6.0 CONCLUSIONS & RECOMMENDATIONS

A preferred Water Cycle Management Option has been identified which is described and shown in Section 3.2.1 and Figure 3-1. It comprises a range of elements that work together to deliver an integrated outcome addressing each of the following:

- stormwater quality improvement
- flooding and detention
- potable water substitution
- environmental restoration/rehabilitation

The following provides the strategic response to all these elements.

6.1. Stormwater quality improvement

Stormwater quality targets for the development can be met by combining the effects of rainwater tanks on individual lots with bioretention systems either in road corridors or as end of line basins. End of line bioretention are preferred which can have pre-filtering using GPTs, or by installing sediment/litter trapping forebays.

In order to comply with Landcom's baseline water quality targets, bioretention areas of 46-59 m^2/Ha of new development (46m^2/Ha with GPT pre-filtering; 59m^2/Ha without GPT pre-filtering) are required.

Bioretention is favoured over wetlands because it requires significantly less area to be dedicated.

The five existing GPTs along the eastern boundary of the study area shall be retained with improved access and maintenance pads provided in some instances.

6.2. Flooding and detention

6.2.1. Smiths Creek Flood Extents

In existing conditions the 100 yr ARI flood extent is well contained within the riparian corridor of Smiths Creek. Post development a small flood wall will be constructed on Georges River Rd Crossing and on the boundary of one of the lower lying lots, following which there will not be any flooding of the Georges River Rd or surrounding residential lots in the 100 yr ARI event.

6.2.1. Overland Flows

Drainage corridors for the development must be designed to convey flows for the 100year ARI storm event. Some of the assessed drainage corridors have adequate capacity while others will require further detailed hydraulic analysis to assess their capacity. The ultimate solutions for undersized overland flow paths may include combinations of the following:

- Regrade existing roads to divert flows
- Augmenting sub-surface drainage infrastructure
- Increase the capacity of the road reserve

6.2.2. Detention Requirements

It is proposed to utilise the flood storage capacity formed by the embankment of Georges River Road to provide the detention required to match pre- and post-development flows for a range of rain events.

In order to achieve this, it will be required to modify the existing culvert arrangement, and to install barriers to detain flood waters adjacent to Georges River Road.

It should be noted that the cumulative effect of rain tanks, bioretention systems, the pond and stormwater harvesting will also provide distributed detention across the proposed development, meaning that the results are conservative. The detention effects of these items has not been modelled or reported in the results.

6.3. Potable water substitution

The only significant stormwater harvesting scheme identified is for the two proposed playing fields in the Smiths Creek corridor. A high reliability of supply can be obtained for the irrigation demands by harvesting from the upstream catchment. A tank of 400-500kL storage capacity (above or below ground) is recommended based on preliminary water balance modelling.

6.4. Environmental restoration/rehabilitation

The eroding channel within the Smiths Creek corridor needs to be rehabilitated by employing the Natural Channel Design Guidelines (Brisbane City Council, 2003). Combinations of rock armouring balanced with vegetation will stabilise the stream.

The weeds in the corridor need to be removed, commencing with noxious weeds and followed by environmental weeds. A revegetation plan will allow for the introduction of enhanced biodiversity, however, this must not increase the stream roughness above acceptable levels for flooding.

APPENDIX A

Masterplan – Preferred Option

- STUDY AREA
- POTENTIAL TOWNCENTRE LOCATION
- NEW CARPARKING
- NEW DWELLINGS
- EXISTING COTTAGE PRECINCTS
- PRIVATE OWNERSHIP
- THARAWAL ABORIGINAL CORPORATION
- NEW SENIORS HOUSING DEVELOPMENT
- EXISTING SENIORS HOUSING DEVELOPMENT
- OPEN SPACE
- EXISTING POND

- A — DETACHED FAMILY HOUSING 430m²+, 3/4 BEDROOMS
- B — SMALL-DETACHED OR SEMI-ATTACHED FAMILY HOUSING 350-370m², 3 BEDROOMS
- C — SEMI-ATTACHED OR ATTACHED FAMILY HOUSING 250-300m², 2/3 BEDROOMS
- D — MULTI UNIT DWELLING MEDIUM DENSITY LOT

1:5000 scale

0m 100 200 300 400 600 m

DATE: 21/09/2010

DRAWING: 100909.1

DRAWING TITLE

Preferred Option Base

Airds Bradbury RENEWAL PROJECT

urbis

design outLOUD your voice your community

APPENDIX B

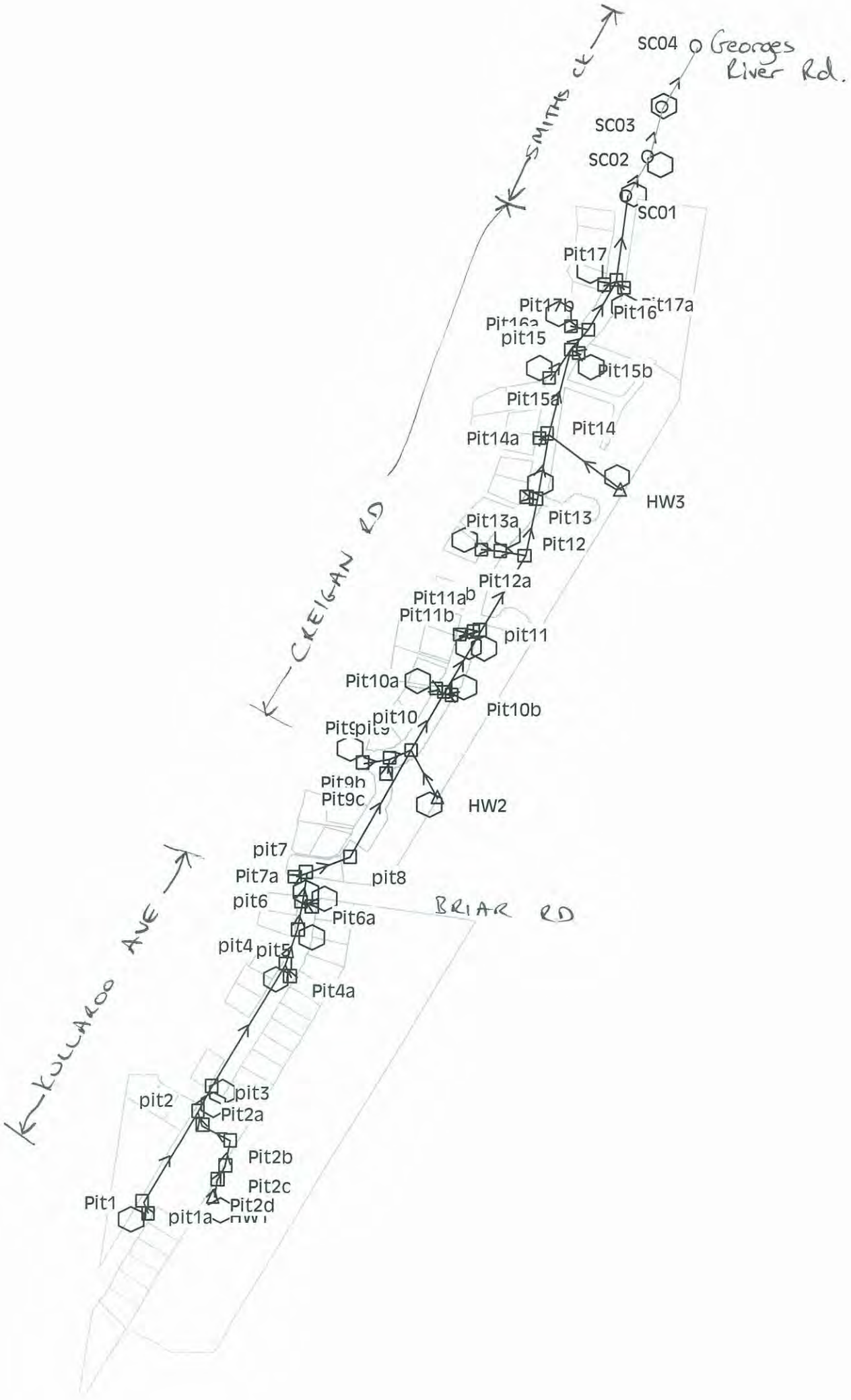
Catchment Plan


KULLAROO AVE
ST JOHNS RD
MORRO CRES
BRIAR RD
CREGAN RD
SMITHS CREEK
GREENGATE RD
"THE POND"
RIVERSIDE DR
RIVERSIDE DR
RIVERSIDE DR
GEORGES RIVER RD
FERRIN CRES
GEORGES RIVER

APPENDIX C

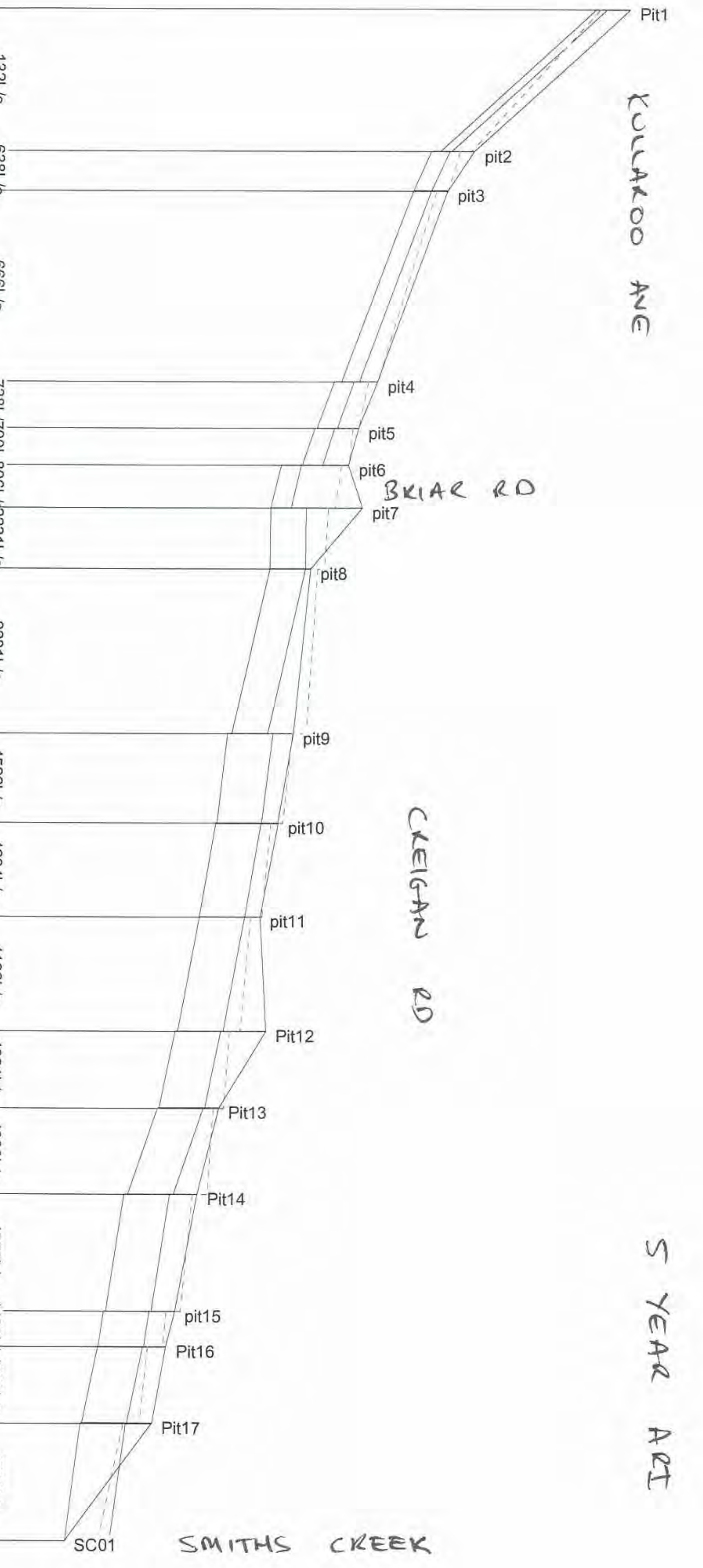
Drainage Capacity Assessment

- DRAINS Modelling details


SC04
Georges River Rd.
SC03
SC02
SC01
SMITHS CK
Pit17
Pit17b
Pit16
Pit17a
Pit16a
pit15
Pit15b
Pit15a
Pit14a
Pit14
HW3
Pit13a
Pit13
Pit12
Pit12a
CREIGAN RD
Pit11a
Pit11b
pit11
Pit10a
Pit10b
pit10
Pit9
Pit9b
Pit9c
HW2
pit7
Pit7a
pit8
pit6
Pit6a
BRIAR RD
pit4
pit5
Pit4a
KULLAROO AVE
pit2
pit3
Pit2a
Pit2b
Pit2c
Pit1
Pit2d
pit1a

Chainage	Invert Level	Surface Level	HGL	Pipe	Pit
0	132.470	133.64	132.629	132L/s 375mm 5.40%	Pit1
	127.300		128.328		
95.7	127.010	128.43	127.949	638L/s 600mm 2.27%	pit2
	126.410		127.540		
122.107	126.400	127.54	127.172	666L/s 600mm 1.85%	pit3
	124.020		125.240		
250.476	123.770	125.24	124.920	738L/s 675mm 1.82%	pit4
	123.200		124.600		
281.717	123.120	124.6	124.415	790L/s 675mm 1.65%	pit5
	122.710		124.270		
306.641	122.000	124.27	124.026	896L/s 675mm 1.22%	pit6
	121.650		123.806		
335.432	121.650	124.74	123.583	2231L/s 1200mm 0.05%	pit7
	121.630		123.451		
376.526	121.630	123	123.228	2231L/s 1200mm 1.12%	pit8
	120.380		122.868		
487.837	120.240	122.44	122.398	4522L/s 1500mm 0.61%	pit9
	119.870		122.098		
548.271	119.850	121.94	121.685	4234L/s 1500mm 0.87%	pit10
	119.300		121.410		
611.571	119.300	121.35	121.016	4193L/s 1500mm 0.90%	pit11
	118.600		120.695		
688.971	118.510	121.56	120.334	4091L/s 1500mm 1.01%	Pit12
	117.990		120.137		
740.606	117.930	119.98	119.800	4080L/s 1500mm 1.68%	Pit13
	116.950		119.592		
798.873	116.830	119.27	119.111	4575L/s 1500mm 0.76%	Pit14
	116.230		118.711		
877.412	116.160	118.54	118.248	4489L/s 1500mm 0.71%	pit15
	115.990		118.132		
901.214	115.960	118.25	117.632	4660L/s 1500mm 1.03%	Pit16
	115.430		117.361		
952.663	115.390	117.78	116.833	4792L/s 1500mm 0.66%	Pit17
	114.870		116.000		
1031.38		114.87			SC01

Datum El. 109



Pipe	Flow	Size	Grade	Invert Level (upstream)	Invert Level (downstream)	HGL (upstream)	HGL (downstream)
Pit1 – pit2	132L/s	375mm	5.40%	132.470	127.300	132.629	128.369
pit2 – pit3	635L/s	600mm	2.27%	127.010	126.410	127.998	127.540
pit3 – pit4	663L/s	600mm	1.85%	126.400	124.020	127.219	125.240
pit4 – pit5	758L/	675m	1.82%	123.770	123.200	124.917	124.600
pit5 – pit6	820L/	675m	1.65%	123.120	122.710	124.415	124.270
pit6 – pit7	916L/s	675mr	1.22%	122.000	121.650	124.126	123.996
pit7 – pit8	2233L/s	1200mm	0.05%	121.650	121.630	123.835	123.739
pit8 – pit9	2233L/s	1200mm	1.12%	121.630	120.380	123.578	123.318
pit9 – pit10	4959L/s	1500mm	0.61%	120.240	119.870	122.752	122.391
pit10 – pit11	4481L/s	1500mm	0.87%	119.850	119.300	121.930	121.621
pit11 – Pit12	4309L/s	1500mm	0.90%	119.300	118.600	121.195	120.846
Pit12 – Pit13	4176L/s	1500mm	1.01%	118.510	117.990	120.464	120.256
Pit13 – Pit14	4155L/s	1500mm	1.68%	117.930	116.950	119.904	119.688
Pit14 – pit15	4675L/s	1500mm	0.76%	116.830	116.230	119.186	118.770
pit15 – Pit16	4556L/s	1500mr	0.71%	116.160	115.990	118.294	118.175
Pit16 – Pit17	4718L/s	1500mm	1.03%	115.960	115.430	117.663	117.385
Pit17 – SC01	4850L/s	1500mm	0.66%	115.390	114.870	116.844	116.084

Pit	Chainage	Surface Level
Pit1	0	133.64
pit2	95.7	128.43
pit3	122.107	127.54
pit4	250.476	125.24
pit5	281.717	124.6
pit6	306.641	124.27
pit7	335.432	124.74
pit8	376.526	123
pit9	487.837	122.44
pit10	548.271	121.94
pit11	611.571	121.35
Pit12	688.971	121.56
Pit13	740.606	119.98
Pit14	798.873	119.27
pit15	877.412	118.54
Pit16	901.214	118.25
Pit17	952.663	117.78
SC01	1031.38	114.87

DRAINS results prepared 31 May, 2010 from Version 2009.06 5 YEAR

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW1	129.75	1.239			-0.13	0.778	system capacity
HW2	124.35	2.695			0.29	0	None
HW3	121.97	1.225			-0.07	0.317	system capacity
Pit1	132.95		0.457		0.69	0.391	Inlet Capacity
pit10	122.1		0		-0.16		Outlet System
Pit10a	121.89		5.067		0	5.229	Outlet System
Pit10b	121.97		4.92		0	5.046	Outlet System
pit11	121.41		0		-0.06		Outlet System
Pit11a	121.31		5.392		0	5.553	Outlet System
Pit11b	121.37		5.281		0	5.215	Inlet Capacity
Pit12	120.69		0		0.87		None
Pit12a	120.48		6.267		0	6.489	Outlet System
Pit12b	120.58		0.148		0	0.012	Outlet System
Pit13	120.14		0		-0.16		Outlet System
Pit13a	119.95		6.574		0	6.701	Outlet System
Pit14	119.59		0		-0.32		Outlet System
Pit14a	119.33		6.832		0	6.985	Outlet System
pit15	118.71		0		-0.17		Outlet System
Pit15a	118.8		7.126		0.02	7.06	Inlet Capacity
Pit15b	118.48		0.138		0	0.284	Outlet System
Pit16	118.13		0		0.12		None
Pit16a	118.29		8.332		0	8.151	Outlet System
Pit17	117.36		0		0.42		None
Pit17a	117.41		8.201		0.33	8.135	Inlet Capacity
Pit17b	117.41		8.147		0.21	8.081	Inlet Capacity
pit1a	133.23		0.523		0.82	0.457	Inlet Capacity
pit2	128.33		1.897		0.1	1.747	Inlet Capacity
Pit2a	128.65		0.956		0.28	0.89	Inlet Capacity
Pit2b	128.96		0		-0.01		Outlet System
Pit2c	129.21	129.21	1.144	10	-0.2	0.956	Outlet System
Pit2d	129.23		0.778		0	1.144	Outlet System
pit3	127.54		1.836		0	1.81	Outlet System
pit4	125.24		1.89		0	1.871	Outlet System
Pit4a	125.29		0.252		0.11	0.186	Inlet Capacity
pit5	124.6		2.1		0	2.278	Outlet System
pit6	124.27		2.253		0	2.219	Outlet System
Pit6a	124.32		2.319		0	2.253	Inlet Capacity
pit7	123.81		0		0.93		None
Pit7a	124.52		2.493		0	1.189	Outlet System
pit8	123.45		0		-0.45		Outlet System
pit9	122.87		0		-0.43		Outlet System
Pit9a	122.72		0		0.03		None
Pit9b	122.7		2.108		0	2.129	Outlet System
Pit9c	122.63		4.266		0	4.343	Outlet System

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)
Cat4	0.252	0.192	0.06	8	8	0
Cat5	0.322	0.251	0.073	9	9	0
Cat18	2.62	1.423	1.291	24	24	0
Cat19	3.125	0.971	2.283	27	27	0
Cat20	6.524	4.868	1.764	35	35	0
Cat6	0.122	0.101	0.023	6	6	0
Cat7	2.493	1.919	0.642	22	22	0
Cat10a	0.066	0.043	0.023	5	0	0
Cat12b	0.148	0.097	0.051	7	7	0
Cat12a	0.964	0.437	0.527	15	15	0
Cat13	0.263	0.046	0.217	9	9	0
Cat15a	0.432	0.169	0.263	10	10	0
Cat16	1.474	0.84	0.663	18	18	0
Cat1	0.523	0.338	0.185	12	12	0
Cat2	0.672	0.158	0.514	13	13	0
Cat3	0.173	0.122	0.051	7	7	0
Cathw1	1.239	0.522	0.734	17	17	0
Cat11b	0.142	0.094	0.049	7	7	0
Cat11a	0.893	0.312	0.581	5	0	0
Cat8	2.695	1.6	1.184	24	24	0
Cat14	1.225	0.307	0.929	17	17	0
Cat17a	0.217	0.013	0.204	8	8	0
Cat10b	0.728	0.045	0.684	14	14	0
Cat9	0.997	0.461	0.542	16	16	0
Cat15b	0.138	0.114	0.026	6	6	0
Cat17b	0.064	0.041	0.023	5	5	0

Outflow Volumes for Total Catchment (78.0 impervious + 101 pervious = 179 total ha)

Storm	Total Rainfall cu.m	Total Runo cu.m (Runc	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
15 min.	38478.55	23202.67 (I	15996.05 (95.3%)	7206.62 (33.2%)
30 min.	54585.85	35669.24 (I	23018.70 (96.7%)	12650.54 (41.1%)
45 min.	65905.7	44186.16 (I	27954.06 (97.3%)	16232.10 (43.7%)
60 min.	74809.46	50881.24 (I	31836.07 (97.6%)	19045.17 (45.1%)
90 min.	86710.98	58655.90 (I	37024.77 (97.9%)	21631.13 (44.2%)
120 min.	95927.91	64503.24 (I	41043.42 (98.1%)	23459.82 (43.4%)
180 min.	110603.48	74128.75 (I	47441.97 (98.4%)	26686.78 (42.8%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)
24	0.065	0.6	125.264	125.24
6	0.738	2.1	124.92	124.6
7	0.79	2.2	124.415	124.27
8	0.896	2.5	124.026	123.806
9	2.231	2	123.583	123.451
10	2.231	2	123.228	122.868
11	4.522	2.5	122.398	122.098
Pipe12	4.234	2.3	121.685	121.41
Pipe12brar	4.193	2.3	121.016	120.695
13	4.091	2.2	120.334	120.137
14	4.08	2.2	119.8	119.592
15	4.575	2.5	119.111	118.711
16	4.489	2.5	118.248	118.132
17	4.66	2.6	117.632	117.361
18	4.792	3.3	116.833	116
25	0.066	0.6	124.29	124.27
26	1.484	3.4	123.875	123.806
29	0.066	0.6	122.632	122.719
32	0.227	2.1	122.719	122.868
33	0.348	3.2	121.894	122.098
38	0.137	0.9	120.524	120.48
39	0.179	1.1	120.486	120.695
40	0.066	0.6	119.953	120.137
42	0.066	0.6	119.334	119.592
43	0.066	0.6	118.771	118.711
45	0.451	2.8	118.226	118.132
2	0.066	2.1	133.065	132.951
3	0.132	3	132.629	128.328
4	0.638	2.3	127.949	127.54
5	0.666	2.4	127.172	125.24
19	0.461	2.1	129.452	129.23
20	0.32	1.5	129.22	129.21
21	0.378	1.7	129.081	128.955
22	0.383	1.8	128.826	128.652
23	0.421	1.9	128.455	128.328
35	0.066	0.6	121.339	121.31
36	0.132	1.2	121.314	121.41
27	2.695	2.6	123.905	122.868
41	0.908	4.3	121.076	119.592
46	0.066	0.6	117.384	117.361
34	0.066	0.6	121.973	122.098
31	0.215	2	122.701	122.719
Pipe43a	0.064	0.6	118.484	118.711
47	0.066	0.6	117.383	117.361

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)
Chnl1	15.101	1.9		
Chnl2	18.205	2.3		
Chnl3	24.713	2.5		

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
OF4a	0.186	0.186	0.256	0.044	0.03	12.89	0.59
OF5	1.871	1.871	0.256	0.113	0.13	26.54	1.13
OF6	2.278	2.278	0.256	0.123	0.14	28.52	1.18
OF6b	2.219	2.219	0.256	0.121	0.14	28.16	1.18
OF6a	2.253	2.253	0.256	0.122	0.14	28.34	1.18
OF7	1.189	1.189	0.256	0.094	0.09	22.77	0.99
OF10	4.343	4.343	0.256	0.159	0.22	35.88	1.39
OF11	5.229	5.229	0.256	0.171	0.25	38.22	1.47
OF12b	0.012	0.012	0.256	0.016	0	5.24	0.29
OF13	6.489	6.489	0.256	0.187	0.29	41.45	1.55
OF14	6.701	6.701	0.256	0.189	0.3	41.81	1.57
OF14b	6.985	6.985	0.256	0.193	0.3	42.53	1.58
OF15	7.06	7.06	0.256	0.194	0.31	42.71	1.58
OF16c	8.151	8.151	0.256	0.205	0.34	45.04	1.64
OF1a	0.457	0.457	0.256	0.063	0.05	16.66	0.77
OF1	0.391	0.391	0.256	0.06	0.04	15.94	0.73
OF2	1.747	1.747	0.256	0.11	0.12	26	1.1
OF3	1.81	1.81	0.256	0.111	0.12	26.18	1.12
OF2e	0.778	0.778	0.256	0.079	0.07	19.72	0.89
OF2d	1.144	1.144	0.256	0.092	0.09	22.41	0.99
OF2c	0.956	0.956	0.256	0.086	0.08	21.15	0.94
OF2a	0.89	0.89	0.256	0.083	0.08	20.61	0.93
OF11b	5.215	5.215	0.256	0.171	0.25	38.22	1.47
OF12	5.553	5.553	0.256	0.176	0.26	39.11	1.49
OF9b	0	0	0.256	0	0	0	0
OF14c	0.317	0.317	0.256	0.054	0.04	14.87	0.7
OF17a	8.135	8.135	0.256	0.205	0.34	45.04	1.64
OF10a	5.046	5.046	0.256	0.169	0.25	37.86	1.45
OF9d	2.129	2.129	0.256	0.119	0.14	27.8	1.16
OF15b	0.284	0.284	0.256	0.053	0.04	14.51	0.67
OF17b	8.081	8.081	0.256	0.204	0.33	44.86	1.64

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW1	129.85	2.267			-0.23	1.776	system capacity
HW2	124.84	4.999			-0.2	1.494	system capacity
HW3	122.08	2.264			-0.18	1.307	system capacity
Pit1	132.95		0.836		0.69	0.77	Inlet Capacity
pit10	122.39		0		-0.45		Outlet System
Pit10a	121.89		12.069		0	12.316	Outlet System
Pit10b	121.97		11.8		0	12.03	Outlet System
pit11	121.62		0		-0.27		Outlet System
Pit11a	121.31		12.712		0	12.953	Outlet System
Pit11b	121.37		12.41		0	12.344	Outlet System
Pit12	120.85		0		0.71		None
Pit12a	120.48		14.215		0	14.534	Outlet System
Pit12b	120.58		0.25		0	0.114	Outlet System
Pit13	120.26		0		-0.28		Outlet System
Pit13a	119.95		14.706		0	14.872	Outlet System
Pit14	119.69		0		-0.42		Outlet System
Pit14a	119.33		15.777		0	15.959	Outlet System
pit15	118.77		0		-0.23		Outlet System
Pit15a	118.82		16.234		0	16.18	Outlet System
Pit15b	118.48		0.231		0	0.386	Outlet System
Pit16	118.17		0		0.08		None
Pit16a	118.29		18.375		0	18.201	Outlet System
Pit17	117.38		0		0.4		None
Pit17a	117.43		18.315		0.31	18.249	Inlet Capacity
Pit17b	117.43		18.273		0.19	18.207	Inlet Capacity
pit1a	133.23		0.902		0.82	0.836	Inlet Capacity
pit2	128.37		3.644		0.06	3.494	Inlet Capacity
Pit2a	128.68		1.98		0.25	1.914	Inlet Capacity
Pit2b	128.97		0		-0.02		Outlet System
Pit2c	129.21	129.21	2.171	10	-0.2	1.98	Outlet System
Pit2d	129.23		1.776		0	2.171	Outlet System
pit3	127.54		3.663		0	3.647	Outlet System
pit4	125.24		3.851		0	3.83	Outlet System
Pit4a	125.29		0.418		0.11	0.352	Inlet Capacity
pit5	124.6		4.239		0	4.417	Outlet System
pit6	124.27		4.448		0	4.576	Outlet System
Pit6a	124.32		4.514		0	4.448	Inlet Capacity
pit7	124		0		0.74		None
Pit7a	124.52		4.326		0	3.172	Outlet System
pit8	123.74		0		-0.74		Outlet System
pit9	123.32		0		-0.88		Outlet System
Pit9a	122.79		0		-0.04		Outlet System
Pit9b	122.7		4.74		0	4.815	Outlet System
Pit9c	122.63		10.672		0	10.783	Outlet System

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)
Cat4	0.418	0.313	0.109	8	8	0
Cat5	0.533	0.408	0.136	9	9	0
Cat18	4.951	2.259	2.74	24	24	0
Cat19	6.395	1.549	4.901	27	27	0
Cat20	11.599	7.844	3.983	35	35	0
Cat6	0.205	0.16	0.045	6	6	0
Cat7	4.326	3.04	1.324	22	22	0
Cat10a	0.106	0.067	0.039	5	0	0
Cat12b	0.25	0.16	0.09	7	7	0
Cat12a	1.7	0.773	0.946	15	15	0
Cat13	0.445	0.077	0.368	9	9	0
Cat15a	0.734	0.286	0.448	10	10	0
Cat16	2.702	1.37	1.363	18	18	0
Cat1	0.902	0.596	0.318	12	12	0
Cat2	1.153	0.283	0.884	13	13	0
Cat3	0.291	0.2	0.091	7	7	0
Cathw1	2.267	0.91	1.377	17	17	0
Cat11b	0.24	0.154	0.087	7	7	0
Cat11a	1.478	0.487	0.991	5	0	0
Cat8	4.999	2.542	2.511	24	24	0
Cat14	2.264	0.535	1.742	17	17	0
Cat17a	0.367	0.022	0.345	8	8	0
Cat10b	1.286	0.076	1.21	14	14	0
Cat9	1.788	0.813	0.994	16	16	0
Cat15b	0.231	0.18	0.051	6	6	0
Cat17b	0.106	0.067	0.039	5	5	0

Outflow Volumes for Total Catchment (78.0 impervious + 101 pervious = 179 total ha)

Storm	Total Rainfall cu.m	Total Runo cu.m (Runc	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
15 min.	63981.78	48212.68 (	27115.35 (97.2%)	21097.33 (58.5%)
30 min.	91274.71	71602.17 (	39014.74 (98.0%)	32587.44 (63.3%)
45 min.	110066.55	87448.14 (	47207.87 (98.4%)	40240.27 (64.8%)
60 min.	123489.3	98541.26 (	53059.99 (98.6%)	45481.27 (65.3%)
90 min.	144965.69	116057.46	62423.63 (98.8%)	53633.83 (65.6%)
120 min.	161073.02	128791.89	69446.09 (98.9%)	59345.81 (65.3%)
180 min.	186307.8	148315.59	80448.44 (99.0%)	67867.15 (64.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)
24	0.066	0.6	125.265	125.24
6	0.758	2.1	124.917	124.6
7	0.82	2.3	124.415	124.27
8	0.916	2.6	124.126	123.996
9	2.233	2	123.835	123.739
10	2.233	2	123.578	123.318
11	4.959	2.7	122.752	122.391
Pipe12	4.481	2.5	121.93	121.621
Pipe12brar	4.309	2.4	121.195	120.846
13	4.176	2.3	120.464	120.256
14	4.155	2.3	119.904	119.688
15	4.675	2.6	119.186	118.77
16	4.556	2.5	118.294	118.175
17	4.718	2.6	117.663	117.385
18	4.85	3.1	116.844	116.084
25	0.066	0.6	124.29	124.27
26	1.484	3.4	124.051	123.996
29	0.066	0.6	122.633	122.789
32	0.226	2	122.789	123.318
33	0.361	3.3	121.985	122.391
38	0.138	0.9	120.526	120.48
39	0.183	1.2	120.487	120.846
40	0.066	0.6	119.955	120.256
42	0.066	0.6	119.335	119.688
43	0.066	0.6	118.804	118.77
45	0.452	2.8	118.249	118.175
2	0.066	2.1	133.065	132.951
3	0.132	3	132.629	128.369
4	0.635	2.2	127.998	127.54
5	0.663	2.3	127.219	125.24
19	0.49	2.3	129.481	129.23
20	0.317	1.5	129.22	129.21
21	0.373	1.7	129.088	128.968
22	0.373	1.7	128.845	128.68
23	0.418	1.9	128.491	128.369
35	0.066	0.6	121.342	121.31
36	0.132	1.2	121.318	121.621
27	3.505	3.2	123.974	123.318
41	0.958	4.3	121.09	119.688
46	0.066	0.6	117.407	117.385
34	0.066	0.6	121.977	122.391
31	0.215	2	122.703	122.789
Pipe43a	0.065	0.6	118.485	118.77
47	0.066	0.6	117.406	117.385

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)
Chnl1	27.108	2.3		
Chnl2	32.822	2.7		
Chnl3	44.397	3		

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
OF4a	0.352	0.352	7.665	0.057	0.04	15.41	0.71
OF5	3.83	3.83	7.665	0.151	0.2	34.26	1.35
OF6	4.417	4.417	7.665	0.16	0.22	36.06	1.4
OF6b	4.576	4.576	7.665	0.162	0.23	36.42	1.42
OF6a	4.448	4.448	7.665	0.16	0.23	36.06	1.41
OF7	3.172	3.172	7.665	0.14	0.18	31.93	1.3
OF10	10.783	10.783	7.665	0.229	0.4	49.89	1.76
OF11	12.316	12.316	7.665	0.23	0.46	49.99	2
OF12b	0.114	0.114	7.665	0.036	0.02	11.27	0.53
OF13	14.534	14.534	7.665	0.23	0.54	49.99	2.36
OF14	14.872	14.872	7.665	0.23	0.56	49.99	2.42
OF14b	15.959	15.959	7.665	0.23	0.6	49.99	2.6
OF15	16.18	16.18	7.665	0.23	0.61	49.99	2.63
OF16c	18.201	18.201	7.665	0.23	0.68	49.99	2.96
OF1a	0.836	0.836	7.665	0.081	0.07	20.25	0.9
OF1	0.77	0.77	7.665	0.079	0.07	19.72	0.88
OF2	3.494	3.494	7.665	0.146	0.19	33.19	1.32
OF3	3.647	3.647	7.665	0.148	0.2	33.55	1.34
OF2e	1.776	1.776	7.665	0.11	0.12	26	1.12
OF2d	2.171	2.171	7.665	0.12	0.14	27.98	1.17
OF2c	1.98	1.98	7.665	0.115	0.13	27.08	1.14
OF2a	1.914	1.914	7.665	0.114	0.13	26.72	1.14
OF11b	12.344	12.344	7.665	0.23	0.46	49.99	2.01
OF12	12.953	12.953	7.665	0.23	0.48	49.99	2.11
OF9b	1.494	1.494	7.665	0.103	0.11	24.57	1.06
OF14c	1.307	1.307	7.665	0.097	0.1	23.49	1.02
OF17a	18.249	18.249	7.665	0.23	0.68	49.99	2.97
OF10a	12.03	12.03	7.665	0.23	0.45	49.99	1.96
OF9d	4.815	4.815	7.665	0.166	0.24	37.14	1.44
OF15b	0.386	0.386	7.665	0.059	0.04	15.76	0.74
OF17b	18.207	18.207	7.665	0.23	0.68	49.99	2.96

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 100 year, 1 hour storm, average 69 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Pit4a	551.78	551.78	0	0
pit4	7816.99	7817.36	0	0
pit5	8552.94	8553.13	0	0
pit6	8802.84	8802.94	0	0
pit7	6539.94	6548.29	0	-0.1
pit8	6548.29	6553.29	0	-0.1
pit9	15043.51	15044.99	0	0
pit10	14480.24	14481.16	0	0
pit11	14344.56	14340.46	0	0
Pit12	13970.13	13966.49	0	0
Pit13	13689.14	13686.91	0	0
Pit14	15760.67	15759.86	0	0
pit15	15589.92	15590.21	0	0
Pit16	16429.32	16436.61	0	0
Pit17	16895.04	16897.34	0	0
SC01	57385.82	57385.82	0	0
SC02	70011.67	70011.63	0	0
SC03	98556	98555.9	0	0
SC04	98555.9	98555.9	0	0
Pit6a	6656.71	6656.71	0	0
Pit7a	8518.46	8518.46	0	0
Pit9c	14930.51	14930.5	0	0
Pit9a	-32.09	-31.39	0	0
Pit10a	17347.86	17347.87	0	0
Pit12b	307.29	307.28	0	0
Pit12a	22672.37	22671.48	0	0
Pit13a	23580.9	23580.91	0	0
Pit14a	25106.57	25106.57	0	0
Pit15a	26425.82	26425.85	0	0
Pit16a	31650.48	31650.47	0	0
pit1a	1369.18	1369.18	0	0
Pit1	1369.18	1369.18	0	0
pit2	6903.53	6903.71	0	0
pit3	7264.96	7265.22	0	0
HW1	3835	3835.01	0	0
Pit2d	3835	3835.2	0	0
Pit2c	3835.2	3834.75	0	0
Pit2b	1036.38	1036.55	0	0
Pit2a	3834.92	3834.37	0	0
Pit11b	17926.51	17926.53	0	0
Pit11a	19452.19	19451.59	0	0
HW2	9799.32	9799.32	0	0
HW3	3689.89	3689.89	0	0
Pit17a	31232.63	31232.66	0	0
Pit10b	16947.9	16947.88	0	0
Pit9b	7273.07	7273.06	0	0
Pit15b	281	280.99	0	0
Pit17b	31124.34	31124.33	0	0

Run Log for drains v0c.drn run at 10:50:55 on 31/5/2010

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19 April 2011

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SUSTAINABLE WATER
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Dear Craig,

RE: Airds Bradbury WCM_Addendum 1

The Addendum addresses the "Key Issue 14" in the DGRs as detailed below.

14. Flooding

"An assessment of any flood risk on site in consideration of any relevant provisions of the NSW Floodplain Development Manual (2005) including the potential effects of climate change, sea level rise and an increase in rainfall intensity."

Sea Level Rise

Due to the location of the development there is not expected to be any flooding issues associated with sea level rise.

Climate Change

The post development flood model was run to include a 10% increase in rainfall intensity for each duration ARI event to determine potential impacts of climate change.

The modelling results are presented below and indicate that the post development top water level in the 100 yr ARI climate change event will be 113.88 mAHD. This is approximately 2.49 m and 0.20 m higher than the respective predevelopment and post development scenarios.

This flood level is higher than the existing low point on Georges River Rd crossing of 113.57 mAHD. To ensure that no flooding occurs the minimum road level along Georges River Rd crossing will either be raised or a barrier will be installed adjacent to the road.

This flood level is also slightly higher than some adjacent lots located to the west of the creek. Where this occurs a wall along the lot boundary will be constructed to prevent flooding of these lots.

In the post development 100 yr ARI climate change scenario the peak flow rate at Georges River Rd crossing is approximately 16.09 m3/sec. This flow rate is less than the 100 yr ARI pre development rate due to the proposed constriction of the culverts.

Table 4-3: Peak Flow at Smiths Creek upstream of Georges River Road Crossing

ARI Storm Event (yr)	Duration (Min)	Peak Flow (m3/sec)		
		Existing Conditions	Post Development	Post Development Climate Change
2	60	24.27	29.49	32.89
	90*	26.05	31.41	35.37
	120	23.66	28.52	31.79
5	60	32.63	40.04	44.53
	90*	36.56	43.08	48.11
	120	31.96	39.22	43.70
20	60	44.83	53.1	58.90
	90*	49.29	57.6	64.00
	120	44.34	52.61	58.47
50	60	49.82	53.15	66.67
	90*	56.45	65.024	72.30
	120	51.07	59.68	66.26
100	60	56.98	66.204	73.47
	90*	62.6	71.81	79.66
	120	56.33	65.59	72.96

*Peak flows for each ARI event.

Table 4-6: Post Development Conditions at Georges River Road Crossing, Smiths Creek

Peak Flow Rate (m^3/sec)							
Culvert Type	Dimensions (m)	2 yr ARI	5 yr ARI	20 yr ARI	50 yr ARI	100 yr ARI	100 yr ARI Climate Change
Circular	0.75	4.23	4.63	5.06	5.24	5.4	5.50
Box	1.45 x 1.45	20.21	24.77	29.11	30.82	32.31	33.16
Over Road		0	0	0	0	0	3.97
Total Flow		24.44	29.4	34.17	36.06	37.71	42.63
Top Water Level (m AHD)		111.34	112.11	112.96	113.34	113.68	113.88

Table 4-7: Existing vs. Post-Development Flow Rates and water levels at Georges River Road Crossing, Smiths Creek

	Peak Flow Rate (m^3/sec)					
	2 yr ARI	5 yr ARI	20 yr ARI	50 yr ARI	100 yr ARI	100 yr ARI Climate Change
Existing (Pre-development) Conditions	24.74	34	45.58	52.29	58.72	-
Post-development	24.44	29.4	34.17	36.06	37.71	42.63
Reduction in Flow Post-Development	0.3	4.6	11.41	16.23	21.01	16.09
Increase in water level post – pre-development (m)	1.36	1.68	1.94	2.12	2.29	2.49

Rainfall Intensity

Rainfall intensity was increased by 10% when assessing the effects of climate change as discussed above. The top water level adjacent to Georges River Rd Crossing was approximately 113.88 mAHD.

This flood level is higher than the lowest point on Georges River Rd crossing and some lot boundaries to the west of the creek.

To ensure that flooding does not occur the minimum road level along Georges River Rd crossing will either be raised or a barrier will be installed adjacent to the road and where required a wall will be constructed along lot boundaries.

Yours sincerely

Gerard Edwards
Environmental Engineer
STORM_CONSULTING PTY LTD