.8	3500	5500	7300	16300	5.9	2.7	
B3D	1.4	1.6	na	8.7	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
B4A	18.6	17.0	na	80.7	na	na	na	na	na	na	Low Intensity - apply low impact design.
B5A	2.7	2.0	Offline	13.3	2300	3400	4500	10200	3.9	2.00	
B5B	1.6	1.1	Offline	8.1	1400	2100	3300	6800	2.6	1.1	
B5C	2.5	2.0	na	12.3	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
B6A	2.8	2.2	Offline	16.4	2900	4100	5900	12900	4.4	2.2	
B6B	3.7	2.6	Offline	21.8	3800	5500	9200	18500	6.3	2.6	
B6C	0.85	0.55	Offline	5.3	900	1400	2100	4400	1.5	0.55	
B6D	7.5	7.8	na	43.9	na	na	na	na	na	na	Low Intensity - apply low impact design / Protected Riparian Area
B7A	3.5	2.8	Online	21.7	3500	5500	8000	17000	5.6	2.8	
B7B	7.4	4.2	Online	20.2	3200	5100	7000	15300	6.6	4.2	
B7C	1.2	0.87	Online	7.5	1300	1900	3400	6600	2.2	0.87	
B7D	1.2	1.2	na	10.4	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
B8A	2.6	2.1	Online	18.7	3000	4700	6500	14200	4.0	2.1	
B8B	4.3	3.8	Online	30.8	5400	7800	8700	21900	5.9	3.8	
B8C	2.2	1.6	na	18.0	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
B9A	2.3	1.5	Offline	14.1	2300	3600	6000	11900	3.9	1.5	
B9B	3.5	3.0	Offline	24.7	4300	6200	6700	17200	4.9	3.0	
B9C	9.4	8.4	Offline	63.0	10400	15800	14500	40700	12.0	8.4	
B9D	4.0	3.3	Offline	25.3	4500	6400	9200	20100	6.4	3.3	
B9E	1.3	0.9	Offline	9.2	1700	2300	4100	8100	2.5	0.93	
B9F	0.53	0.29	Offline	3.8	700	1000	1800	3500	1.2	0.29	
B9G	4.2	3.4	na	27.9	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
C1A	2.2	1.4	Offline	12.3	2100	3100	5200	10400	3.6	1.4	
C1B	1.5	1.0	Offline	8.3	1500	2100	3500	7100	2.6	1.0	
C1C	5.6	3.8	Online	31.2	5100	7800	11600	24500	8.4	3.8	
C1D	12.7	14.0	na	70.6	na	na	na	na	na	na	Low Intensity - apply low impact design / Protected Riparian Area
C2A	0.77	0.46	Offline	5.7	1000	1500	2700	5200	1.8	0.46	
C2B	2.2	1.4	Offline	16.1	2700	4100	6800	13600	3.9	1.4	
C2C	1.4	0.95	Offline	11.7	2100	3000	5100	10200	2.6	0.95	
C2D	3.5	3.4	na	27.1	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
C3A	1.9	1.3	Online	11.5	2000	2900	4800	9700	3.1	1.3	
C3B	2.4	1.8	Offline	15.3	2600	3900	5100	11600	3.5	1.8	
C3C	0.19	0.09	Offline	1.3	300	400	600	1300	0.40	0.09	
C3D	0.51	0.29	Offline	3.4	600	900	1600	3100	1.1	0.29	
C3E	4.0	3.6	na	23.8	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
C4A	0.98	0.74	Offline	8.9	1600	2300	4000	7900	2.0	0.74	
C4B	1.5	1.4	na	13.3	na	na	na	na	na	na	Protected Riparian/Conservation Area. No treatment required.
C5A	10.1	9.3	Online	57.5	8900	14400	7200	30500	10.9	9.3	
C6A	12.9	11.2	Online	23.0	3800	5800	6200	15800	11.3	11.2	
C6B	1.1	0.94	Offline	10.3	1700	2600	3700	8000	2.1	0.94	
D1A	² 1.5	1.3	Online	11.8	2100	3000	4400	9500	2.7	1.3	
D1B	2.9	3.2	na	22.3	na	na	na	na	na	na	Urban Park. No treatment required.
D2A	² 8.8	7.4	Online	53.1	9000	13300	8800	31100	9.8	7.4	
E1A	15.3	15.0	Online	110.7	17600	27700	12500	57800	17.1	15.0	
C6C	1.1	1.7	na	9.7	na	na	na	na	na	na	Urban Park. No treatment required.
C7A	2.8	2.7	na	18.4	na	na	na	na	na	na	Urban Park. No treatment required.

¹ Refer to Map 9 for details on future subcatchment boundary

² D2A and D1A were modelled as separate online ponds in the model, feeding into node 150 and node 140 respectively. Due to now current development, D2A should be modelled as an online pond further downstream of D1A and node 140. In the future model update, this arrangement should be rectified. The implication of the current arrangement is that the pond may need to be slightly larger and the flow between node 140 to 150 will be larger than the combined flow out from the separate online ponds, D1A and D2A.

Table 6.5: Peak Velocity in the Main Channels

U/S Node	D/S Node¹	Peak Velocity (m/s)		
		100 yr Future Mitigated	5 yr Future Mitigated	2 yr Future Mitigated
10	15	0.58	0.47	0.35
15	20	0.58	0.47	0.34
20	160	0.63	0.43	0.29
30	35	1.96 ²	1.28	1.02
35	60	1.77 ²	1.20	0.80
40	45	2.13 ²	1.21	0.97
45	50	1.70 ²	1.15	0.80
50	55	1.68 ²	1.20	0.79
55	60	1.41	0.73	0.71
60	65	0.90	0.63	0.53
65	70	0.96	0.64	0.54
70	75	1.21	0.70	0.51
75	80	0.63	0.39	0.39
80	130	0.76	0.47	0.36
90	93	0.99	0.72	0.44
93	96	1.06	0.67	0.46
96	100	0.81	0.60	0.44
100	105	1.26	0.83	0.55
105	120	0.79	0.58	0.52
110	120	0.63	0.34	0.12
120	130	0.45	0.25	0.23
130	150	0.97	0.81	0.63
140	150	0.54	0.32	0.18
150	160	0.51	0.29	0.22
160	165	1.08	1.02	1.07
165	170	7.84	3.03	2.20
165	170	7.84	3.03	2.20
170	180	1.46	1.12	0.92
180	220	1.36	0.92	0.67
190	210	0.09	0.04	0.02
191	195	0.21	3.96	3.71
191	195	3.92	3.96	3.71
193	195	0.06	3.76	3.21
193	195	4.04	3.76	3.21
195	197	0.53	1.53	1.53
195	197	1.57	1.53	1.53
197	199	0.53	10.07	1.12
197	199	1.11	10.07	1.12
199	200	0.57	2.87	2.88
199	200	2.76	2.87	2.88
200	210	1.22	1.02	0.88
210	220	1.18	0.79	0.59
220	230	1.28	0.83	0.63

1. Refer to Map 9 for node locations
2. Attention will need to be given to channel stability at design stage