Figure 5-11: Study Area for Preliminary lot based OSD Assessment

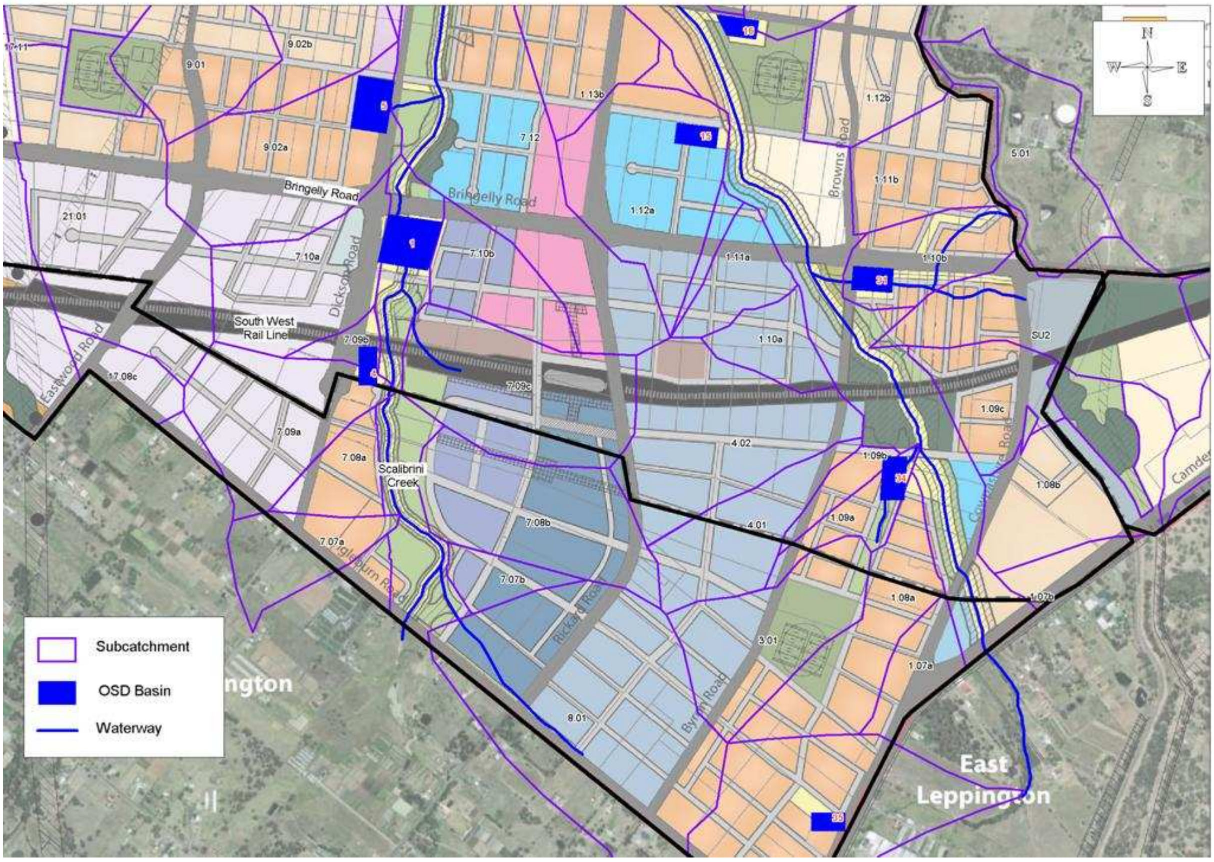


Table 5-3: Study Area Catchment Breakdown

Catchment ID	Total Area (ha)	Commercial / Industrial Lots controlled by OSD (ha)	Medium Density Residential / Road / Open Space (ha)
8.01	46.54	23.44	23.10
*7.07a	8.66	0.00	8.66
7.07b	5.56	3.15	2.41
*7.08a	13.34	0.00	13.34
7.08b	19.24	15.39	3.85
7.09b	4.63	0.74	3.90
7.09c	21.59	16.26	5.33
7.10a	16.86	12.20	4.66
7.10b	13.25	8.36	4.89
7.11b	4.45	0.00	4.45
	154.12	79.54	74.59
		52%	48%

**These catchments have medium density residential land uses and would not be managed by lot based OSD. Hence Basin 4 has been retained from the previous strategy for these areas.*

Hydrology

Runoff from the study area was estimated using an **xprafts** hydrological model. Models of the existing and proposed land uses were prepared to assess runoff in the 2 year and 100 year ARI events. These two ARIs are guided by the approach adopted by the Upper Parramatta River Catchment Trust when preparing the fourth edition of its OSD handbook (UPCRT , 2005) and in accordance with the guiding principles for OSD stated above. The 2 year ARI is generally representation of a bankfull flow condition (DNR, 2007) that would satisfy stream stability objectives while the 100 year ARI is the benchmark for determining flood planning levels (NSW Government, 2005) that would satisfy the flooding objective.

The setup of the model is consistent with the methods documented in the Water Cycle Management reports prepared by Cardno for public exhibition (Cardno, 2011). The imperviousness of land uses were based on values given in the Camden Council Engineering Design Specification. For the purposes of this investigation, the flows at Bringelly Road are of particular importance because it is a suitable location for an on-line retarding basin. The catchments upstream of the precinct boundary were assumed to be developed with residential land use and retarding basins that would not increase peak flows in 2 yr ARI and 100 yr ARI events.

Recently the approach to delineating Riparian Corridors has changed from the Riparian Corridor Management Strategy (RCMS, 2004) to the Strahler Method. The new approach would allow basins to be located on-line on second order streams such as Scalibrini Creek. This offers an opportunity to reduce the number of offline basins within the developable areas of the Leppington Town Centre. Within the two Precincts numerous basins were proposed in the ILP exhibited to the public including Basins 1, 2, 3, 4 and 7. The revised strategy of lot based OSD for the private domain (commercial/industrial lots) and an on-line basin at Bringelly Road could obviate the need for offline Basins 1, 2, 3 and 7. Note that this does not take into account any water quality treatment requirements.

Lot based OSD

The post-development hydrological model was then modified to include OSD within lots using the OSD feature in **xprafts**. This feature allows the user to nominate a stage-storage relationship and permissible site discharge (PSD) for each of the sub-catchments. The hydrology model then continually stores a portion of the basin inflow with outflows released according to a defined stage discharge relationship. A similar stage discharge relationship was adopted to that used for the regional basins. The model would then limit the basin outflow according to the peak flow of the existing hydrograph. In this manner the lower level outlet and upper level outlet are considered in the design storms modelled. Results for the site storage requirements are listed in **Table 5.4** and results for PSD are included in **Table 5.5**.

A summary of the Site Storage Requirement (SSR) and PSD for each sub-catchment is given in **Table 5.6**. It is shown that similar results are estimated to those reported in the 2011 exhibition report (Cardno 2011). A comparison is also given to the requirements of the Upper Parramatta River Catchment Trust OSD handbook (UPCRT 2005). The comparison shows that the PSD and SSR are slightly different because of the physical conditions of the existing catchment and that the proposed land use would not be consistent between the study areas. For example the proposed LTC land use includes an impervious percentage of

90 that would be higher than for the general urban land use for the Parramatta River catchment modelled for existing conditions in 1990. Notwithstanding the PSD and SSR values are within reasonable bounds of what would be expected in comparison to the UPCRT values.

Table 5-4: Lot based OSD Results

ID	Lot Area (ha)	2yr ARI Lot ARI OSD Vol (m^3)	2yr ARI SSR (m^3/ha)	100yr ARI Lot OSD volume (m^3)	100yr ARI SSR (m^3/ha)
8.01	23.44	6,755.1	288	13,639	582
7.07a	0				
7.07b	3.15	950	302	1,898	603
7.08a	0				
7.08b	15.39	4,644	302	9,268	602
7.09b	0.74	230	311	446	603
7.09c	16.26	4,904.6	302	9,604	591
7.10a	12.2	3,620	297	7,212	591
7.10b	8.36	2,471	296	4,895	586
7.11b	0				
Average			300		594

Table 5-5: Comparison of Peak Flows

Catchment	Total Area (ha)	Existing 2yr ARI			Existing 100 year ARI		
		Peak Flow (m^3/s)	Peak Flow/ Total Area (m^3/s/ha)	Critical Duration (hours)	Peak Flow (m^3/s)	Peak Flow/ Total Area (m^3/s/ha)	Critical Duration (hours)
8.01	34.04	0.85	0.02	12	4.10	0.12	9
7.07a	3.294	0.20	-	12	0.94	0.29	9
7.07b	5.564	0.29	0.05	12	1.42	0.26	9
7.08a	5.673	0.22	-	12	1.04	0.18	9
7.08b	19.244	0.37	0.02	12	1.83	0.10	9
7.09b	2.137	0.11	0.05	12	0.54	0.25	12
7.09c	21.592	0.43	0.02	12	2.12	0.10	9
7.10a	15.645	0.25	0.02	12	1.33	0.09	9
7.10b	9.475	0.21	0.02	12	1.09	0.12	9
Average	12.00		0.03			0.17	

Table 5-6: Comparison of SSR

Source	2yr ARI SSR (m^3/ha)	2yr ARI PSD (l/s/ha)	100yr ARI SSR (m^3/ha)	100yr ARI PSD (l/s/ha)
Cardno 2011	350	28	630	100
UPRCT 2005	300	40	455	150
Current Study	300	30	594	170

Bringelly Road Crossing of Scalibrini Creek

A comparison of the estimated hydrographs at Bringelly Road under existing and proposed land use is presented in **Figure 5-12** and **Figure 5-13.**

It is shown that development has a far greater impact on the 2 year ARI peak flows than the 100 year ARI peak flows. It was also found that the 12 hour and 9 hour storm duration are critical for sizing OSD in lots and basins for the 2 yr ARI and 100 yr ARI events respectively. It is evident that the lot based OSD goes a long way to replicating the existing 100 year ARI runoff. However the agreement between the 2 yr ARI flows under existing conditions and with the lot based OSD is not as good due to the increased volume of runoff due to development. Therefore if the agreement with the existing condition hydrograph is to be improved then further storage in the form of an on-line basin would be necessary. This has been assessed using a hydraulic model.

Figure 5-12: 2yr ARI Hydrographs

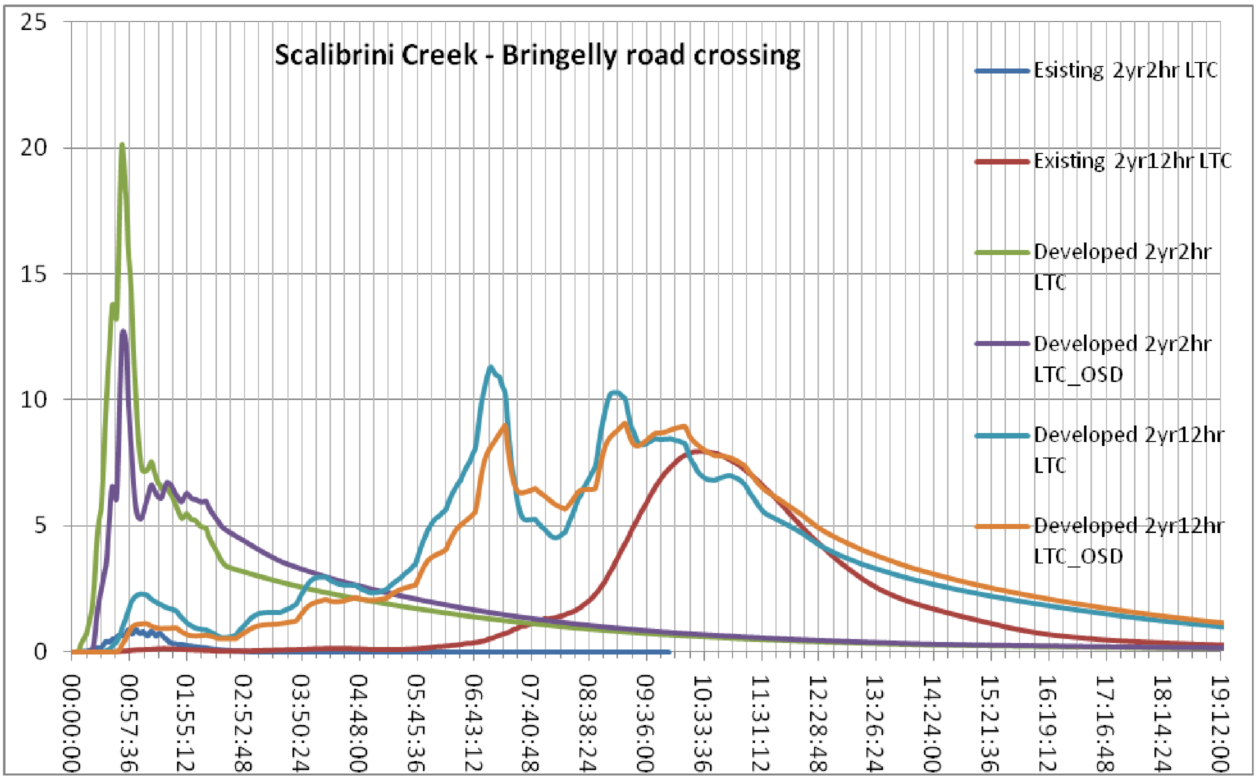
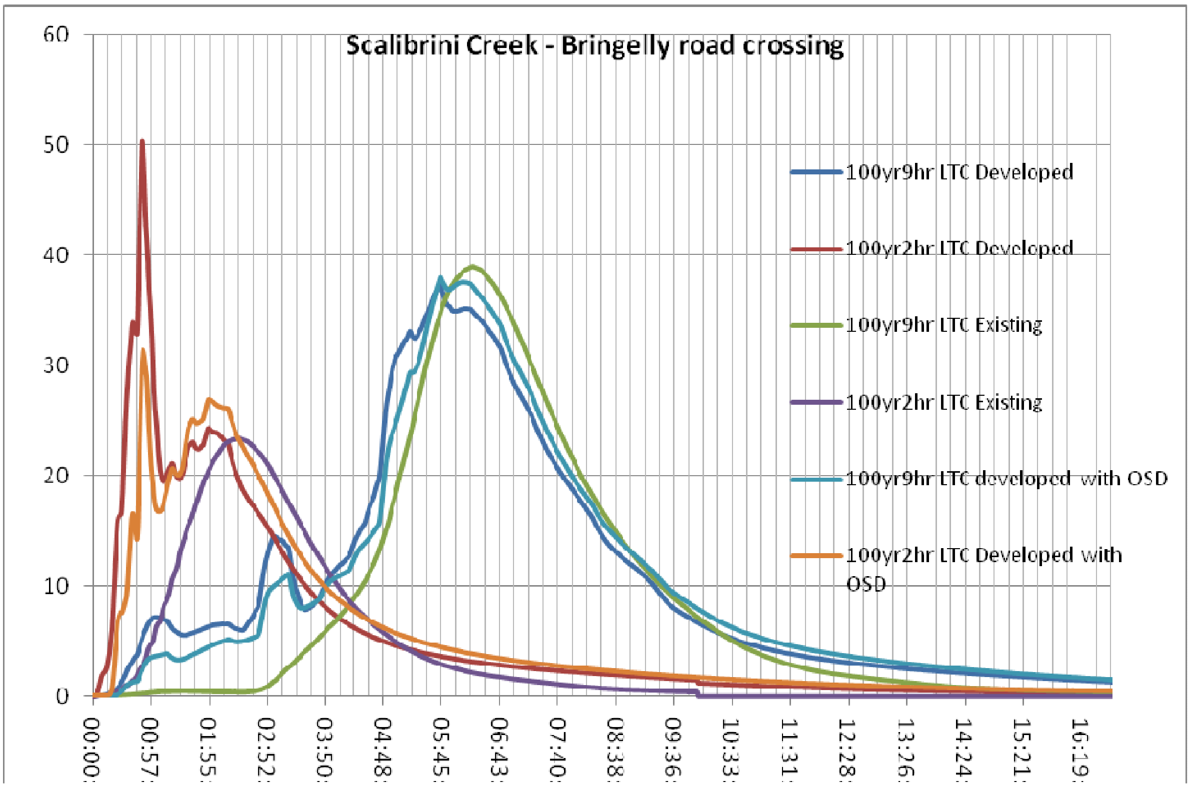


Figure 5-13:100yr ARI Hydrographs



Hydraulic Investigation

The inclusion of an on-line basin directly upstream of Bringelly Road was investigated. This location is suitable as both Dickson Road and Bringelly Road are to be upgraded and the basin wall could be incorporated into the road verge, subject to agreement with RMS. In addition the upgrade of the road crossing of Scalibrini Creek also offers an opportunity to configure the crossing in a manner that controls flows. The basin footprint is indicated in Figure 1 as Basin #1 and represents an approximate area of 2ha. Preliminary sizing of the storage was undertaken using the **xprafts** model of the 2 year 12hr duration storm event. Using the optimisation tool it was found that the site storage requirement was approximately 20,000 m^3. Therefore proposed Basin 1 would need to provide storage of around this volume for 2 yr ARI runoff. It was estimated that approximately 0.5 – 1 m depth of excavation would be required across the 2ha footprint of the basin to achieve this storage volume.

A nominal stage - storage relationship was then developed as given in **Table 5.7**.

The results of the hydrological assessment are shown in **Figure 5-14** and **Figure 5-15**.

Table 5-7: On-line basin stage storage relationship

RL (m AHD)	Storage (m^3)	Description
71.0	0	Creek invert
72.3	1,500	Top of bank
73.0	20,000	Top of basin bund
73.7	35,000	Top of Bringelly Road
74.0	50,000	Upper limit

Figure 5-14: 2 year ARI hydrographs for On-line Basin

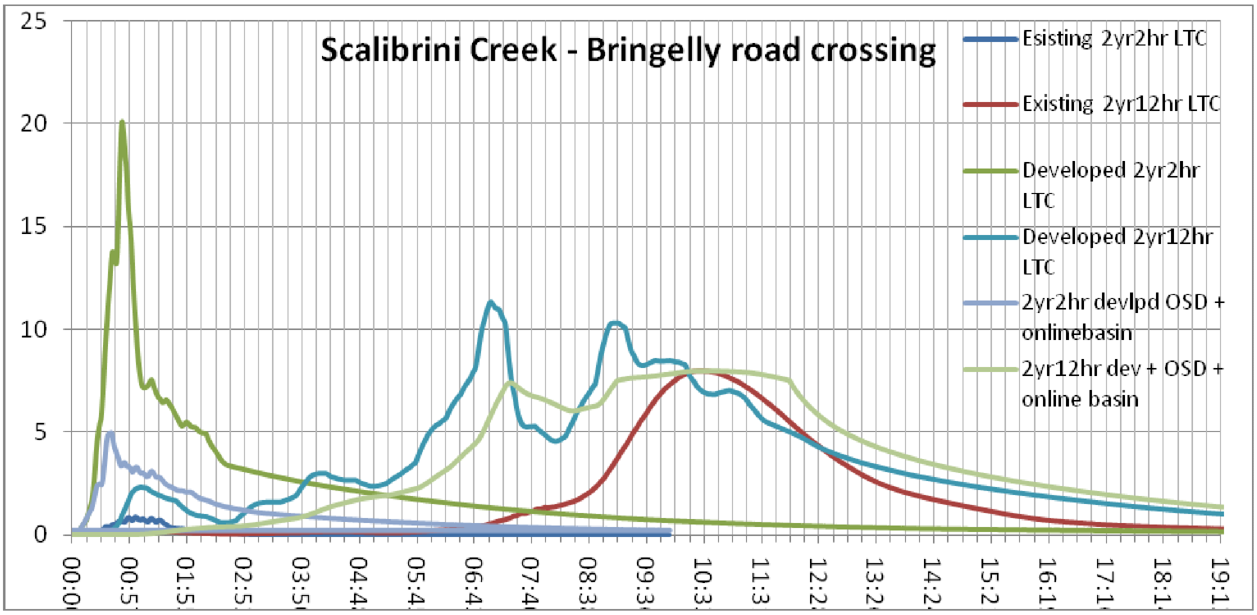
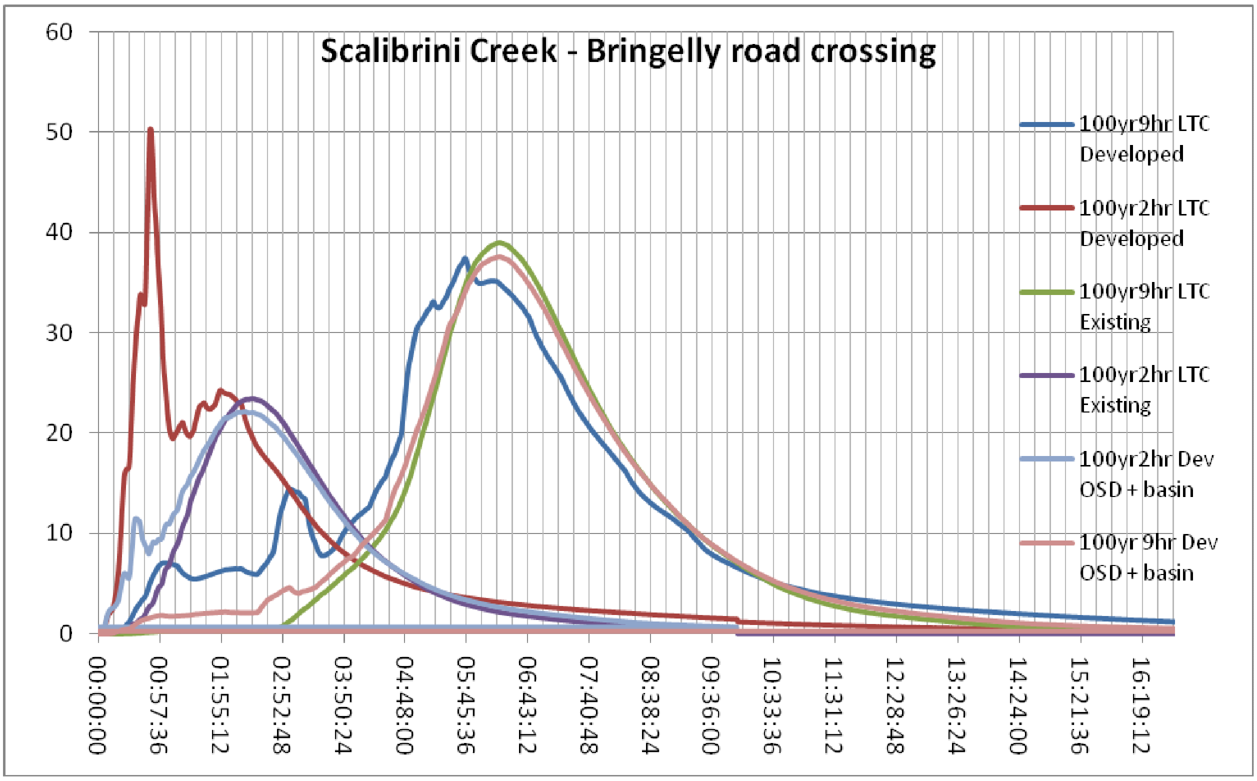


Figure 5-15: 100 year ARI hydrographs for On-line Basin



An **xpswmm1D** model was then developed. The model includes the natural channel of Scalibrini Creek commencing at the Precinct boundary and extending to a location 100 m downstream of Bringelly Road. The model is indicative of the creek channel and floodplain to a total width of 250 m and is based on the invert levels recorded from ALS data at each of the proposed road crossings. Bringelly Road was included in the model as a culvert and road crossing based on the RMS ground survey of existing conditions. The 100 year ARI hydrographs under existing conditions were exported from the **xprafts** model and were imported into the **xpswmm1D** model. Adjustments were made until a flood level of 73.7 m AHD was achieved upstream of Bringelly Road compared with the existing flood level of 73.72 m AHD estimated by the TUFLOW model. The model was then used to assess a number of scenarios. This approach has been chosen to provide a rapid assessment of various scenarios that would inform the OSD strategy for Leppington Town Centre. Once a preferred approach has been agreed the OSD strategy would be applied across the entire LTC area in the TUFLOW model.

The proposed development was modelled by importing hydrographs for both the 2 year ARI and 100 year ARI events under post-development conditions with Basin 4 and lot based OSD. Then the stage-storage relationship of Table 5-7 was inserted directly upstream of Bringelly Road. The key component to explore in the hydraulic model was the configuration of an outlet under Bringelly Road so that the existing flood levels directly downstream of Bringelly Road and at the SWRL can be maintained. The design of both Bringelly Road upgrade and the SWRL has been completed and therefore both are sensitive to any changes in flood behaviour. However it has been advised that there may be some flexibility in the Bringelly Road design. **Table 5-8** lists the scenarios modelled.

Table 5-9 outlines results of the scenarios modelled:

Flood profiles for the scenarios are provided in **Figure 5-16**.

Table 5-8: 1D Hydraulic Model Scenarios

Scenario	Culvert Size	Description
A	1 x 1.2 m (H) x 2.4 m (W) RCBC + 4 x 0.6 m (H) x 2.1 m (W) RCBC	Raise Bringelly Road crown to 75.0 m AHD to prevent overtopping of the road
B	1 x 1.2 m (H) x 2.4 m (W) RCBC + 4 x 0.6 m (H) x 2.1 m (W) RCBC	Maintain Bringelly Road at existing level allowing for overtopping of the road in a 100 year ARI event
C	1 x 1.2 m (H) x 2.4 m (W) RCBC + 9 x 0.6 m (H) x 2.1 m (W) RCBC	Raise Bringelly Road crown to 74.2 m AHD to prevent overtopping of the road

Notes: *Existing Bringelly Road crown level ~73.6 m AHD.*

1200 mm (H) x 2400 mm (W) RCBC @ IL 71.0 m AHD (2 yr ARI);

600 mm (H) x 2100mm (W) RCBC @ IL 72.4 m AHD (100 yr ARI)

Table 5-9: 1D Hydraulic Model Results

Location		100yr ARI Water Level (m AHD)			
		Existing	Scenario A	Scenario B	Scenario C
1	Upstream of SWRL	78.19	78.16	78.16	78.16
2	Downstream of SWRL	74.44	74.81	74.40	74.40
3	Bringelly Road	73.70	74.80	73.72	73.94
4	Downstream of Bringelly Road	72.31	72.12	71.96	72.00

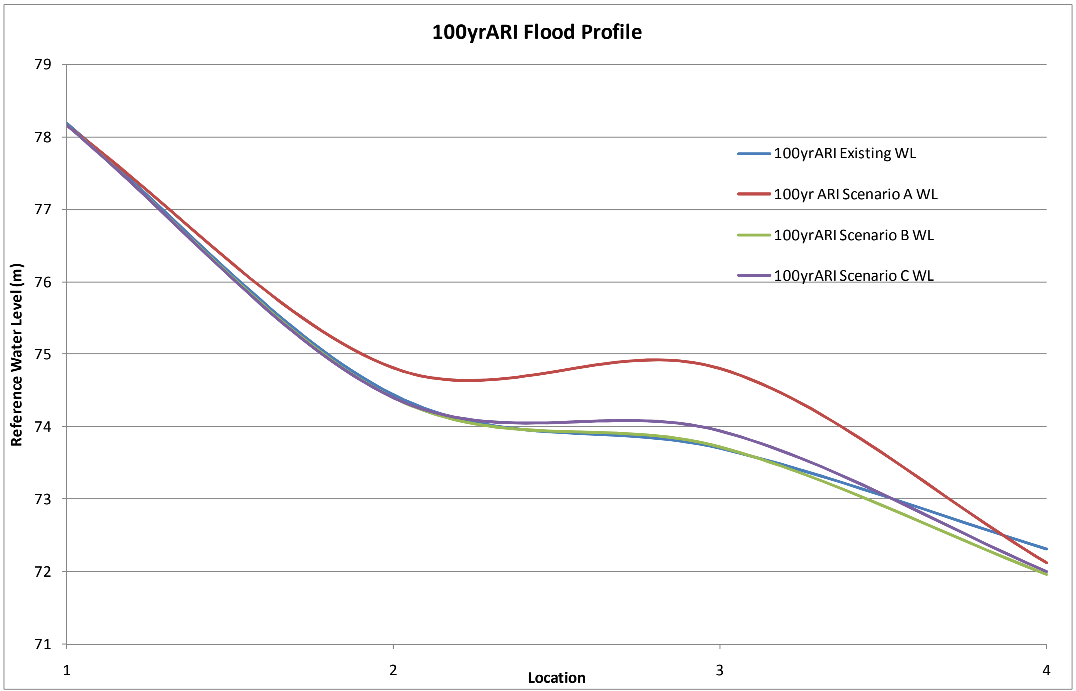


Figure 5-16: 100yr ARI Flood Profiles

The 1D model has found that the lot based OSD strategy coupled with an on-line basin at Bringelly Road would achieve negligible flood impact for Scenario B or C while the impact under Scenario A is far greater.

Scenario B is preferred as it provides negligible impact on flood levels and would not require any regrading of Bringelly Road. However it does permit the 100 year ARI to overtop the road as under existing conditions. It is expected that one of the design objectives adopted by the RMS is to eliminate overtopping of Bringelly Road in the 100 year ARI event. If overtopping is not acceptable to RMS then Scenario C would be the preferred approach where the road crown would need to be raised 500 mm and multiple culverts would need to be installed.

The ultimate configuration of the on-line basin would be subject to further design development by RMS. At the time of writing it is understood that a brief has been advertised for design of Bringelly road upgrade including the Scalibrini Creek crossing. For the ultimate development TUFLOW model, Scenario C was adopted and the configuration is described by **Figure 5-17** and **Figure 5-18**.

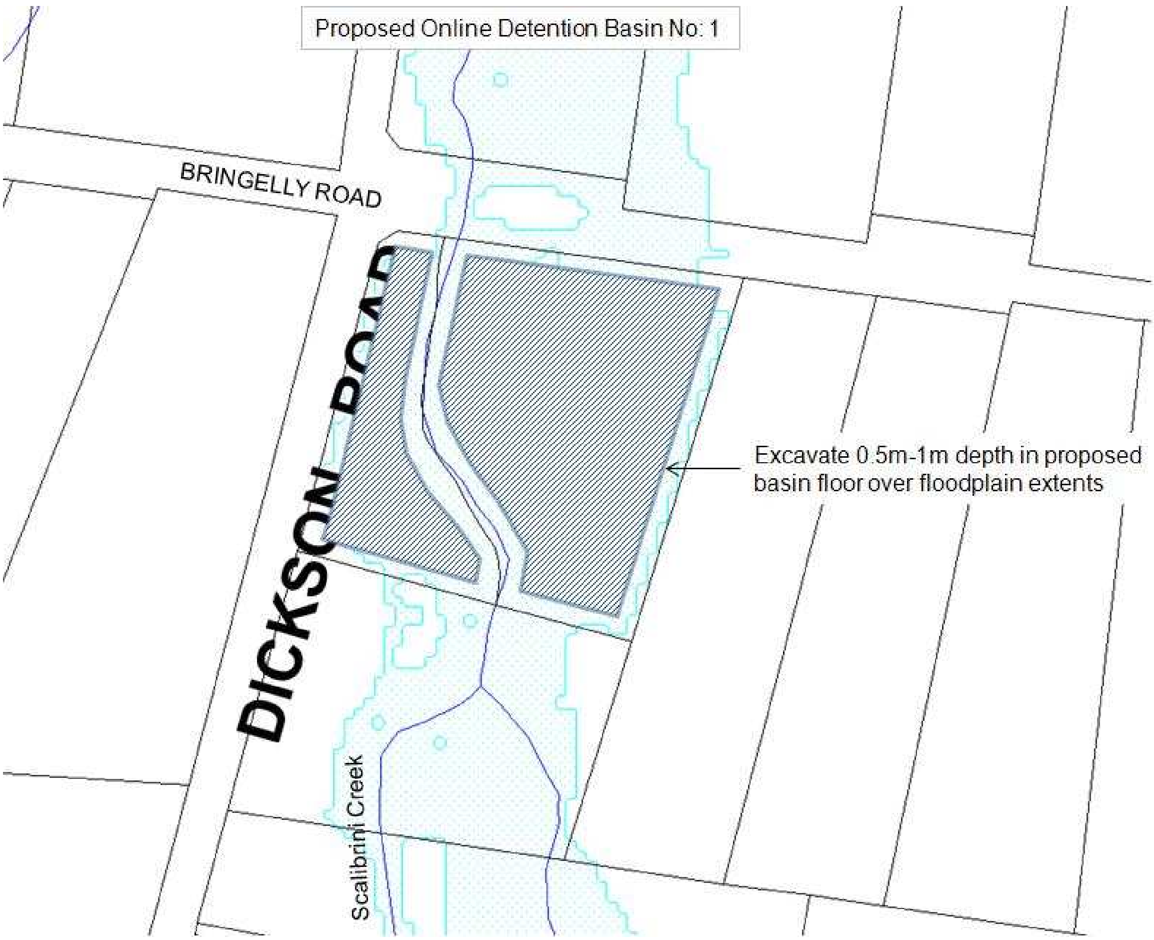


Figure 5-17: Basin 1 Layout included in Ultimate Development TUFLOW Model

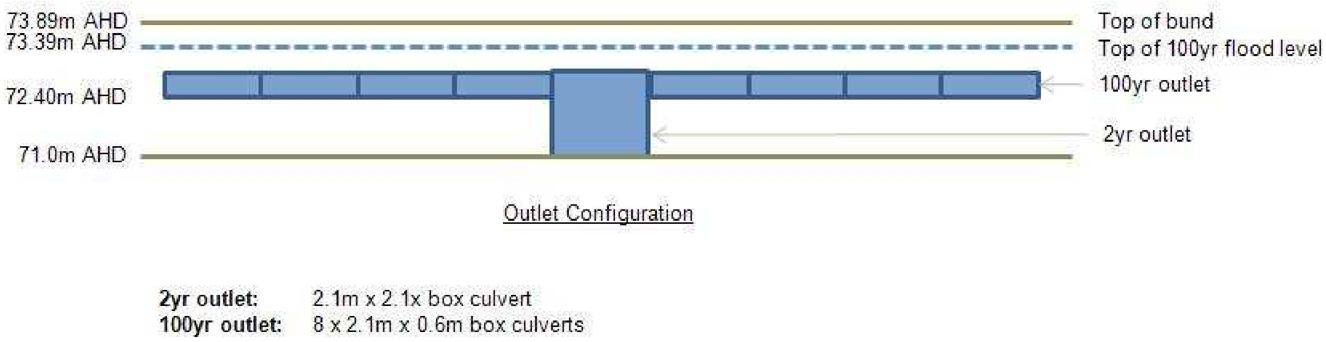


Figure 5-18: Basin 1 Outlet Elevation included in the Ultimate Development TUFLOW Model

6 Hydraulic Modelling

Additional hydraulic modelling was undertaken and included:

- Updating the TUFLOW model of existing conditions and the re-assessment of the 2yr, 20yr, 100yr, 500yr ARI and PMF events;
- Investigation of opportunities to increase the capacity of the trunk drainage system and to narrow and reduce the length of overland flow paths;
- Investigation of the impact of further filling of the floodplain under developed conditions on 100 year ARI flood levels;
- Updating the TUFLOW model of post-development conditions and re-assessing the 2yr, 20yr, 100yr, 500yr ARI and PMF events;

6.1 Additional Survey

Cardno conducted a topographic survey of several natural channel cross sections and road crossings in April 2012. The locations surveyed are shown in **Appendix B**.

Cross sections were extracted at the same locations as the ground survey using the ALS data in order to identify any differences between the ALS data and surveyed ground levels. In general the ALS levels are higher than the ground survey within the natural channels. This is a common finding and is usually a result of dense vegetation within the channel which hinders the ALS signal from reaching the actual ground. The natural channels of Kemps, Bonds and Scalibrini Creeks along with their tributaries were all observed to contain dense vegetation during site inspections. Comparisons of the cross sections are included in **Appendix B**. A general trend was interpreted as follows:

- Where the channel is approximately 5 m wide the ALS levels are approximately 1 m higher than the surveyed invert level of the channel; and
- Where the channel is approximately 10 m wide or greater, the ALS levels are approximately 0.5 m higher than the ground survey nor does it delineate the full base width of the channel.

6.2 Adjustments to Watercourse Levels

The results of the flood model are highly dependent on the geometry of the watercourses located within the precincts. Therefore it is expected that the accuracy of the flood levels and extents would be improved by adjusting the ALS levels in the location of the watercourses based on the outcome of the comparison of ALS levels and survey levels. Due to the relative inaccuracy of the ALS levels in the watercourses, the following adjustments were made to the terrain:

- Where the channel is approximately 5 m wide the ALS levels were lowered by 1 m; and
- Where the channel is approximately 10m wide or greater, the ALS levels were lowered by 0.5m.

Adjustment of the channels across the precincts is appropriate given that site observations confirmed that dense vegetation exists throughout.

6.3 Model Runs

The TUFLOW model of Existing Conditions within the precincts was updated using the information and approach discussed in **Sections 6.1** and **6.2**.

6.3.1 Existing Conditions

The TUFLOW model of Existing Conditions was re-run for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events. Amended plots of the flood extents, depths, hazards and velocities are included in **Appendix B** as follows:

- The estimated peak flood extents for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D1** to **D5**;
- The estimated peak flood depths for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D6** to **D10**;
- The estimated hazard for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D11** to **D15**; and
- The estimated peak flood velocities for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D16** to **D20**.

In general the flood levels are up to 0.1 m lower resulting in slightly narrower flood extents. This is mainly due to the refinement of the natural channel geometry within the model. The accuracy of the model is improved and verification of the model has been discussed in **Section 3.1**.

6.3.2 Flood Filling Assessment

As a result of the ALS adjustments and additional culvert survey, it was found that the revised Existing Conditions flood levels are lower than previously identified. This results in a narrower flood extent and provides an opportunity to fill some parts of the floodplain, subject to more detailed assessments for any development proposals that include floodplain filling.

The assessment of the impact of filling was undertaken in a similar manner to the approach which was documented in the Exhibition report (Cardno, 2011). The approach adopted was to fill those areas of the floodplain where the 100 yr ARI flood depth is less than 300 mm to minimise any increase in flood risk under future development. The filling is capped at the 100 yr ARI flood level such that larger storm events are permitted to overtop the fill areas in a similar manner to existing conditions.

This assessment does not include any compensatory excavation in other parts of the floodplain to offset the impacts of filling. This is due to the highly fragmented pattern of land ownership which makes compensatory works on other properties impractical in most situations.

6.3.3 Developed Conditions

The TUFLOW model of post-development conditions was run for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events. The model includes the floodplain filling assessment outlined in Section 6.3.2.

Amended plots of the flood extents, depths, hazards and velocities are included in **Appendix B** as follows:

- The estimated peak flood extents for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D21** to **D25**;
- The estimated peak flood depths for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D26** to **D30**;
- The estimated hazard for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D31** to **D35**;
- The estimated peak flood velocities for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D36** to **D40**;
- The impact of planned development on 100 yr ARI flood levels is shown in **Figure D41**; while
- The impact of adjustments to the terrain on 100 yr ARI flood levels under Existing Conditions (as outlined previously in Cardno, 2011) is shown in **Figure D42**.

Under Post-development Conditions the floodplain is well defined because there is little difference between the flood extents under the various design storm events. Furthermore it is shown that the flood depth and provision hazard is high along the watercourses in most reaches. Broad expanses of lower flood depths and provisional low hazard are evident on the floodplain on both sides of the watercourses. Exceptions to this general observation exist at the confluence of Kemps and Bonds Creek and the reach of Kemps Creek downstream of the confluence. These exceptions are most likely due to the natural channel having the less capacity (in ARI terms) in comparison with other watercourses in the Precincts. Therefore the floodplain is inundated to a greater depth in Kemps Creek and a higher provisional hazard is evident as a result. Due to the expanse of floodplain and low flood depths the indicative filling has a limited impact on existing flood behaviour.

Planned land use in the ILP for areas on the fringe of the floodplain is appropriate provided that flood risk management controls are applied. In low provisional hazard areas some land uses such a passive/active open space, environmental living and roads have been proposed and are suitable with flood risk management measures. Relevant measures for these land uses would include constructing habitable floors above the flood planning level, constructing roads with footpaths where pedestrian egress from floods is safe, ensuring active recreation uses are above say the 20 year ARI flood extent and constructing shared pathways so that safe pedestrian egress can be achieved during floods. Detailed flood risk management measures should be investigated in future stages of the urban design.

Figure D41 indicates that a general reduction in 100 yr ARI peak flood levels is expected in Bonds, Kemps and Scalibrini Creeks within the Precincts with minor local increases of up to 50 mm in some locations. Any increases would be contained within the riparian corridor and do not adversely affect existing flood behaviour in areas external to the precincts in Kemps Creek. Some negligible flood level increases of 1-3 cm are identified downstream of the Austral Precinct for a tributary of Kemps Creek to the north east of the transmission sub-station. This area remains undeveloped and as such the increases are considered to be of minor impact.

The impact of adjustments to the terrain (floodplain filling) on 100 yr ARI flood levels under Existing Conditions are evident in **Figure D42** with a reduction in 100 yr ARI peak water levels of greater than 0.1 m apparent throughout the Precincts.

6.4 Emergency Response Strategy

At the time when an extreme flood event is experienced there may be the need for residents and/or workers located in the floodplain to safely vacate the floodplain prior to or during a flood. Response to the extreme flood emergency may be in the form of departing the floodplain and travelling to a suitable point of refuge for the duration of the flood. If the duration of the PMF is predicted to be greater than 24 hours then the refuge should be equipped with suitable facilities and provision of food and water. The duration of the PMF in the case of the Precincts is 2 hours and therefore it is predicted that response to the extreme flood should be to vacate the floodplain or evacuate to the nearest hospital or refuge if necessary. Cases where evacuation is required is only expected if the resident/worker is in need of the local hospital or their property is significantly damaged by flood.

At the time of this assessment suitable points of refuge have not been identified and therefore an evacuation strategy has been prepared on the basis that evacuation by vehicle from the precinct would be required. A more detailed evacuation strategy could be prepared in consultation with the NSW SES, with one or more refuges identified within the precincts, during future stages of the urban design or in a Floodplain Risk Management Study for the catchment.

The criterion for safe evacuation that has been adopted is for vehicles to be able safely traverse a road crossing during the 500 year ARI event i.e. a velocity depth product for floodwaters overtopping any crossing of less than 0.6 m^2/s. The results for the 500 yr ARI event under Post-development Conditions are used for the assessment. It should be noted that the existing topography and road crossings for all roads are included in this model.

The assessment of the velocity depth product at various road crossing is included in **Appendix B** and the suitable routes of evacuation are shown in **Figure 6-1**. It is shown that evacuation could be made to the east of the Precincts to access critical infrastructure such as Campbelltown and Camden hospitals and the NSW SES is also located in this direction. The primary evacuation routes to the east are Bringelly Road for the Leppington North Precinct or 15th Avenue for the Austral Precinct.

6.5 Dam Break Assessment

An assessment of a scenario where a number of retarding basins would fail was undertaken using a dam breech method in the XP_RAFTS software. The user inserts a number of parameters that would model a failure in the dam wall. The failure would occur at a user defined time, width and duration. This is undertaken using the Fuseplug function of the storage node in RAFTS. A dam breech hydrograph is then estimated by the model for each of the basins that are chosen for failure. The hydrographs were then inserted to the developed TUFLOW model to estimate the difference between flood level and extents for the 100 year and 500 year ARI. **Table 6-1** includes some of the parameters used.

Table 6-1: Details Dam Breech for the 100 year ARI

Basin ID	100yr ARI Basin Depth (m)	100yr ARI Breech time (min)	100yrARI Maximum Breech width (m)	Surcharge Depth (m)	100yr ARI Decay Rate (m/hr)
1	2.85	5	6.66	0.002	79.94
5	1.084	8	4.19	0.002	31.42
8	1.505	7	4.02	0.002	34.44
11	1.618	6	5.05	0.002	50.51
14	1.232	7	4.12	0.002	35.34
17	1.61	6	5.63	0.002	56.35
22	1.44	7	4.30	0.002	36.88
29	1.373	7	4.75	0.002	40.72
32	1.142	8	4.02	0.002	30.13
34	1.048	8	2.30	0.002	17.27

Where Breech Width = 0.1803 x K x (V)^0.32 x (H)^0.19
K = 1 for earthen dam
V = volume
H = Breech head

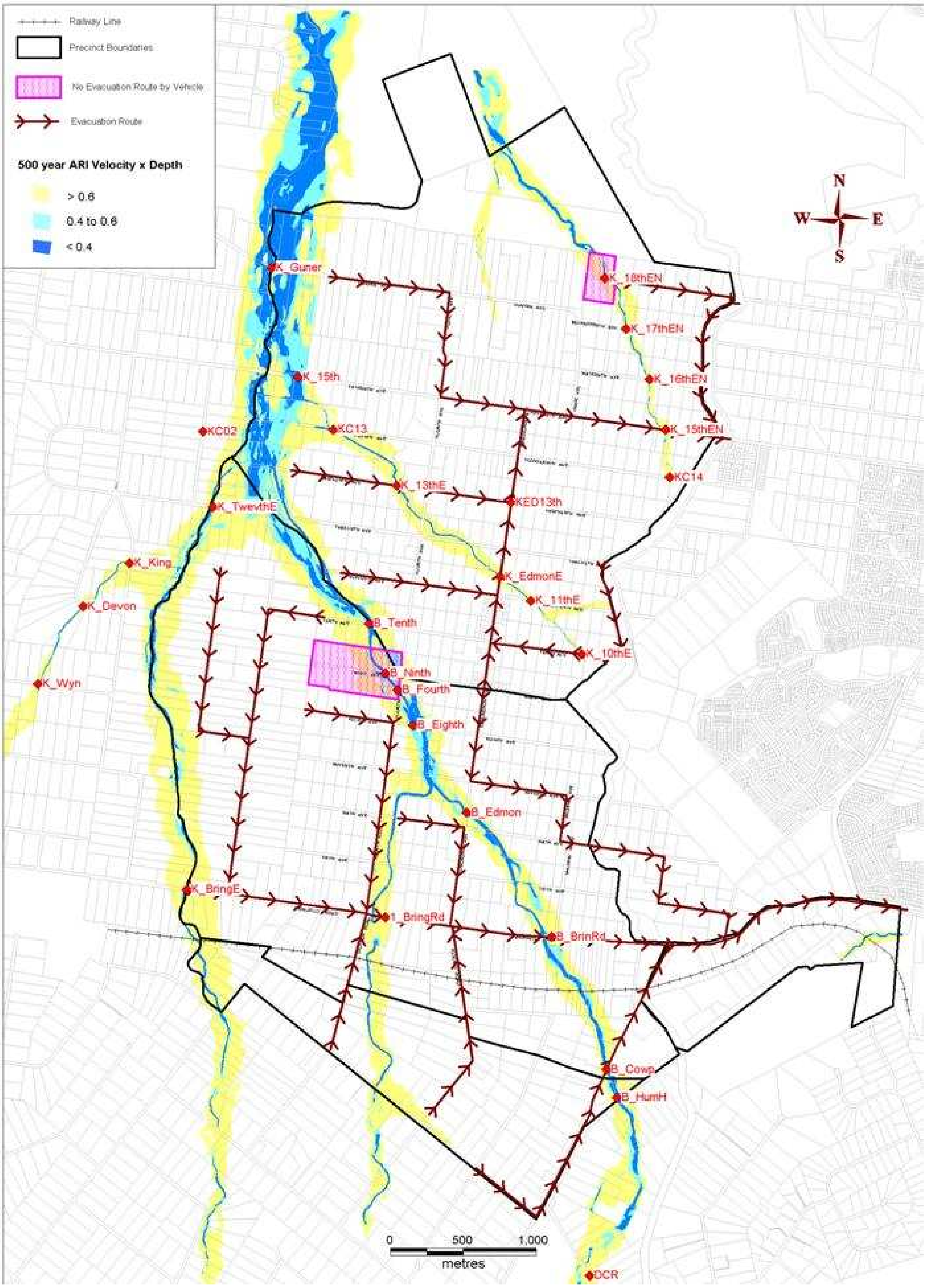
Table 6-2: Results of the Dam Breech Hydrology

Basin ID	100yr ARI Basin Outflow (m3/s)	100yr ARI Basin Breech Outflow (m^3/s)	500yr ARI Basin Outflow (m3/s)	500yr ARI Basin Breech Outflow (m3/s)
1	37.22	77.22	42.72	85.32
5	3.01	9.23	3.73	10.96
8	2.59	11.3	3.29	13.29
11	6.28	19.8	7.72	23.39
14	4.56	11.83	5.11	13.28
17	7.04	22.87	8.56	27.3
22	6.07	14.86	7.47	17.30
29	13.06	22.33	14.95	25.46
32	4.75	10.98	5.27	12.12
34	2.08	3.93	2.48	4.25

Results of the TUFLOW model for the Dam Break Assessment are shown in **Figure D43 - D46**. It is shown that the Basins selected for the assessment do have an impact on flood levels as a result of the dam breech. The magnitude of the impact ranges from 0-0.5m as shown in Figures D43 and D44. The amount of flood level impact is dependent on the capacity of the receiving waterway. Where the waterway is broad and carries a significant volume of overland flow from upstream there is negligible impact. There is more notable impact where the waterway capacity is less than the basin breech volume.

It is shown in Figures D45 and D46 that the dam breech would pose minimal lateral expansion of the developed case flood extent. This is due to the high definition of the floodplain where the difference in both flood level and flood extent between the ARIs is minimal. Therefore the flood behaviour is less sensitive to scenarios such as dam break than would be expected elsewhere.

Figure 6-1: Draft Evacuation Strategy



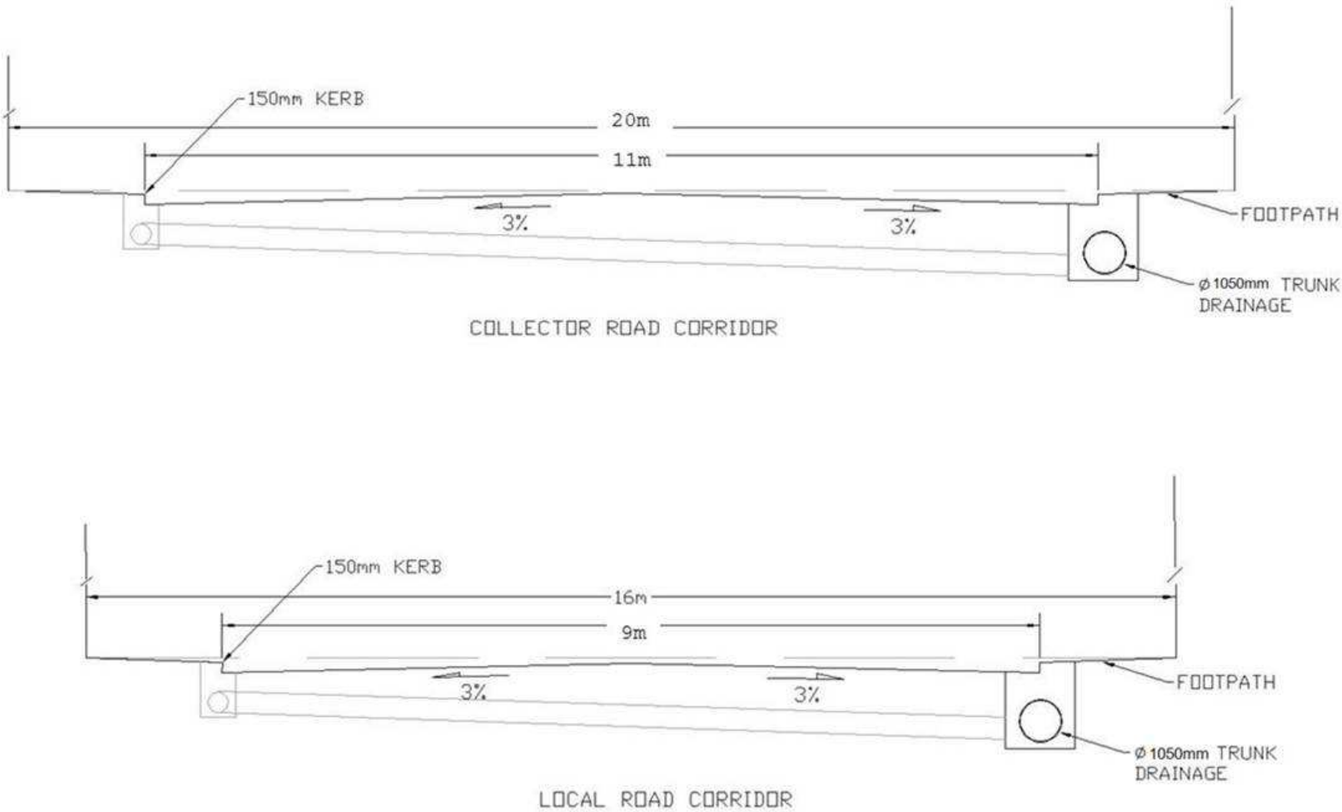
7 Review of Trunk Drainage Capacity

The headwater sub-catchments for the Austral and Leppington North Precincts were assumed to have the following properties:

- Approximate Area = 20ha;
- Imperviousness = 70%, and;
- Critical Storm Duration = 2hrs.

Generic road corridor sections were prepared based on planning guidelines provided in Camden Councils DCP. It is predicted that overland flows within headwater sub-catchments will commonly be conveyed by two road types namely; collector roads and local roads. In determining the design hydraulic capacity of the road corridors, it has been assumed that a 1050 mm drainage pipe will be installed for both road types. Standard cross sections of the two road corridors are given in Figure 7-1**.**

Figure 7-1: Standard Collector and Road Corridors



The capacity of the two roads were calculated using Manning's equation assuming a flow depth of approximately 100 mm above the top of kerb, and 250 mm at toe of kerb. The roughness value used for the road was 0.025. The calculated capacities of the two roads for slopes of 1%, 3%, and 5% are summarised in **Table 7-1**.

It was determined that the slopes of the headwater sub-catchments could be approximated as either a 1%, 3% or 5% slope. The estimated peak discharges for 5 yr, 20 yr and 100 yr ARI events are summarised in Table 7-1.

Table 7-1: Peak Flows (m3/s) for 20ha Catchment and various Drainage System Designs

Scenario	Catchment Slope		
	1%	3%	5%
20ha Catchment Design Storms			
5yr 2hr Peak Flow	3.69	4.23	4.36
20yr 2hr Peak Flow	5.05	5.69	5.74
100yr 2hr Peak Flow	6.38	7.08	7.14
Drainage Design Capacity**			
1050mm dia. Pipe Capacity	3.00	5.20	7.00
Total Minor Road Capacity* (Includes 1050mm dia. Pipe)	7.00	12.13	15.95
Total Collector Road Capacity* (Includes 1050mm dia. Pipe)	7.43	12.87	16.90

* Road design capacity assumes a depth of 0.1 m above top of kerb

** Calculated using Manning's equation

The 100 year ARI flow is conveyed as both pipe flow and overland flow on the roadway. As indicated in Table 7-1**,** a 1050 mm drainage pipe in combination with the two road types listed above is able to convey at least the 100 year ARI flow. It should be noted that these assessed capacities have not considered whether or not the road flows exceed pedestrian or vehicular safety criteria and would be reviewed at the detailed design stage.

7.1 Overland Flow and Category 3 Streams

Within the Austral and Leppington North Precincts there are a number of overland flowpaths (OFP) or Category 3 streams (CAT3) that convey flows from headwater sub-catchment to perennial streams. The location of these flowpaths is shown in Figure 7-2**.**

There are 20 sub-catchments that have a flowpath connecting a headwater sub-catchment to a perennial stream. It is expected that these flowpaths will need to be formalised during development and will require the construction of a channel section capable of conveying the 100 year ARI peak flows to manage flood risk in adjoining urban areas. The current topography and stream channel typically does not have sufficient hydraulic capacity to convey post-development 100 yr ARI flows. Therefore augmentation of the channel capacities will be required. This needs to be undertaken in a manner that meets the management objectives for riparian corridors while achieving a 100 yr ARI capacity.

Figure 7-2: Category 3 Stream Types and Overland Flowpaths

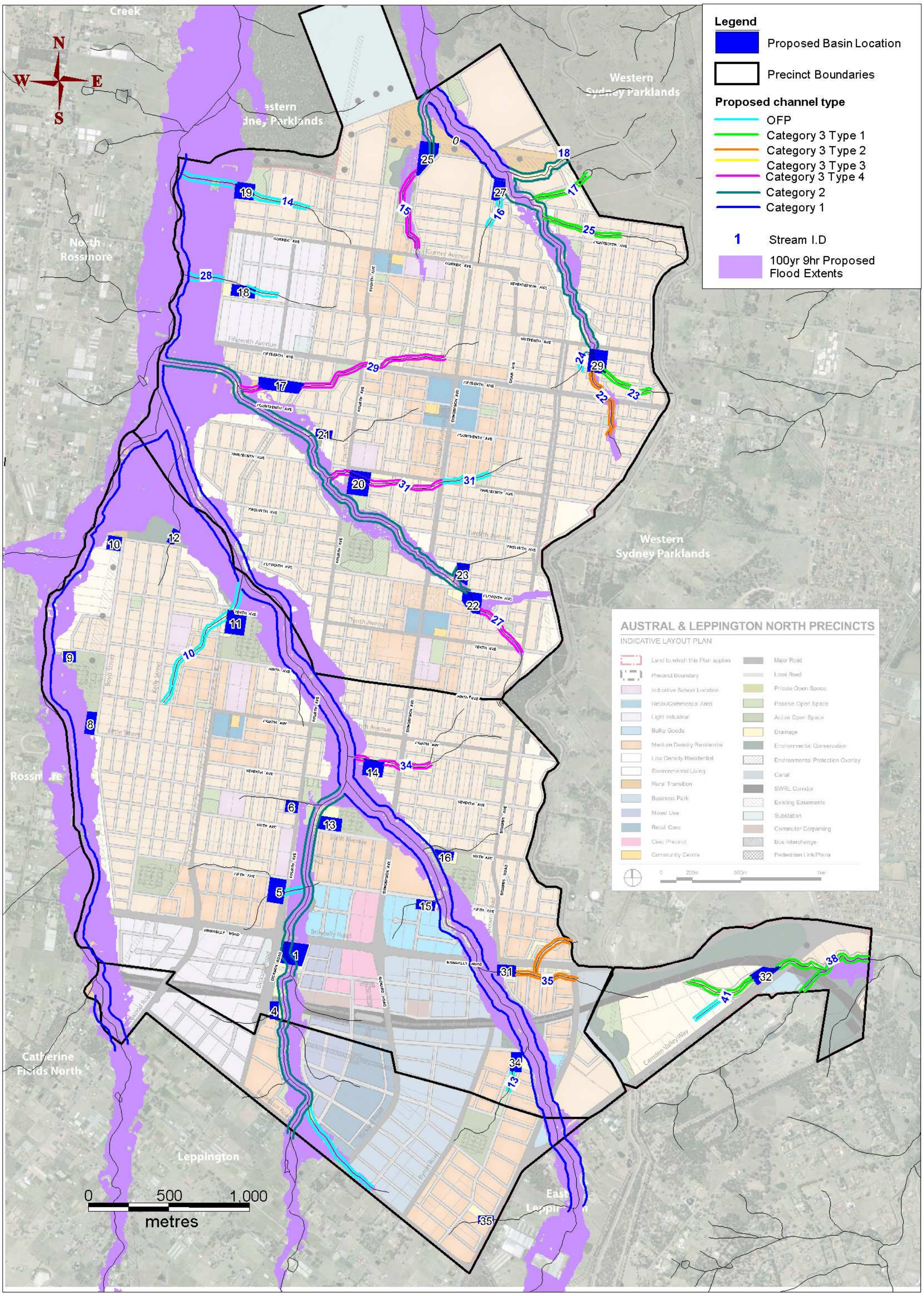
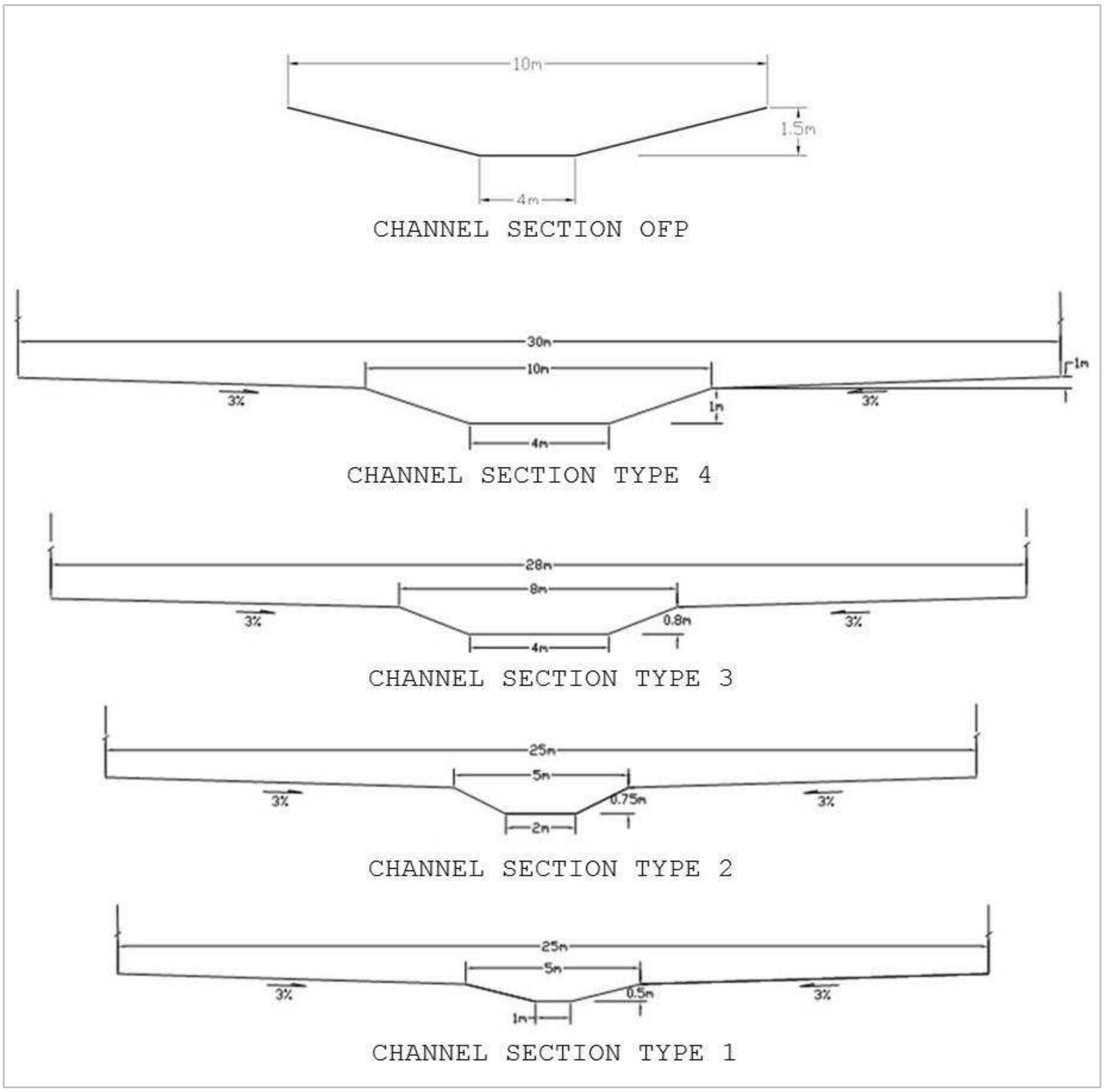


Figure 7-3: Typical Channel Types and Sections



Due to the variation in the required capacity for the 20 flowpaths, five channel types shown in **Figure 7-3** were assessed. Channel sections based on the representative natural channel geometries are the preferred form of overland flowpath to maintain waterway health through connectivity with perennial streams, to achieve stable banks and to improve water quality. The cross section shape and width has been selected to replicate existing conditions, as far as practical, where streams typically have small channels inset in a broad floodplain.

The hydraulic capacity of the channels was estimated using Manning's Equation with an assumed roughness value of 0.06. These capacities are summarised in **Table 7-2**.

Table 7-2: Estimated Channel Capacity (m3/s) for Various Channel Slopes

Channel Type	Slope = 1%	Slope = 3%	Slope = 5%
1	3.8	6.7	8.6
2	5.1	8.8	11.4
3	7.6	13.2	17.0
4	13.3	23.0	29.7
OFP	12.1	20.9	27.0

The 100 year ARI peak flow was estimated for each of the 20 flowpaths and each flowpath was categorised into a slope category of 1%, 3%, or 5%. A design channel section was then allocated to each of the flowpaths by comparing design peak flows to the hydraulic capacity of each of the three channel types above. Results of this assessment are shown in Table 7-3.

Table 7-3: Channel Assessment

Stream ID	Basin ID	Type	100yr ARI Peak Flow (m^3/s)	Avg Slope (%)	Rounded Slope (%)	Channel Type	Corridor Width (m)
10	Basin 11	OFP	15.5	0.98	1	5	10
34	Basin 14	CAT3	11.7	1.88	1	4	30
*	Basin 35	-	8.3	1.23	1	-	-
13		OFP	8.5	1.49	1	5	10
35	Basin 31	CAT3	4.2	1.27	1	2	25
14	Basin 19	OFP	12.5	0.68	1	5	10
28	Basin 18	OFP	7.0	1.2	1	5	10
	Basin 1	OFP	14.0	1.59	1	5	10
*	Basin 5	-	7.8	1.45	1	-	-
	Basin 5	OFP	7.7	1.45	1	5	10
27	Basin 22	CAT3	11.4	1.36	1	4	30
31	Basin 20	CAT3	15.0	1.17	1	4	30
29	Basin 17	CAT3	17.6	1.15	1	4	30
17		CAT3	2.3	4.65	5	1	25
16	Basin 27	OFP	8.7	1.64	1	5	10
23	Basin 29	CAT3	4.5	2.07	3	1	25
24	Basin 29	OFP	7.7	1.3	1	5	10
25		CAT3	4.5	4.44	5	2	25
15	Basin 25	CAT3	11.7	2.39	3	1	25
22	Basin 29	CAT3	10.3	2.39	3	2	25

**This channel is no longer required due to the 20ha headwater criterion eliminating the requirement for an overland flowpath. Instead a trunk drainage system would connect to Basins 5 & 35.*

The locations of the 20 overland flowpaths / Category 3 streams are presented in **Figure 7-2**. It is noted that the map is indicative and stream centre lines should be offset during the planning process to achieve adequate widths for the overland flow requirements.

8 Water Sensitive Urban Design

The WSUD strategy includes treatment of water quality with biofilters placed in the floor of retarding basins for the majority of subcatchments in the Precincts. During the development of the ILP various sub-catchments could not be drained to a retarding basin with a biofilter. As a result, in the draft Precinct Plan no water quality treatment was nominated for those catchments and indicative land take requirements for alternative treatment measures were provided in the Austral and Leppington North Precincts WSUD report dated July 2011.

Since exhibition, both Camden Council and Liverpool City Council have indicated a preference for water quality to be treated in these catchments using more centralised biofilter basins for sub-catchments with residential land uses. The overall footprint of biofilter and the strategy to meet the water quality objectives may comprise the installation of a single or multiple biofiltration devices within each sub-catchment. **Figure 8-1** outlines all catchments within the Precinct not draining to sub-regional biofilters located within basins. Note that where commercial/retail, business and industrial land uses are found, WSUD would be provided on a lot scale. Stormwater from the public domain would be captured in biofiltration measures located in road reserves and other paved areas. It is recommended that street trees and raingardens would be the most appropriate measures for this application.

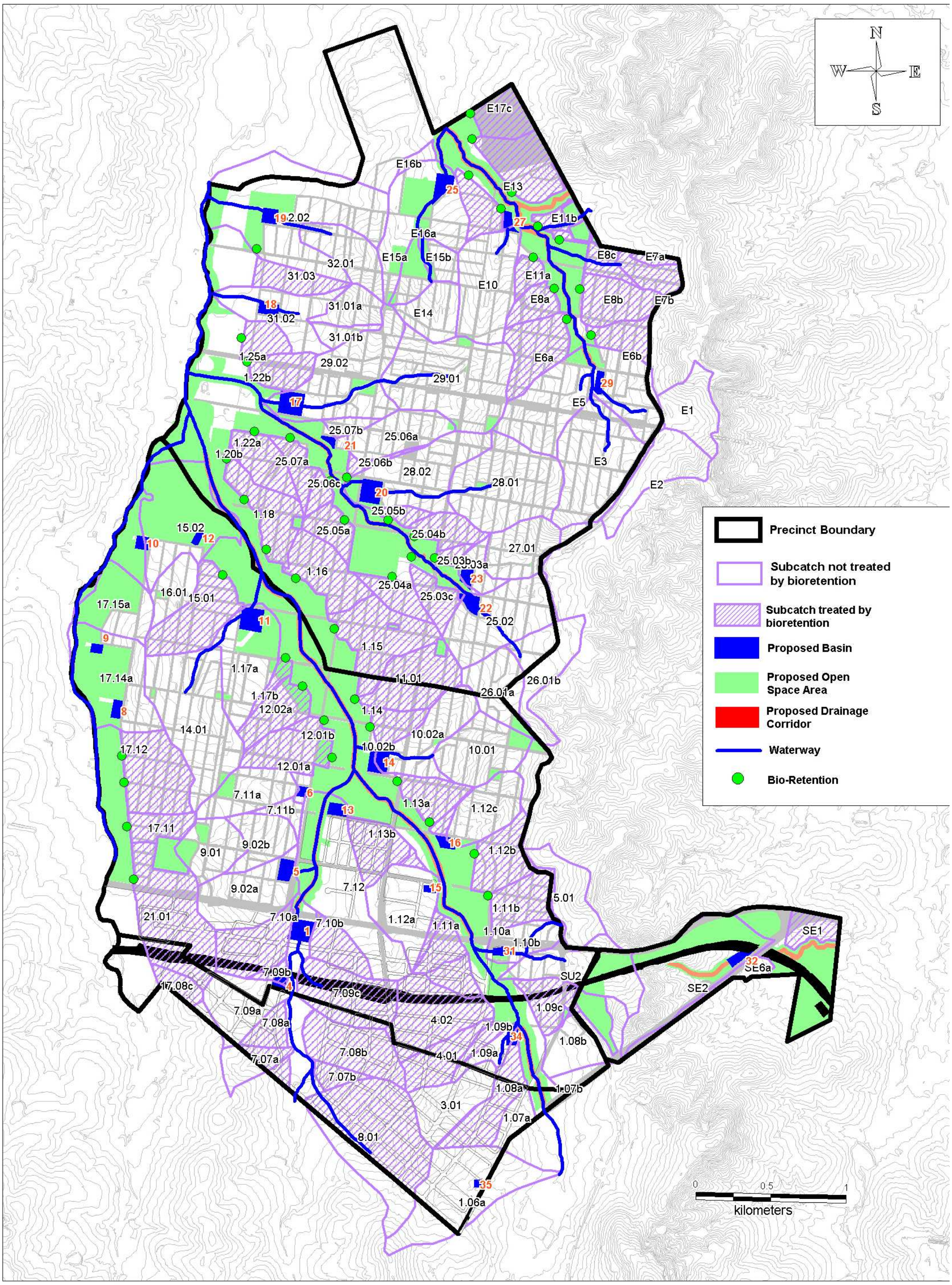
An assessment of each sub-catchment has been undertaken using MUSIC and the total bioretention area requirements for sub-catchments no draining to basins are summarised in **Table 8-1**.

Table 8-1: Bioretention Area for Subcatchments not draining to a Basin

Catchment Reference	Treatment Area (ha)	Bioretention Footprint (m^2)		Catchment Reference	Treatment Area (ha)	Bioretention Footprint (m^2)
1.14	6.95	208		7.07b	2.85	142.3
1.15	22.96	689		7.08b	3.85	192.4
1.16	16.40	492		7.09a	3.94	197
1.18	14.95	448		7.09b	0.93	46.3
4.01	2.30	115.2		7.09c	4.32	215.9
4.02	4.85	242.3		7.10a	3.37	168.6
8.01	9.31	465.4		7.10b	2.65	132.5
11.01	18.68	560		7.11b	2.02	101
15.01	20.56	617		E11a	5.01	150
17.11	7.26	218		E11b	3.48	104
17.12	22.18	665		E13	24.84	745
21.01a	20.80	1040		E16b	1.20	60
21.01b	5.28	264		E17c	5.86	293
31.03	5.28	264		E6a	9.38	469
1.07a	3.34	167		E6b	4.78	239
1.07b	2.08	104		E7a	1.08	54
1.08b	9.70	485		E7b	4.36	218
1.09c	9.63	481.5		E8a	3.94	197
1.10a	2.28	114.2		E8b	8.26	413
1.11a	1.66	83.1		E8c	2.98	149
1.11b	12.80	640		SE1	3.90	195
1.12b	10.84	542		SE6a	1.94	97
1.13a	5.66	283		E17d	0.28	13.83
1.13b	11.70	585		E17c	0.24	12.05
1.17b	0.76	38		E18	0.28	14.06
1.20b	0.26	13		SE5	0.07	3.26
1.22a	6.66	333				
1.22b	5.26	263				
1.25a	3.96	198				
12.01a	6.80	340				
12.01b	1.04	52				
12.02a	5.46	273				
17.08c	3.34	167				
25.03b	1.99	60				
25.03c	7.13	214				
25.04a	7.04	211				
25.04b	7.99	240				
25.05a	7.30	219				
25.05b	2.79	84				
25.06b	2.32	69				
25.06c	3.11	93				
25.07a	6.09	183				
25.07b	1.84	92				

Highlighted Areas Indicate the Road Area of a Commercial/Industrial Land Use Catchment in LTC where biofiltration could be provided in the public domain in concert with lot based measures

Figure 8-1: Bioretention Locations for Subcatchments Not Draining to Basins



Note – Where bioretention locations are not shown, the strategy allows for biofiltration within the road reserve in the form of raingardens and street trees.

Potential locations for the biofilters have been reviewed and are shown in **Figure 8-1.** It is noted that these locations are based on existing topography and the land use layout given in the Final ILP. Bioretention basins will require outlet pipe connections to the stormwater network or nearest open channel to convey treated flows. Refinement of the biofilter configuration, location and layout is expected to occur during future stages of the detailed design.

9 LTC DCP Recommendations

9.1 WSUD

A specific DCP is proposed for the Leppington Town Centre to control development in a manner that reflects the strategy outlined above. Recommendations and provisions for the DCP are outlined below:

9.1.1 Objectives

- To ensure an integrated approach to water cycle management through the use of water sensitive urban design principles and to replicate, as far as possible, existing hydrology so that there is minimal impact on flood behaviour and stability of existing watercourses;
- To integrate stormwater controls into the private domain to mimic the natural water cycle and improve the amenity of commercial, business, retail and industrial zones;
- To encourage the use of green roofs so that air quality, ambient air temperature, aesthetics and the quality of roof runoff is improved;
- To include stormwater controls in passive open spaces and the riparian corridor to optimise water management and recreation uses;
- To Apply a "green engineering" approach to the structural elements of stormwater controls to increase visual amenity and to enhance the landscape; and
- To as far as possible consolidate stormwater quality and quantity controls into sub-regional facilities in order to manage construction and maintenance costs and to rationalise the land take for water management measures.

9.1.2 Guiding principles/documents

- *Growth Centres Development Code,* NSW Government Growth Centres Commission (2006)
- *Evaluating Options for WSUD – A National Guide,* Prepared by the Joint Steering Committee for Water Sensitive Cities (2009)
- *Managing Urban Stormwater – Environmental Targets,* Sydney Metro CMA (2007)
- *Camden Council Engineering Design Specification* (2009)
- *Camden Council DCP 2011 – Environmental Management*
- Camden Council's *Building in Saline Prone Environments Policy*
- Camden Council's *Flood Policy*
- *Upper South Creek Floodplain Development Matrix*

9.1.3 Provisions

Green Roofs

(1) New buildings having a footprint of greater than 2,000m^2 are encouraged to consider the installation of part or all of it's roof as a green roof;

(2) Any garden beds in the roof area should to be planted with native plants (preferably endemic to the Leppington region) in a suitable depth of soil to sustain the species selected; and

(3) A detailed landscape plan of the roof design is to be provided with the development application.

Stormwater Management

(1) Development is to undertake a Stormwater Quality Assessment to demonstrate that the development will meet the following post-development pollutant reduction targets:

- Litter and vegetation larger than 5 mm: 90% reduction on the Benchmark Average Annual Gross Pollutant Load;
- Total Suspended Solids: 85% reduction on the Benchmark Average Annual TSS Pollutant Load;
- Total Phosphorous: 65% reduction on the Benchmark Average Annual TP Pollutant Load; and
- Total Nitrogen: 45% reduction on the Benchmark Average Annual TN Pollutant Load.

The Benchmark Average Annual Pollutant Load is defined as the average annual Post-development pollutant load that would be discharged from the site in the absence of stormwater or rainwater harvesting and reuse or of any treatment measures.

(2) The Stormwater Quality Assessment is to be prepared by a suitably qualified engineer with experience in WSUD and include:

- Estimation of the Benchmark Average Annual Pollutant Loads and the assessment of the performance of the nominated WSUD measures using an industry standard water quality modeling package;
- The design of WSUD devices used to achieve the post-development pollutant load standards; and
- Maintenance schedules of any proposed WSUD device that requires maintenance and/or full replacement including the likely recycling disposal location of any wastes that may be generated.

WSUD measures could include (but are not limited to) rainwater and / or stormwater harvesting and re-use, street tree bioretention systems, rain garden bioretention systems, bioretention swale systems and gross pollutant traps. Swales and constructed wetlands are not recommended in the Leppington Town Centre.

(3) Where filtration and bio-retention measures are proposed, they are to be designed to capture, filter and provide temporary storage of stormwater prior to drainage to the drainage system and/or a local drainage line or watercourse;

(4) Development proposals for commercial and industrial zones where HAZCHEM and liquid waste would be stored / produced on-site are to capture all site generated runoff up to the 3 month ARI event within a purpose built device such as a grease trap or retention tank/basin. The device must reduce the risk of runoff polluted by contaminants deposited or spilled on the site from being discharged to the receiving environment. The critical duration storm for the property and the 24 hour duration storm should be analysed; and

(5) Drainage and waste disposal from commercial and industrial zones is to be conducted to the levels specified by the NSW Environmental Protection Authority.

On-site Detention

(1) The maximum post-development discharge from the site shall not exceed the pre-development flows for the 2 year and 100 year ARI for the critical duration storm duration under pre-development conditions. The critical duration is to be determined through an examination of a full range of design storms durations;

(2) The stormwater drainage system (including surface grades, gutters, pipes, surface drains and overland flowpaths) for the property must:

- Be able to collect and convey all site runoff to the OSD system in a 100-year ARI event in the post-development critical storm; and
- Ensure that the all runoff from any upstream properties bypasses the OSD storage. in all storms up to and including the 100-year ARI event.

The required OSD storage can be achieved through either below ground or above ground storage or a combination of below ground and above ground storage and ideally should be integrated with other WSUD measures where possible. Any above ground storage is to be designed in such a manner that public safety and the integrity of property is not compromised and it does not interfere with overland flowpaths or adversely affect flood behavior.

(3) The duration of the stream forming flow under post development conditions should be less than 3.5 to 5 times the duration under existing conditions. The stream forming flow is 50% of the peak 2-year flow rate estimated under pre-development conditions. The hydrograph of the OSD outlet shall be used to estimate the stream forming flow under post-development conditions.

The required upper and lower limits for sizing the OSD shall be informed by the following:

Table 9-1: On Site Detention SSR and PSD Sizing Limits

2yr ARI SSR (m^3/ha)	2yr ARI PSD (l/s/ha)	100yr ARI SSR (m^3/ha)	100yr ARI PSD (l/s/ha)
300	30	594	170

- All above-ground OSD basins and below ground OSD tanks shall be located outside any overland flow paths;
- Below-ground OSD tanks will be approved for commercial and industrial developments only with an approved mesh screen and a minimum orifice outlet diameter of 25 mm;
- Discharge from above-ground OSD basins during storms in excess of the adopted pipe system capacity, shall be via a weir designed to have a maximum depth of flow of 150 mm in a 100 year ARI storm;
- All above-ground OSD basin outlets and below-ground OSD tank orifices shall be protected by a screening device to minimise blockage;
- An emergency overland flow path shall be provided for all OSD system in case of extremely large flows or blockage of OSD outlet; and
- All stormwater must drain by gravity to an approved drainage system. Discharge by use of mechanical pump system, or pressurised lines, is not allowed.

Specific Requirements

A local drainage management plan is required with each development application. This management plan is to be prepared by a suitably qualified engineer with experience in drainage design and WSUD. The plan is to assess the site drainage requirements for the proposed development, and prepare the required site drainage plan in accordance with the provisions of this DCP. Specifically the plan must address:

- The hydrology of the site and its relationship to the drainage system;
- Drainage system design;
- WSUD device design;
- The distribution of soil types and any measures to prevent infiltration in sodic soils;
- Any expected rise in ground water level due to development;
- The role of the principal landscape components (including any green roofs) on the site for water conservation and on-site detention;
- Details of any on-site stormwater detention and retention, including the collection of water for re-use;

- How any detrimental impacts on the hydrology and water quality of the receiving environment are proposed to be minimised;
- Consideration of suitable methods to manage salinity; and
- Integration of stormwater management devices and open spaces.

9.2 Water Harvesting and Reclaimed Water

The main objective of water harvesting and the use of reclaimed water is to reduce the use of potable water within the Town Centre. The capture and reuse of rainwater and stormwater provides significant environmental benefits for local waterways including Bonds Creek, Kemps Creek and Scalibrini Creek through the reduction of pollutant loads, runoff volumes and flow rates.

Both rainwater and stormwater harvesting are being considered at the Growth Centre with potential uses as follows:

Rainwater Harvesting

Rainwater harvesting is typically implemented on residential properties with collection of roof runoff in an above-ground tank with reuse for garden watering and/or toilet flushing. There is scope to include rainwater harvesting tanks as part of LTC medium density residential and mixed use development.

Greywater Harvesting

Greywater harvesting on residential properties collects wastewater from showers, baths, washing machines and dishwashers with its reuse for the purpose of garden watering. This is mostly applicable to low density residential land use and would not be included in LTC.

Stormwater Harvesting

Stormwater harvesting involves the harvesting of stormwater runoff generated from roads and pavements and landscaped areas /open space in the public domain for reuse for the purpose of public space irrigation. The harvested stormwater contains greater levels of pollutants than roof runoff and stormwater treatment is typically required prior to reuse.

There is great potential for stormwater harvesting within the LTC given the predominant commercial and industrial land uses. Reuse options include irrigation of nearby parks and public open space.

The integration of stormwater harvesting measures into the on-site detention systems proposed for LTC is possible and should be investigated at the design stage.

9.3 Guiding Documents

- *Growth Centres Development Code*, NSW Government Growth Centres Commission (2006);
- *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) – Stormwater Harvesting and Reuse*, National Water Quality Management Strategy (2009);

- *Camden Council Engineering Design Specification* (2009)

9.4 Provisions

Recommended provisions for water harvesting and the use of reclaimed water are outlined as follows:

- Development proposals that propose to capture and to reuse runoff from paved surfaces for irrigation and/or wash down purposes are to incorporate treatment measures into the development to ensure that the harvested water is fit for purpose and that contaminants such as litter, sediment and oil are captured prior to re-use;
- Where possible, water used for irrigation of public and private open space is to be drawn from reclaimed water or harvested rainwater sources;
- Where stormwater harvesting is proposed for irrigation of passive and active open spaces, the design and management of such systems is to be undertaken in accordance with the NWQMS Australian Guidelines for Stormwater Harvesting (2009). All harvested stormwater must be treated prior to re-use to be 'fit for purpose'.
- Rainwater harvested from a roof and stored in rainwater tanks can be used for toilet flushing, laundry uses, car washing, swimming pools, water features, irrigation and as a source of cooling tower make-up water;
- For residential development rainwater storage is required to harvest rainwater from rooves to supply garden watering, toilet flushing and laundry as a minimum. Efficiency of supply to meet the demands is to be 90% i.e. reclaimed water will supply the non-potable demands (toilet flushing and laundry) 90% of the time;
- Where possible, rainwater tanks should be installed for all non-residential developments, including major alterations and additions, and plumbed to appropriate end uses;
- Any proposed rainwater tank should be:

  (a) Equipped with a 'first flush' diversion system to exclude the initial wash-off (first 5mm of rainfall) from a roof;
  (b) Connected to toilet, laundry and /or garden irrigation fixtures;
  (c) Provided with screens on inlets and overflows to reduce mosquito risk;
  (d) Where a tank is used for toilet flushing or other indoor uses it is to have a low level float valve to allow top-up from the mains supply in order to maintain a small residual volume in the bottom of the tank; and
  (e) Provide an appropriate air gap in accordance with Sydney Water requirements;

  The following preventative measures may assist with ensuring rainwater contamination does not occur:

- Ensuring the roof area draining to rainwater tanks do not have overhanging vegetation such as tree branches which provide roosting points for birds and can provide access for small animals such as rodents, cats and possums;
- Preventing access by small animals and birds into rainwater tanks by screening all tank inlets and overflows, keeping access hatches closed and by maintaining the integrity of tank rooves;
- Preventing the entry of surface runoff from areas other than the roof catchment into below-ground tanks. Rooves should be secure and the sides and bottom of tanks should be sealed to prevent ingress;

- Rainwater tanks are to be designed, installed and operated in accordance with:

(a) NSW Health Guideline - Rainwater Tanks Where a Public Water Supply is Available - Use of (GL2007_009) June 2007;
(b) Sydney Water Guidelines for Rainwater Tanks on Residential Properties where it is on a residential property;
(c) Australian Standard 3500: Plumbing; and
(d) Sydney Water's Backflow Prevention Policy and the New South Wales Code of Practice: Plumbing and Drainage where it is on a non-residential property, and;

- Recycled water schemes for development that is not a single residential dwelling are to be designed and operated in accordance with NWQMS Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (2006).

Specific Requirements

- Details of rainwater and stormwater harvesting are to be included in the local drainage management plan with each development application.
- A risk management would be required for stormwater harvesting and effluent recycling schemes in accordance with the NWQMS.

10 References

Camden Council *(2009) Engineering Design Specification*

Camden Council *DCP 2011 – Environmental Management*

Cardno 2011 *Austral Leppington North Flooding and Riparian Assessment*

John Holland (2011) *Glenfield to Leppington Rail Line, Flood Study*, Issue B

Joint Steering Committee for Water Sensitive Cities (2009) *Evaluating Options for WSUD – A National Guide*

Lyall & Associates (2011) *Bringelly Road Upgrade REF Vol 2, Initial Assessment of Drainage Requirements*

National Water Quality Management Strategy (2009) *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) – Stormwater Harvesting and Reuse*

NSW Government Growth Centres Commission (2006) *Growth Centres Development Code*

Sydney Metro CMA (2007) *Managing Urban Stormwater – Environmental Targets*

Appendix A

Hydrology

Table C.1 HydrologicaL Sub-catchments Peak Flows

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
1.01	5.76	5.82	12hr	5.82	1.01	12hr	1.81	4.00
1.02	9.59	9.67	12hr	9.67	1.02	12hr	3.25	6.42
1.03	19.78	19.72	9hr	19.78	1.03	12hr	6.12	13.67
1.04	21.82	20.77	9hr	21.82	1.04	12hr	7.13	14.68
1.05	25.07	22.92	9hr	25.07	1.05	12hr	8.69	16.38
1.14	0.41	0.42	12hr	0.42	1.14	18hr	0.11	0.31
1.15	1.23	1.27	12hr	1.27	1.15	12hr	0.75	0.52
1.16	1.07	1.10	12hr	1.10	1.16	12hr	0.55	0.55
1.18	1.03	1.04	12hr	1.04	1.18	18hr	0.34	0.70
1.21	2.27	2.30	12hr	2.30	1.21	12hr	0.79	1.51
1.23	0.94	0.95	12hr	0.95	1.23	12hr	0.30	0.65
1.24	0.88	0.89	12hr	0.89	1.24	18hr	0.22	0.66
1.26	0.29	0.43	12hr	0.43	1.26	12hr	0.43	0.00
1.27	52.35	58.73	12hr	58.73	1.27	18hr	55.74	2.99
1.28	53.57	59.35	12hr	59.35	1.28	18hr	56.43	2.92
2.01	9.32	9.41	12hr	9.41	2.01	18hr	2.61	6.80
3.01	0.79	0.82	12hr	0.82	3.01	12hr	0.43	0.40
4.01	0.59	0.60	12hr	0.60	4.01	12hr	0.31	0.28
4.02	1.82	1.83	12hr	1.83	4.02	12hr	0.85	0.98
5.01	0.17	0.24	12hr	0.24	5.01	12hr	0.24	0.00
7.01	1.04	1.06	12hr	1.06	7.01	12hr	0.46	0.60
7.02	4.17	4.20	12hr	4.20	7.02	12hr	1.55	2.65
7.03	7.37	7.42	12hr	7.42	7.03	12hr	2.79	4.62
7.04	8.88	8.85	9hr	8.88	7.04	12hr	3.43	5.44
7.05	11.12	11.31	12hr	11.31	7.05	12hr	4.53	6.79
7.06	12.43	12.10	9hr	12.43	7.06	12hr	5.03	7.40
7.12	1.19	1.19	12hr	1.19	7.12	18hr	0.59	0.60
8.01	1.49	1.50	12hr	1.50	8.01	12hr	0.85	0.65
9.01	0.68	0.70	12hr	0.70	9.01	12hr	0.34	0.36
10.01	1.01	1.04	12hr	1.04	10.01	12hr	0.52	0.51
11.01	0.96	0.98	12hr	0.98	11.01	12hr	0.48	0.51
14.01	1.91	1.94	12hr	1.94	14.01	12hr	0.83	1.11
15.01	1.04	1.06	12hr	1.06	15.01	12hr	0.46	0.60
15.02	0.96	0.99	12hr	0.99	15.02	12hr	0.60	0.39
16.01	0.47	0.48	12hr	0.48	16.01	12hr	0.22	0.26
17.01	1.03	1.05	12hr	1.05	17.01	12hr	0.47	0.58
17.02	3.34	3.38	12hr	3.38	17.02	12hr	1.33	2.05
17.03	7.84	7.88	12hr	7.88	17.03	12hr	2.69	5.19
17.04	11.58	11.68	12hr	11.68	17.04	12hr	3.98	7.70
17.06	14.51	14.04	9hr	14.51	17.06	12hr	5.10	9.41
17.07	16.44	15.87	9hr	16.44	17.07	12hr	5.96	10.48
17.09	1.53	1.54	12hr	1.54	17.09	18hr	0.46	1.08
17.11	0.46	0.47	12hr	0.47	17.11	12hr	0.23	0.24
17.12	1.23	1.25	12hr	1.25	17.12	12hr	0.51	0.73
17.13	0.94	0.95	12hr	0.95	17.13	12hr	0.29	0.66
17.16	20.77	20.42	9hr	20.77	17.16	12hr	16.86	3.90
18.01	1.83	1.86	12hr	1.86	18.01	12hr	0.77	1.09
18.02	2.79	2.83	12hr	2.83	18.02	12hr	1.21	1.62
20.01	1.37	1.39	12hr	1.39	20.01	12hr	0.59	0.80
22.01	2.47	2.49	12hr	2.49	22.01	12hr	0.79	1.70
23.01	0.98	0.99	12hr	0.99	23.01	12hr	0.33	0.65
24.01	1.33	1.34	12hr	1.34	24.01	12hr	0.52	0.82
24.02	3.29	3.31	12hr	3.31	24.02	12hr	1.19	2.13

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
1.01	15.12	16.31	12hr	16.31	1.01	9hr	9.31	6.99
1.02	25.25	27.26	12hr	27.26	1.02	9hr	16.25	11.00
1.03	51.73	55.36	12hr	55.36	1.03	9hr	31.71	23.65
1.04	57.74	59.02	12hr	59.02	1.04	9hr	36.39	22.64
1.05	67.31	66.18	9hr	67.31	1.05	9hr	43.79	23.52
1.14	1.10	1.20	12hr	1.20	1.14	12hr	0.71	0.49
1.15	4.23	4.76	12hr	4.76	1.15	9hr	3.56	1.20
1.16	3.20	3.49	12hr	3.49	1.16	12hr	2.65	0.84
1.18	2.90	3.20	12hr	3.20	1.18	9hr	1.87	1.33
1.21	6.05	6.54	12hr	6.54	1.21	9hr	3.87	2.67
1.23	2.47	2.68	12hr	2.68	1.23	9hr	1.56	1.12
1.24	2.21	2.39	12hr	2.39	1.24	12hr	1.20	1.20
1.26	2.30	2.22	9hr	2.30	1.26	9hr	2.30	0.00
1.27	216.33	223.88	12hr	223.88	1.27	9hr	251.85	-27.97
1.28	218.18	226.20	12hr	226.20	1.28	9hr	253.48	-27.28
2.01	23.87	25.83	12hr	25.83	2.01	9hr	13.58	12.26
3.01	2.04	2.19	12hr	2.19	3.01	12hr	2.08	0.11
4.01	1.41	1.48	12hr	1.48	4.01	12hr	1.51	-0.03
4.02	4.32	4.55	12hr	4.55	4.02	12hr	4.08	0.47
5.01	1.27	1.19	9hr	1.27	5.01	9hr	1.27	0.00
7.01	2.90	3.13	12hr	3.13	7.01	9hr	2.23	0.90
7.02	11.07	12.02	12hr	12.02	7.02	9hr	7.55	4.47
7.03	19.47	21.16	12hr	21.16	7.03	9hr	13.43	7.73
7.04	23.63	25.16	12hr	25.16	7.04	9hr	16.65	8.51
7.05	30.30	32.50	12hr	32.50	7.05	9hr	21.98	10.52
7.06	34.08	34.94	12hr	34.94	7.06	9hr	24.72	10.22
7.12	2.76	2.92	12hr	2.92	7.12	9hr	3.03	-0.11
8.01	3.49	3.69	12hr	3.69	8.01	9hr	4.09	-0.40
9.01	1.96	2.11	12hr	2.11	9.01	12hr	1.66	0.45
10.01	2.92	3.13	12hr	3.13	10.01	12hr	2.53	0.60
11.01	2.74	2.94	12hr	2.94	11.01	12hr	2.32	0.62
14.01	5.40	5.88	12hr	5.88	14.01	9hr	3.96	1.92
15.01	3.25	3.59	12hr	3.59	15.01	9hr	2.36	1.23
15.02	3.61	4.06	12hr	4.06	15.02	9hr	3.20	0.86
16.01	1.30	1.41	12hr	1.41	16.01	12hr	1.06	0.35
17.01	2.88	3.11	12hr	3.11	17.01	12hr	2.27	0.85
17.02	9.02	9.78	12hr	9.78	17.02	9hr	6.38	3.40
17.03	20.48	22.16	12hr	22.16	17.03	9hr	13.51	8.65
17.04	30.30	32.90	12hr	32.90	17.04	9hr	20.07	12.83
17.06	38.49	39.53	12hr	39.53	17.06	9hr	26.00	13.53
17.07	44.19	45.13	12hr	45.13	17.07	9hr	30.28	14.85
17.09	3.98	4.31	12hr	4.31	17.09	9hr	2.42	1.89
17.11	1.51	1.69	12hr	1.69	17.11	9hr	1.17	0.52
17.12	3.60	3.94	12hr	3.94	17.12	9hr	2.52	1.42
17.13	2.48	2.70	12hr	2.70	17.13	9hr	1.54	1.16
17.16	76.74	70.26	9hr	76.74	17.16	9hr	82.84	-6.10
18.01	5.03	5.43	12hr	5.43	18.01	9hr	3.66	1.78
18.02	7.69	8.32	12hr	8.32	18.02	9hr	5.77	2.55
20.01	3.78	4.10	12hr	4.10	20.01	9hr	2.82	1.29
22.01	6.50	7.02	12hr	7.02	22.01	9hr	4.00	3.02
23.01	2.61	2.82	12hr	2.82	23.01	9hr	1.71	1.11
24.01	3.59	3.89	12hr	3.89	24.01	9hr	2.52	1.37
24.02	8.70	9.41	12hr	9.41	24.02	9hr	5.84	3.57

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
24.03	4.80	4.85	12hr	4.85	24.03	12hr	1.78	3.07
24.04	5.58	5.34	9hr	5.58	24.04	12hr	2.19	3.40
24.05	6.57	6.30	9hr	6.57	24.05	12hr	2.71	3.86
24.06	7.71	7.29	9hr	7.71	24.06	12hr	3.22	4.49
25.01	0.26	0.38	12hr	0.38	25.01	12hr	0.37	0.00
25.02	2.06	2.10	12hr	2.10	25.02	12hr	1.25	0.85
27.01	0.89	0.95	12hr	0.95	27.01	12hr	0.73	0.22
28.01	1.76	1.78	12hr	1.78	28.01	12hr	0.72	1.07
28.02	2.92	2.94	12hr	2.94	28.02	12hr	1.22	1.72
29.01	2.18	2.21	12hr	2.21	29.01	12hr	0.84	1.36
29.02	3.51	3.53	12hr	3.53	29.02	12hr	1.41	2.12
30.01	1.22	1.24	12hr	1.24	30.01	12hr	0.52	0.72
30.02	3.37	3.41	12hr	3.41	30.02	12hr	1.30	2.11
31.02	1.78	1.81	12hr	1.81	31.02	12hr	0.67	1.14
32.01	0.70	0.72	12hr	0.72	32.01	12hr	0.36	0.36
32.02	2.40	2.43	12hr	2.43	32.02	12hr	1.14	1.29
1.06a	0.00	0.00	12hr	0.00	1.06a	12hr	0.72	-0.72
1.06b	27.49	24.24	9hr	27.49	1.06b	12hr	9.78	17.71
1.07a	0.00	0.00	12hr	0.00	1.07a	12hr	0.33	-0.33
1.07b	0.57	0.83	12hr	0.83	1.07b	12hr	0.82	0.01
1.08a	0.00	0.00	12hr	0.00	1.08a	12hr	0.37	-0.37
1.08b	0.83	0.87	12hr	0.87	1.08b	12hr	0.52	0.34
1.09a	0.79	0.82	12hr	0.82	1.09a	12hr	0.55	0.27
1.09b	0.00	0.00	12hr	0.00	1.09b	12hr	0.15	-0.15
1.09c	0.61	0.63	12hr	0.63	1.09c	12hr	0.36	0.28
1.10a	11.50	12.69	12hr	12.69	1.10a	12hr	14.02	-1.32
1.10b	1.20	1.19	9hr	1.20	1.10b	12hr	0.74	0.46
1.11a	0.42	0.43	12hr	0.43	1.11a	12hr	0.21	0.21
1.11b	0.65	0.68	12hr	0.68	1.11b	12hr	0.42	0.26
1.12a	0.90	0.91	12hr	0.91	1.12a	12hr	0.49	0.42
1.12b	12.56	13.73	12hr	13.73	1.12b	12hr	15.81	-2.08
1.12c	0.79	0.80	12hr	0.80	1.12c	12hr	0.37	0.44
1.13a	0.55	0.57	12hr	0.57	1.13a	12hr	0.32	0.24
1.13b	0.00	0.00	12hr	0.00	1.13b	12hr	0.42	-0.42
1.17a	2.68	2.72	12hr	2.72	1.17a	12hr	1.29	1.42
1.17b	0.19	0.26	12hr	0.26	1.17b	12hr	0.25	0.00
1.20a	0.12	0.16	12hr	0.16	1.20a	12hr	0.16	0.00
1.20b	0.09	0.12	12hr	0.12	1.20b	12hr	0.12	0.01
1.22a	0.63	0.64	12hr	0.64	1.22a	30min	0.34	0.30
1.22b	0.46	0.47	12hr	0.47	1.22b	30min	0.14	0.33
1.25a_Com	0.31	0.31	12hr	0.31	1.25a	18hr	0.22	0.09
1.25a_Rest	0.24	0.25	12hr	0.25				0.25
1.25b	3.87	3.88	12hr	3.88	1.25b	12hr	1.44	2.44
10.02a	1.94	1.98	12hr	1.98	10.02a	12hr	0.97	1.01
10.02b	0.08	0.09	12hr	0.09	10.02b	12hr	0.09	0.00
12.01a	9.86	10.29	12hr	10.29	12.01a	12hr	10.01	0.27
12.01b	0.16	0.21	12hr	0.21	12.01b	12hr	0.20	0.01
12.02a	0.51	0.53	12hr	0.53	12.02a	12hr	0.29	0.24
12.02b	0.05	0.06	12hr	0.06	12.02b	12hr	0.06	0.00
17.08a	0.88	0.89	12hr	0.89	17.08a	12hr	0.37	0.52
17.08b	0.52	0.53	12hr	0.53	17.08b	12hr	0.24	0.29
17.08c_Com	0.34	0.34	12hr	0.34	17.08c	12hr	0.35	-0.01
17.08cRest	1.34	1.36	12hr	1.36				1.36
17.08d	0.05	0.05	12hr	0.05	17.08d	12hr	0.03	0.03

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
24.03	12.65	13.77	12hr	13.77	24.03	9hr	8.74	5.02
24.04	15.03	15.34	12hr	15.34	24.04	9hr	10.65	4.70
24.05	18.02	18.33	12hr	18.33	24.05	9hr	13.11	5.22
24.06	21.37	21.04	9hr	21.37	24.06	9hr	15.69	5.68
25.01	1.87	1.89	12hr	1.89	25.01	9hr	1.84	0.05
25.02	6.98	7.86	12hr	7.86	25.02	9hr	6.04	1.82
27.01	3.59	4.07	12hr	4.07	27.01	9hr	3.51	0.56
28.01	4.75	5.13	12hr	5.13	28.01	9hr	3.45	1.68
28.02	8.06	8.80	12hr	8.80	28.02	9hr	5.92	2.87
29.01	5.78	6.23	12hr	6.23	29.01	9hr	4.02	2.21
29.02	9.63	10.51	12hr	10.51	29.02	9hr	6.90	3.62
30.01	3.35	3.64	12hr	3.64	30.01	9hr	2.51	1.12
30.02	9.06	9.81	12hr	9.81	30.02	9hr	6.25	3.56
31.02	3.68	4.00	12hr	4.00	31.02	9hr	3.30	0.70
32.01	2.02	2.16	12hr	2.16	32.01	12hr	1.76	0.40
32.02	7.57	8.44	12hr	8.44	32.02	9hr	5.71	2.73
1.06a	0.00	0.00	12hr	0.00	1.06a	9hr	3.46	-3.46
1.06b	74.41	70.70	9hr	74.41	1.06b	9hr	48.95	25.47
1.07a	0.00	0.00	12hr	0.00	1.07a	9hr	1.57	-1.57
1.07b	4.04	3.98	9hr	4.04	1.07b	9hr	3.95	0.09
1.08a	0.00	0.00	12hr	0.00	1.08a	9hr	1.78	-1.78
1.08b	2.91	3.23	12hr	3.23	1.08b	9hr	2.51	0.72
1.09a	2.04	2.19	12hr	2.19	1.09a	12hr	2.64	-0.45
1.09b	0.00	0.00	12hr	0.00	1.09b	12hr	0.72	-0.72
1.09c	1.99	2.18	12hr	2.18	1.09c	12hr	1.74	0.44
1.10a	59.64	53.11	9hr	59.64	1.10a	9hr	68.29	-8.65
1.10b	3.99	4.27	12hr	4.27	1.10b	9hr	3.53	0.75
1.11a	1.01	1.06	12hr	1.06	1.11a	12hr	1.04	0.03
1.11b	2.32	2.58	12hr	2.58	1.11b	12hr	2.11	0.47
1.12a	2.13	2.25	12hr	2.25	1.12a	12hr	2.41	-0.16
1.12b	63.58	56.51	9hr	63.58	1.12b	9hr	75.26	-11.68
1.12c	2.22	2.39	12hr	2.39	1.12c	12hr	1.80	0.59
1.13a	1.88	2.10	12hr	2.10	1.13a	9hr	1.58	0.52
1.13b	0.00	0.00	12hr	0.00	1.13b	9hr	2.07	-2.07
1.17a	8.00	8.81	12hr	8.81	1.17a	9hr	6.22	2.59
1.17b	1.24	1.29	12hr	1.29	1.17b	9hr	1.22	0.08
1.20a	0.77	0.76	9hr	0.77	1.20a	9hr	0.77	0.00
1.20b	0.59	0.63	12hr	0.63	1.20b	12hr	0.57	0.06
1.22a	1.81	2.04	12hr	2.04	1.22a	12hr	1.44	0.60
1.22b	1.24	1.37	12hr	1.37	1.22b	12hr	0.82	0.55
1.25a_Com	0.72	0.76	12hr	0.76	1.25a	9hr	1.17	-0.41
1.25a_Rest	1.03	1.15	12hr	1.15				1.15
1.25b	10.17	11.00	12hr	11.00	1.25b	9hr	6.99	4.01
10.02a	5.50	5.94	12hr	5.94	10.02a	12hr	4.59	1.35
10.02b	0.41	0.45	12hr	0.45	10.02b	12hr	0.45	0.00
12.01a	42.07	37.02	9hr	42.07	12.01a	9hr	48.33	-6.26
12.01b	0.95	1.02	12hr	1.02	12.01b	12hr	0.97	0.05
12.02a	1.69	1.87	12hr	1.87	12.02a	9hr	1.41	0.46
12.02b	0.30	0.30	12hr	0.30	12.02b	12hr	0.30	0.00
17.08a	2.41	2.61	12hr	2.61	17.08a	9hr	1.80	0.81
17.08b	1.44	1.56	12hr	1.56	17.08b	9hr	1.13	0.43
17.08c_Com	0.81	0.85	12hr	0.85	17.08c	9hr	1.71	-0.86
17.08cRest	3.48	3.74	12hr	3.74				3.74
17.08d	0.14	0.16	12hr	0.16	17.08d	12hr	0.13	0.02

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
17.10a	0.70	0.71	12hr	0.71	17.10a	12hr	0.26	0.45
17.10b	1.09	1.11	12hr	1.11	17.10b	12hr	0.37	0.74
17.14a	0.98	1.01	12hr	1.01	17.14a	12hr	0.59	0.42
17.14b	0.75	0.77	12hr	0.77	17.14b	12hr	0.32	0.44
17.15a	0.73	0.74	12hr	0.74	17.15a	12hr	0.35	0.39
17.15b	0.25	0.28	12hr	0.28	17.15b	12hr	0.19	0.09
21.01_Com	1.58	1.58	12hr	1.58				1.58
21.01_Rest	0.53	0.54	12hr	0.54				0.54
25.03a	1.17	1.19	12hr	1.19	25.03a	12hr	0.85	0.34
25.03b	0.13	0.16	12hr	0.16	25.03b	12hr	0.13	0.03
25.03c	0.38	0.39	12hr	0.39	25.03c	12hr	0.19	0.21
25.04a	0.76	0.77	12hr	0.77	25.04a	12hr	0.30	0.47
25.04b	0.46	0.47	12hr	0.47	25.04b	12hr	0.23	0.24
25.05a	0.49	0.50	12hr	0.50	25.05a	12hr	0.20	0.29
25.05b	0.18	0.19	12hr	0.19	25.05b	12hr	0.14	0.05
25.06a	0.77	0.78	12hr	0.78	25.06a	12hr	0.30	0.48
25.06b	0.47	0.48	12hr	0.48	25.06b	12hr	0.44	0.05
25.06c	0.14	0.16	12hr	0.16	25.06c	12hr	0.12	0.04
25.07a	0.42	0.43	12hr	0.43	25.07a	12hr	0.21	0.22
25.07b	0.14	0.20	12hr	0.20	25.07b	12hr	0.17	0.03
26.01a	0.76	0.78	12hr	0.78	26.01a	12hr	0.33	0.44
26.01b	0.28	0.39	12hr	0.39	26.01b	12hr	0.39	0.00
3.01Comm	0.34	0.35	12hr	0.35				0.35
31.03_Comm	0.44	0.44	12hr	0.44				0.44
31.03_Rest	0.29	0.30	12hr	0.30				0.30
					31.01a	12hr	0.23	
					31.01b	12hr	0.11	
33.01a	0.39	0.50	12.00	0.50	33.01a	12hr	0.43	0.07
33.01b	0.47	0.63	12.00	0.63	33.01b	12hr	0.55	0.08
7.07a	0.00	0.00	12.00	0.00	7.07a	12hr	0.20	-0.20
7.07b	0.20	0.20	12.00	0.20	7.07b	12hr	6.08	-5.88
7.08a	0.00	0.00	12.00	0.00	7.08a	12hr	0.22	-0.22
7.08b	0.98	0.98	12.00	0.98	7.08b	12hr	0.37	0.61
7.09a	0.85	0.86	12.00	0.86	7.09a	12hr	0.35	0.51
7.09b	0.05	0.05	12.00	0.05	7.09b	12hr	0.11	-0.06
7.09c	1.03	1.04	12.00	1.04	7.09c	12hr	0.43	0.61
7.10a	0.78	0.78	12.00	0.78	7.10a	18hr	0.25	0.53
7.10b	0.53	0.53	12.00	0.53	7.10b	12hr	0.21	0.32
7.11a	0.73	0.75	12.00	0.75	7.11a	12hr	0.34	0.41
7.11b	0.52	0.51	9.00	0.52	7.11b	12hr	0.45	0.08
9.02a	0.39	0.40	12.00	0.40	9.02a	12hr	0.46	-0.06
9.02b	1.27	1.29	12.00	1.29	9.02b	12hr	0.59	0.69
Al_Com_B18	0.97	0.98	12.00	0.98				0.98
DumB1	0.87	0.82	9.00	0.87				0.87
DumB10	0.36	0.36	12.00	0.36				0.36
DumB11	1.32	1.32	9.00	1.32				1.32
DumB12	0.60	0.61	12.00	0.61				0.61
DumB13	0.40	0.39	9.00	0.40				0.40
DumB14	1.01	0.94	9.00	1.01				1.01
DumB15	0.37	0.34	9.00	0.37				0.37
DumB16	0.38	0.36	9.00	0.38				0.38
DumB17	1.45	1.49	12.00	1.49				1.49
DumB18	1.23	1.11	9.00	1.23				1.23
DumB19	1.16	1.20	12.00	1.20				1.20

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
17.10a	1.87	2.03	12hr	2.03	17.10a	9hr	1.29	0.74
17.10b	2.91	3.15	12hr	3.15	17.10b	9hr	1.91	1.24
17.14a	3.47	3.91	12hr	3.91	17.14a	9hr	2.87	1.04
17.14b	2.07	2.25	12hr	2.25	17.14b	9hr	1.56	0.69
17.15a	2.21	2.44	12hr	2.44	17.15a	9hr	1.72	0.72
17.15b	0.98	1.12	12hr	1.12	17.15b	9hr	0.90	0.22
21.01_Com	3.65	3.85	12hr	3.85				3.85
21.01_Rest	1.46	1.59	12hr	1.59				1.59
25.03a	4.30	4.84	12hr	4.84	25.03a	9hr	4.11	0.73
25.03b	0.64	0.72	12hr	0.72	25.03b	12hr	0.63	0.10
25.03c	1.13	1.24	12hr	1.24	25.03c	9hr	0.89	0.34
25.04a	2.11	2.31	12hr	2.31	25.04a	9hr	1.49	0.82
25.04b	1.40	1.56	12hr	1.56	25.04b	9hr	1.10	0.46
25.05a	1.37	1.50	12hr	1.50	25.05a	9hr	1.01	0.49
25.05b	0.72	0.83	12hr	0.83	25.05b	9hr	0.66	0.17
25.06a	2.03	2.21	12hr	2.21	25.06a	9hr	1.45	0.76
25.06b	2.14	2.22	12hr	2.22	25.06b	9hr	2.14	0.08
25.06c	0.58	0.65	12hr	0.65	25.06c	12hr	0.58	0.08
25.07a	1.26	1.40	12hr	1.40	25.07a	12hr	1.04	0.36
25.07b	0.81	0.90	12hr	0.90	25.07b	12hr	0.80	0.09
26.01a	2.11	2.29	12hr	2.29	26.01a	9hr	1.61	0.68
26.01b	1.90	1.89	9hr	1.90	26.01b	9hr	1.90	0.00
3.01Comm	0.82	0.86	12hr	0.86				0.86
31.03_Comm	1.01	1.07	12hr	1.07				1.07
31.03_Rest	1.21	1.36	12hr	1.36				1.36
					31.01a	12hr	1.10	
					31.01b	12hr	0.54	
33.01a	2.02	2.29	12.00	2.29	33.01a	12hr	2.13	0.16
33.01b	2.56	2.88	12.00	2.88	33.01b	12hr	2.72	0.16
7.07a	0.00	0.00	12.00	0.00	7.07a	12hr	0.94	-0.94
7.07b	0.48	0.50	12.00	0.50	7.07b	9hr	29.85	-29.35
7.08a	0.00	0.00	12.00	0.00	7.08a	9hr	1.04	-1.04
7.08b	2.29	2.42	12.00	2.42	7.08b	9hr	1.83	0.60
7.09a	2.03	2.15	12.00	2.15	7.09a	9hr	1.72	0.43
7.09b	0.11	0.12	12.00	0.12	7.09b	12hr	0.54	-0.42
7.09c	2.43	2.57	12.00	2.57	7.09c	9hr	2.12	0.44
7.10a	1.81	1.91	12.00	1.91	7.10a	9hr	1.33	0.57
7.10b	1.24	1.31	12.00	1.31	7.10b	9hr	1.09	0.23
7.11a	2.06	2.23	12.00	2.23	7.11a	12hr	1.65	0.58
7.11b	2.10	2.29	12.00	2.29	7.11b	12hr	2.21	0.08
9.02a	0.93	0.98	12.00	0.98	9.02a	9hr	2.25	-1.26
9.02b	3.52	3.83	12.00	3.83	9.02b	12hr	2.84	0.99
Al_Com_B18	2.31	2.43	12.00	2.43				2.43
DumB1	2.35	2.35	12.00	2.35				2.35
DumB10	1.73	1.73	12.00	1.73				1.73
DumB11	6.29	6.24	9.00	6.29				6.29
DumB12	3.27	3.22	9.00	3.27				3.27
DumB13	1.57	1.50	9.00	1.57				1.57
DumB14	4.37	4.56	12.00	4.56				4.56
DumB15	1.51	1.57	12.00	1.57				1.57
DumB16	1.72	1.79	12.00	1.79				1.79
DumB17	7.04	6.89	9.00	7.04				7.04
DumB18	3.24	3.28	12.00	3.28				3.28
DumB19	5.94	5.73	9.00	5.94				5.94

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
DumB2	0.00	0.00	12.00	0.00				0.00
DumB20	1.25	1.27	12.00	1.27				1.27
DumB21	0.31	0.31	12.00	0.31				0.31
DumB22	1.27	1.25	9.00	1.27				1.27
DumB23	0.82	0.81	9.00	0.82				0.82
DumB25	1.32	1.23	9.00	1.32				1.32
DumB27	0.60	0.58	9.00	0.60				0.60
DumB29	2.74	2.75	12.00	2.75				2.75
DumB3	0.48	0.43	9.00	0.48				0.48
DumB31	0.78	0.76	9.00	0.78				0.78
DumB32	1.05	0.94	9.00	1.05				1.05
DumB34	0.61	0.57	9.00	0.61				0.61
DumB35	0.00	0.00	12.00	0.00				0.00
DumB4	0.35	0.32	9.00	0.35				0.35
DumB5	0.66	0.66	12.00	0.66				0.66
DumB6	0.35	0.34	9.00	0.35				0.35
DumB7	0.54	0.50	9.00	0.54				0.54
DumB8	0.52	0.54	12.00	0.54				0.54
DumB9	0.60	0.60	12.00	0.60				0.60
Dummy1	9.18	10.21	12.00	10.21	Dummy1	12hr	10.42	-0.21
Dummy10	9.86	10.29	12.00	10.29	Dummy10	12hr	9.69	0.60
Dummy11	0.82	0.72	9.00	0.82	Dummy11	12hr	7.08	-6.26
Dummy12	5.51	5.81	12.00	5.81	Dummy12	12hr	6.25	-0.44
Dummy13	23.16	24.34	12.00	24.34	Dummy13	12hr	26.84	-2.50
Dummy14	23.68	25.30	12.00	25.30	Dummy14	12hr	27.50	-2.19
Dummy15	25.46	27.91	12.00	27.91	Dummy15	12hr	29.14	-1.23
Dummy16	26.43	29.16	12.00	29.16	Dummy16	12hr	30.20	-1.04
Dummy17	42.11	48.05	12.00	48.05	Dummy17	12hr	46.99	1.06
Dummy18	19.64	19.19	9.00	19.64	Dummy18	12hr	7.55	12.09
Dummy19	7.63	8.32	12.00	8.32	Dummy19	12hr	7.87	0.45
Dummy2	9.73	10.92	12.00	10.92	Dummy2	12hr	11.41	-0.48
Dummy20	11.07	11.44	12.00	11.44	Dummy20	12hr	10.01	1.43
Dummy21	16.37	15.60	9.00	16.37	Dummy21	12hr	12.71	3.66
Dummy22	2.37	2.36	9.00	2.37	Dummy22	12hr	2.40	-0.03
Dummy23	3.25	3.18	9.00	3.25	Dummy23	12hr	2.90	0.35
Dummy24	4.83	4.56	9.00	4.83	Dummy24	12hr	4.42	0.42
Dummy25	5.35	5.08	9.00	5.35	Dummy25	12hr	4.92	0.43
Dummy26	7.05	6.92	9.00	7.05	Dummy26	12hr	6.65	0.40
Dummy27	47.65	54.64	12.00	54.64	Dummy27	18hr	52.22	2.41
Dummy28	9.68	10.08	12.00	10.08	Dummy28	12hr	10.12	-0.04
Dummy29	1.21	1.25	12.00	1.25	Dummy29	12hr	0.69	0.56
Dummy3	10.00	11.22	12.00	11.22	Dummy3	12hr	12.05	-0.83
Dummy30	1.77	2.13	12.00	2.13	Dummy30	12hr	1.85	0.28
Dummy31	3.79	3.60	9.00	3.79	Dummy31	12hr	3.78	0.01
Dummy32	5.45	5.42	9.00	5.45	Dummy32	12hr	5.57	-0.13
Dummy33	11.42	12.73	12.00	12.73	Dummy33	12hr	12.77	-0.04
Dummy34	13.36	13.66	12.00	13.66	Dummy34	12hr	10.98	2.69
Dummy35	15.22	14.87	9.00	15.22	Dummy35	12hr	12.01	3.21
Dummy36	8.07	8.76	12.00	8.76	Dummy36	12hr	8.30	0.46
Dummy37	8.74	9.48	12.00	9.48	Dummy37	12hr	8.93	0.55
Dummy38	14.51	14.55	12.00	14.55	Dummy38	12hr	11.73	2.83
Dummy39	16.72	15.95	9.00	16.72	Dummy39	12hr	12.98	3.74
Dummy4	10.71	11.96	12.00	11.96	Dummy4	12hr	13.24	-1.29
Dummy40	19.58	19.30	9.00	19.58	Dummy40	12hr	16.14	3.44

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
DumB2	0.00	0.00	12.00	0.00				0.00
DumB20	5.99	5.92	9.00	5.99				5.99
DumB21	1.45	1.45	9.00	1.45				1.45
DumB22	6.08	6.09	12.00	6.09				6.09
DumB23	4.01	4.13	12.00	4.13				4.13
DumB25	5.88	5.99	12.00	5.99				5.99
DumB27	2.72	2.78	12.00	2.78				2.78
DumB29	12.70	13.07	12.00	13.07				13.07
DumB3	1.54	1.55	12.00	1.55				1.55
DumB31	3.56	3.46	9.00	3.56				3.56
DumB32	4.46	4.75	12.00	4.75				4.75
DumB34	1.90	2.08	12.00	2.08				2.08
DumB35	0.00	0.00	12.00	0.00				0.00
DumB4	1.41	1.44	12.00	1.44				1.44
DumB5	3.02	2.94	9.00	3.02				3.02
DumB6	1.58	1.65	12.00	1.65				1.65
DumB7	1.65	1.64	9.00	1.65				1.65
DumB8	2.60	2.52	9.00	2.60				2.60
DumB9	2.92	2.89	9.00	2.92				2.92
Dummy1	48.86	45.44	9.00	48.86	Dummy1	9hr	52.06	-3.20
Dummy10	42.07	37.02	9.00	42.07	Dummy10	9hr	46.84	-4.77
Dummy11	2.94	2.97	12.00	2.97	Dummy11	9hr	34.51	-31.54
Dummy12	26.86	25.45	9.00	26.86	Dummy12	9hr	30.57	-3.71
Dummy13	105.28	91.19	9.00	105.28	Dummy13	9hr	125.87	-20.59
Dummy14	107.25	95.94	9.00	107.25	Dummy14	9hr	128.61	-21.36
Dummy15	112.45	105.02	9.00	112.45	Dummy15	9hr	135.25	-22.80
Dummy16	116.19	111.14	9.00	116.19	Dummy16	9hr	140.28	-24.09
Dummy17	182.61	183.51	12.00	183.51	Dummy17	9hr	218.91	-35.40
Dummy18	53.80	55.25	12.00	55.25	Dummy18	9hr	37.48	17.77
Dummy19	39.39	35.97	9.00	39.39	Dummy19	9hr	38.96	0.42
Dummy2	52.38	48.32	9.00	52.38	Dummy2	9hr	56.89	-4.52
Dummy20	47.61	40.72	9.00	47.61	Dummy20	9hr	50.00	-2.40
Dummy21	58.52	52.05	9.00	58.52	Dummy21	9hr	62.90	-4.39
Dummy22	11.24	11.19	9.00	11.24	Dummy22	9hr	11.53	-0.29
Dummy23	13.97	13.56	9.00	13.97	Dummy23	9hr	14.04	-0.06
Dummy24	21.39	20.60	9.00	21.39	Dummy24	9hr	21.36	0.03
Dummy25	23.81	22.84	9.00	23.81	Dummy25	9hr	23.68	0.13
Dummy26	32.24	30.75	9.00	32.24	Dummy26	9hr	31.89	0.35
Dummy27	204.40	209.53	12.00	209.53	Dummy27	9hr	240.75	-31.22
Dummy28	43.81	43.94	12.00	43.94	Dummy28	9hr	44.93	-0.99
Dummy29	3.54	3.78	12.00	3.78	Dummy29	12hr	3.22	0.56
Dummy3	53.70	48.96	9.00	53.70	Dummy3	9hr	59.88	-6.19
Dummy30	8.15	9.25	12.00	9.25	Dummy30	12hr	8.46	0.79
Dummy31	16.61	17.15	12.00	17.15	Dummy31	9hr	17.10	0.05
Dummy32	24.57	25.43	12.00	25.43	Dummy32	9hr	25.10	0.33
Dummy33	55.73	54.23	9.00	55.73	Dummy33	9hr	56.27	-0.54
Dummy34	51.31	44.30	9.00	51.31	Dummy34	9hr	54.78	-3.46
Dummy35	55.61	49.00	9.00	55.61	Dummy35	9hr	59.87	-4.26
Dummy36	41.20	36.86	9.00	41.20	Dummy36	9hr	41.33	-0.13
Dummy37	43.80	38.81	9.00	43.80	Dummy37	9hr	44.83	-1.03
Dummy38	54.56	47.78	9.00	54.56	Dummy38	9hr	58.48	-3.92
Dummy39	59.68	53.26	9.00	59.68	Dummy39	9hr	64.00	-4.32
Dummy4	56.91	51.07	9.00	56.91	Dummy4	9hr	65.09	-8.18
Dummy40	74.24	68.15	9.00	74.24	Dummy40	9hr	79.39	-5.15

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
Dummy41	19.72	19.50	9.00	19.72	Dummy41	12hr	16.25	3.46
Dummy42	11.43	12.63	12.00	12.63	Dummy42	12hr	13.82	-1.19
Dummy43	0.59	0.53	9.00	0.59	Dummy43	12hr	7.54	-6.95
Dummy44	23.25	24.44	12.00	24.44	Dummy44	12hr	26.93	-2.49
Dummy45	24.07	26.07	12.00	26.07	Dummy45	12hr	27.91	-1.84
Dummy46	25.77	28.31	12.00	28.31	Dummy46	12hr	29.49	-1.18
Dummy47	0.81	0.95	12.00	0.95	Dummy47	12hr	0.72	0.22
Dummy48	2.09	2.06	9.00	2.09	Dummy48	12hr	2.10	-0.02
Dummy49	47.85	54.82	12.00	54.82	Dummy49	18hr	52.43	2.39
Dummy50	48.62	55.40	12.00	55.40	Dummy50	18hr	52.90	2.50
Dummy51	49.85	56.49	12.00	56.49	Dummy51	18hr	53.59	2.90
Dummy52	50.05	56.60	12.00	56.60	Dummy52	18hr	53.80	2.80
Dummy53	51.24	57.70	12.00	57.70	Dummy53	18hr	54.72	2.98
Dummy54	13.78	14.09	12.00	14.09	Dummy54	12hr	11.42	2.67
Dummy55	1.78	1.81	12.00	1.81	Dummy55	12hr	0.34	1.48
Dummy56	0.80	0.91	12.00	0.91	Dummy56	12hr	0.91	0.00
Dummy57	0.74	0.92	12.00	0.92	Dummy57	12hr	0.92	0.00
Dummy58	2.39	2.89	12.00	2.89	Dummy58	12hr	2.96	-0.06
Dummy59	1.66	1.68	12.00	1.68	Dummy59	12hr	1.05	0.63
Dummy6	11.77	12.96	12.00	12.96	Dummy6	12hr	14.44	-1.48
Dummy60	10.29	11.50	12.00	11.50	Dummy60	12hr	12.38	-0.87
Dummy7	12.72	13.82	12.00	13.82	Dummy7	12hr	16.34	-2.52
Dummy8	9.12	9.45	12.00	9.45	Dummy8	12hr	8.82	0.63
Dummy9	5.48	5.48	12.00	5.48	Dummy9	12hr	7.98	-2.50
DummyO1	9.18	10.21	12.00	10.21				10.21
DummyO2	4.80	5.20	12.00	5.20				5.20
DummyO3	7.20	7.90	12.00	7.90				7.90
DummyO4	3.16	3.37	12.00	3.37				3.37
DummyO5	1.40	1.49	12.00	1.49				1.49
E1	0.38	0.42	12.00	0.42	E1	12hr	0.42	0.00
E10	1.29	1.32	12.00	1.32	E10	12hr	0.58	0.73
E11a	5.72	5.74	12.00	5.74	E11a	12hr	5.88	-0.14
E11b	6.89	7.12	12.00	7.12	E11b	12hr	7.26	-0.14
E12	0.42	0.46	12.00	0.46	E12	12hr	0.46	0.00
E13	1.44	1.63	12.00	1.63	E13	12hr	1.19	0.44
E14	0.59	0.61	12.00	0.61	E14	12hr	0.33	0.28
E15a	0.33	0.35	12.00	0.35	E15a	12hr	0.19	0.15
E15b	0.29	0.30	12.00	0.30	E15b	12hr	0.17	0.13
E16a	2.38	2.42	12.00	2.42	E16a	12hr	1.28	1.14
E16b	0.09	0.13	12.00	0.13	E16b	12hr	0.11	0.02
E17a	0.39	0.48	12.00	0.48	E17a	12hr	0.48	0.00
E17b	0.36	0.44	12.00	0.44	E17b	12hr	0.44	0.00
E17c	1.63	2.11	12.00	2.11	E17c	12hr	2.10	0.01
E17d	0.46	0.57	12.00	0.57	E17d	12hr	0.56	0.00
E18	0.54	0.75	12.00	0.75	E18	30min	0.89	-0.13
E2	0.42	0.49	12.00	0.49	E2	12hr	0.48	0.00
E3	1.52	1.61	12.00	1.61	E3	12hr	0.95	0.67
E5	3.69	3.79	12.00	3.79	E5	12hr	2.89	0.90
E6a	0.80	0.83	12.00	0.83	E6a	12hr	0.45	0.39
E6b	0.49	0.59	12.00	0.59	E6b	12hr	0.46	0.13
E7a	0.23	0.28	12.00	0.28	E7a	12hr	0.26	0.02
E7b	0.74	0.96	12.00	0.96	E7b	12hr	0.86	0.09
E8a	0.38	0.40	12.00	0.40	E8a	12hr	0.26	0.15
E8b	0.67	0.69	12.00	0.69	E8b	12hr	0.40	0.29

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
Dummy41	74.64	68.59	9.00	74.64	Dummy41	9hr	79.86	-5.22
Dummy42	59.38	52.82	9.00	59.38	Dummy42	9hr	67.53	-8.15
Dummy43	1.72	1.72	9.00	1.72	Dummy43	9hr	36.66	-34.94
Dummy44	105.61	91.78	9.00	105.61	Dummy44	9hr	126.27	-20.66
Dummy45	108.31	98.18	9.00	108.31	Dummy45	9hr	130.33	-22.02
Dummy46	113.39	106.83	9.00	113.39	Dummy46	9hr	136.79	-23.40
Dummy47	3.67	4.17	12.00	4.17	Dummy47	9hr	3.51	0.66
Dummy48	10.08	10.20	12.00	10.20	Dummy48	9hr	10.12	0.08
Dummy49	204.93	210.09	12.00	210.09	Dummy49	9hr	241.61	-31.52
Dummy50	206.57	212.15	12.00	212.15	Dummy50	9hr	243.09	-30.94
Dummy51	209.29	215.47	12.00	215.47	Dummy51	9hr	245.29	-29.82
Dummy52	209.83	216.08	12.00	216.08	Dummy52	9hr	245.93	-29.86
Dummy53	212.95	219.92	12.00	219.92	Dummy53	9hr	248.66	-28.75
Dummy54	53.48	46.35	9.00	53.48	Dummy54	9hr	57.00	-3.52
Dummy55	3.68	4.00	12.00	4.00	Dummy55	12hr	1.64	2.36
Dummy56	3.96	4.39	12.00	4.39	Dummy56	12hr	4.39	0.00
Dummy57	4.37	4.45	12.00	4.45	Dummy57	12hr	4.45	0.00
Dummy58	13.78	14.11	12.00	14.11	Dummy58	9hr	13.88	0.23
Dummy59	4.45	4.81	12.00	4.81	Dummy59	9hr	5.08	-0.26
Dummy6	60.62	54.21	9.00	60.62	Dummy6	9hr	69.83	-9.20
Dummy60	54.79	49.75	9.00	54.79	Dummy60	9hr	61.37	-6.58
Dummy7	64.13	57.86	9.00	64.13	Dummy7	9hr	77.17	-13.04
Dummy8	39.54	34.79	9.00	39.54	Dummy8	9hr	42.58	-3.04
Dummy9	12.68	13.42	12.00	13.42	Dummy9	9hr	38.99	-25.56
DummyO1	48.86	45.44	9.00	48.86				48.86
DummyO2	24.57	23.37	9.00	24.57				24.57
DummyO3	37.41	34.80	9.00	37.41				37.41
DummyO4	15.61	14.61	9.00	15.61				15.61
DummyO5	7.00	6.81	9.00	7.00				7.00
E1	1.84	2.04	12.00	2.04	E1	12hr	2.04	0.00
E10	3.60	3.90	12.00	3.90	E10	12hr	2.79	1.11
E11a	25.71	26.53	12.00	26.53	E11a	9hr	26.41	0.12
E11b	31.94	32.87	12.00	32.87	E11b	9hr	32.60	0.27
E12	1.94	2.12	12.00	2.12	E12	12hr	2.12	0.00
E13	5.87	6.47	12.00	6.47	E13	12hr	5.60	0.87
E14	1.75	1.86	12.00	1.86	E14	12hr	1.60	0.26
E15a	0.99	1.05	12.00	1.05	E15a	12hr	0.92	0.12
E15b	0.85	0.90	12.00	0.90	E15b	12hr	0.80	0.10
E16a	7.14	7.81	12.00	7.81	E16a	12hr	6.00	1.80
E16b	0.51	0.58	12.00	0.58	E16b	12hr	0.53	0.05
E17a	2.28	2.31	12.00	2.31	E17a	12hr	2.31	0.00
E17b	2.10	2.15	12.00	2.15	E17b	12hr	2.15	0.00
E17c	10.04	10.04	12.00	10.04	E17c	9hr	9.87	0.17
E17d	2.69	2.79	12.00	2.79	E17d	12hr	2.70	0.08
E18	3.64	3.69	12.00	3.69	E18	12hr	3.69	0.00
E2	2.13	2.35	12.00	2.35	E2	12hr	2.34	0.00
E3	4.92	5.29	12.00	5.29	E3	12hr	4.50	0.79
E5	13.74	15.49	12.00	15.49	E5	12hr	13.08	2.41
E6a	2.43	2.62	12.00	2.62	E6a	12hr	2.18	0.44
E6b	2.23	2.49	12.00	2.49	E6b	12hr	2.24	0.25
E7a	1.15	1.28	12.00	1.28	E7a	12hr	1.24	0.04
E7b	3.86	4.37	12.00	4.37	E7b	12hr	4.10	0.27
E8a	1.34	1.46	12.00	1.46	E8a	12hr	1.24	0.22
E8b	2.22	2.43	12.00	2.43	E8b	12hr	2.01	0.43

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	**Developed 2yr 9hr**	**Developed 2yr 12hr**	**Developed Critical Duration (hrs)**	**Developed Critical Peak Flow (m3/s)**	**Existing Node ID**	**Existing Critical Duration (hrs)**	**Existing Critical Peak Flow (m3/s)**	**Difference (Developed Less Exist) (m3/s)**
E8c	0.98	1.24	12.00	1.24	E8c	12hr	1.15	0.09
E9	0.54	0.60	12.00	0.60	E9	12hr	0.60	0.00
MDRes	1.98	1.99	12.00	1.99				1.99
node1	0.52	0.53	12.00	0.53				0.53
node2	0.75	0.76	12.00	0.76				0.76
node3	0.05	0.05	12.00	0.05				0.05
node4	0.20	0.21	12.00	0.21				0.21
node5	6.24	6.46	12.00	6.46				6.46
node6	6.71	6.84	12.00	6.84				6.84
OnlineB1	9.39	9.34	9.00	9.39				9.39
OnlinB1Dum	8.49	8.81	12.00	8.81				8.81
Openspace	0.18	0.25	12.00	0.25				0.25
Out	63.08	65.10	12.00	65.10	Out	18hr	60.42	4.68
Rest_B18	0.84	0.86	12.00	0.86				0.86
Rest30.1	0.46	0.48	12.00	0.48				0.48
Roads	2.23	2.23	9.00	2.23				2.23
SE_out	3.19	3.88	12.00	3.88	SE_out	12hr	3.91	-0.02
SE1	0.66	0.68	12.00	0.68	SE1	30min	0.59	0.10
SE2	1.96	2.01	12.00	2.01	SE2	12hr	1.01	1.00
SE3	0.97	1.34	12.00	1.34	SE3	12hr	1.34	0.00
SE5	0.48	0.58	12.00	0.58	SE5	12hr	0.57	0.01
SE6a	1.21	1.68	12.00	1.68	SE6a	12hr	1.67	0.01
SE6b	3.19	3.88	12.00	3.88	SE6b	12hr	3.91	-0.02
SU2	0.87	0.78	9.00	0.87	SU2	12hr	0.51	0.36
SU3	1.05	1.06	12.00	1.06	SU3	12hr	0.34	0.72

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	**Developed 100yr 9hr**	**Developed 100yr 12hr**	**Developed Critical Duration (hrs)**	**Developed Critical Peak Flow (m3/s)**	**Existing Node ID**	**Existing Critical Duration (hrs)**	**Existing Critical Peak Flow (m3/s)**	**Difference (Developed Less Exist) (m3/s)**
E8c	5.16	5.62	12.00	5.62	E8c	12hr	5.37	0.25
E9	2.60	2.81	12.00	2.81	E9	12hr	2.81	0.00
MDRes	4.91	5.26	12.00	5.26				5.26
node1	0.81	0.83	12.00	0.83				0.83
node2	1.21	1.22	12.00	1.22				1.22
node3	0.08	0.08	12.00	0.08				0.08
node4	0.32	0.33	12.00	0.33				0.33
node5	29.25	27.50	9.00	29.25				29.25
node6	30.65	28.66	9.00	30.65				30.65
OnlineB1	37.92	35.19	9.00	37.92				37.92
OnlinB1Dum	37.23	32.96	9.00	37.23				37.23
Openspace	1.21	1.18	9.00	1.21				1.21
Out	232.46	244.44	12.00	244.44	Out	12hr	271.50	-27.06
Rest_B18	2.34	2.50	12.00	2.50				2.50
Rest30.1	1.56	1.69	12.00	1.69				1.69
Roads	4.88	5.10	12.00	5.10				5.10
SE_out	18.36	18.78	12.00	18.78	SE_out	9hr	18.46	0.32
SE1	1.92	2.06	12.00	2.06	SE1	12hr	1.75	0.31
SE2	5.64	6.06	12.00	6.06	SE2	12hr	4.78	1.28
SE3	6.32	6.22	9.00	6.32	SE3	9hr	6.32	0.00
SE5	2.63	2.86	12.00	2.86	SE5	12hr	2.77	0.09
SE6a	7.80	7.59	9.00	7.80	SE6a	9hr	7.92	-0.12
SE6b	18.36	18.78	12.00	18.78	SE6b	9hr	18.46	0.32
SU2	2.82	2.95	12.00	2.95	SU2	9hr	2.43	0.53
SU3	2.79	3.01	12.00	3.01	SU3	9hr	1.77	1.24

Table C.2 Properties of Regional Basins located with the Austral and Leppington North Precincts

Basin ID	Basin Node	Catchment Area (ha)	Basin Area (m2)	Basin / Catchment Area	100 yr ARI Ave Basin Depth (m)	Indicative Unit Vol (m3/ha)	2yr ARI Outlet Width (m)	100yr ARI Total Outlet Width (m)
1	OnlineB1	455.39	20,000	0.5%	2.94	129	2.4*	23.4*
4	7.09a	17.05	5,992	3.5%	1.39	489	0.46	1.24
5	Dummy59	48.91	16,347	3.3%	1.36	455	1.07	3.57
6	7.11a	14.81	5,103	3.4%	1.25	431	0.5	1.36
8	17.12	29.61	8,505	2.9%	1.51	434	0.61	1.42
9	17.14a	30.93	5,246	1.7%	1.62	275	0.74	1.18
10	17.15a	17.78	4,371	2.5%	1.52	374	0.46	0.98
11	1.17a	65.30	15,491	2.4%	1.62	384	1.14	2.79
12	15.02	43.64	4,690	1.1%	1.69	182	0.71	1.29
13	7.12	41.12	10,847	2.6%	1.61	425	0.64	1.55
14	10.02a	39.27	12,416	3.2%	1.26	398	1.06	3.59
15	1.12a	20.90	7,336	3.5%	1.28	449	0.61	1.99
16	1.12c	15.87	4,608	2.9%	1.45	421	0.45	1.23
17	29.02	77.34	21,966	2.8%	1.61	457	1.16	3.47
18	31.02	31.60	5,813	1.8%	1.48	340	0.71	1.95
19	32.02	73.39	13,927	1.9%	1.72	326	1.03	2.31
20	28.02	63.68	17,901	2.8%	1.59	447	1.04	3.06
21	25.06a	15.06	5,310	3.5%	1.40	495	0.41	1.04
22	25.02	61.89	11,294	1.8%	1.44	263	1.42	2.73
23	25.03a	39.93	5,120	1.3%	1.48	190	1.02	1.85
24								
25	E16a	54.45	13,576	2.5%	1.38	345	1.24	3.73
26								
27	E10	26.11	8,713	3.3%	1.34	445	0.7	1.94
28								
29	E5	110.82	16,614	1.5%	1.40	209	3.28	6.03
30								
31	1.10b	33.95	7,843	2.3%	1.35	312	0.69	3.64
32	SE2	39.51	13,196	3.3%	1.18	393	1.19	4.03
33								
34	1.09a	21.29	2,660	1.2%	1.19	494	0.65	2.89
35	1.06a	36.76	6,992	1.9%	1.60	305	0.83	1.45

* Basin 1 is an Online Basin and therefore doesn't have a weir

Table C.3 Estimated Performance of Regional Basins located within the Precincts in a 2 yr ARI Event under Developed Condition

										Original				
Basin ID	Basin Name	Peak Flow Existing (m^3/s) (a)	Existing Critical Duration (hr)	Peak Flow Developed without Basin (m^3/s)	Critical Duration Developed without Basin (hr)	Peak Flow Developed with Basin (m^3/s) (b)	Critical Duration Developed with Basin (hr)	Peak Average Basin Depth (m)	Difference in Peak Flows (m^3/s) (b) - (a)	Peak Flow Dev A with Basin (m^3/s) (b)	Critical Duration Dev A with Basin (hr)	Peak Average Basin Depth (m)	Difference Peak Flow (Revised - Original) (m^3/s)	Difference Average Depth (Revised - Original) (m)
1	OnlineB1	8.00	12	21.42	6	7.09	12	2.45	-0.91	7.85	12	no online basin	-0.76	*
4	7.09a	0.35	12	2.89	0.5	0.34	9	0.70	-0.01	0.36	9 and 12	0.71	-0.02	-0.02
5	Dummy59	1.05	12	7.47	0.5	0.66	12	0.52	-0.39	1.08	9	0.71	-0.42	-0.18
6	7.11a	0.34	12	2.49	0.5	0.35	9	0.64	0.01	0.35	9	0.65	0.00	0.00
8	17.12	0.51	12	4.83	0.5	0.54	12	0.73	0.03	0.54	12	0.73	0.00	0.00
9	17.14a	0.59	12	3.16	0.5	0.60	12	0.66	0.01	0.60	12	0.66	0.00	0.00
10	17.15a	0.35	12	2.34	0.5	0.36	12	0.72	0.01	0.36	12	0.72	0.00	0.00
11	1.17a	1.29	12	7.17	0.5	1.32	9	0.77	0.03	1.32	9	0.77	0.00	0.00
12	15.02	0.60	12	2.35	1	0.61	12	0.70	0.01	0.61	12	0.70	0.00	0.00
13	7.12	0.59	18	4.83	0.5	0.40	9	0.59	-0.19	0.65	12	0.78	-0.25	-0.20
14	10.02a	0.97	12	5.57	0.5	1.01	9	0.67	0.04	1.01	9	0.67	0.00	0.00
15	1.12a	0.49	12	3.60	0.5	0.37	9	0.58	-0.12	0.51	9	0.69	-0.14	-0.11
16	1.12c	0.37	12	2.62	0.5	0.38	9	0.76	0.01	0.38	9	0.76	0.00	0.00
17	29.02	1.41	12	8.54	0.5	1.49	12	0.82	0.08	1.49	12	0.82	0.00	0.00
18	31.02	0.67	12	3.47	1	1.23	9	0.97	0.56	0.69	9	0.75	0.54	0.22
19	32.02	1.14	12	6.04	1	1.20	12	0.79	0.06	1.20	12	0.79	0.00	0.00
20	28.02	1.22	12	7.11	0.5	1.27	12	0.81	0.05	1.27	12	0.81	0.00	0.00
21	25.06a	0.30	12	2.52	0.5	0.31	12	0.72	0.01	0.31	12	0.72	0.00	0.00
22	25.02	1.25	12	5.69	0.5	1.27	9	0.63	0.02	1.27	9	0.63	0.00	0.00
23	25.03a	0.85	12	3.50	0.5	0.82	9	0.62	-0.03	0.85	2	0.63	-0.03	-0.01
25	E16a	1.28	12	5.47	1	1.32	9	0.71	0.04	1.32	9	0.71	0.00	0.00
27	E10	0.58	12	4.26	0.5	0.60	9	0.69	0.02	0.60	9	0.69	0.00	0.00
29	E5	2.89	12	10.85	0.5	2.75	12	0.58	-0.14	2.90	2	0.60	-0.15	-0.02
31	1.10b	0.74	12	1.68	0.5	0.78	9	0.82	0.04	0.78	9	0.82	0.00	0.00
32	SE2	1.01	12	6.64	0.5	1.05	9	0.63	0.04	1.05	9	0.63	0.00	0.00
34	1.09a	0.55	12	3.81	0.5	0.61	9	0.72	0.06	0.58	9	0.70	0.03	0.01
35	1.06a	0.72	12	4.08	0.5	0.73	12	0.68	0.01	0.73	9	0.68	0.01	0.00

Table C.4 Estimated Performance of Regional Basins located within the Precincts in a 100 yr ARI Event under Developed Condition

										Original				
Basin ID	Basin Name	Peak Flow Existing (m^3/s) (a)	Existing Critical Duration (hr)	Peak Flow Developed without Basin (m^3/s)	Critical Duration Developed without Basin (hr)	Peak Flow Developed with Basin (m^3/s) (b)	Critical Duration Developed with Basin (hr)	Peak Average Basin Depth (m)	Difference in Peak Flows (m^3/s) (b) - (a)	Peak Flow Dev A with Basin (m^3/s) (b)	Critical Duration Dev A with Basin (hr)	Peak Average Basin Depth (m)	Difference Peak Flow (Revised - Original) (m^3/s)	Difference Average Depth (Revised - Original) (m)
1	OnlineB1	38.63	9	37.45	9	29.61	9	2.95	-9.02	37.67	9	no online basin	-8.06	*
4	7.09a	1.72	9	5.98	0.5	1.44	12	1.28	-0.28	1.72	12	1.39	-0.28	-0.11
5	Dummy59	5.08	9	15.68	0.5	3.02	9	1.08	-2.06	5.05	12	1.36	-2.03	-0.28
6	7.11a	1.65	12	5.16	2	1.65	12	1.25	0.00	1.65	12	1.25	0.00	0.00
8	17.12	2.52	9	10.32	0.5	2.60	9	1.50	0.08	2.60	9	1.51	0.00	-0.01
9	17.14a	2.87	9	6.65	0.5	2.92	9	1.62	0.05	2.92	9	1.62	0.00	0.00
10	17.15a	1.72	9	4.92	0.5	1.73	12	1.52	0.01	1.73	12 and 9	1.52	0.00	0.00
11	1.17a	6.22	9	15.51	2	6.29	9	1.62	0.07	6.29	9	1.62	0.00	0.00
12	15.02	3.20	9	5.19	1	3.27	9	1.69	0.07	3.27	9	1.69	0.00	0.00
13	7.12	3.03	9	10.32	0.5	1.57	9	1.17	-1.46	3.17	9	1.61	-1.60	-0.44
14	10.02a	4.59	12	11.91	0.5	4.56	12	1.26	-0.03	4.56	12	1.26	0.00	0.00
15	1.12a	2.41	12	7.49	0.5	1.57	12	1.07	-0.84	2.39	12	1.28	-0.82	-0.21
16	1.12c	1.80	12	5.42	0.5	1.79	12	1.45	-0.01	1.79	12	1.45	0.00	0.00
17	29.02	6.90	9	18.35	0.5	7.04	9	1.61	0.14	7.04	9	1.61	0.00	0.00
18	31.02	3.30	9	7.61	1	3.28	12	1.48	-0.02	3.30	12	1.48	-0.02	0.00
19	32.02	5.71	9	13.43	1	5.94	9	1.72	0.23	5.94	9	1.72	0.00	0.00
20	28.02	5.92	9	15.56	1	5.99	9	1.59	0.07	5.99	9	1.59	0.00	0.00
21	25.06a	1.45	9	5.24	0.5	1.45	9	1.40	0.00	1.45	9	1.40	0.00	0.00
22	25.02	6.04	9	12.50	0.5	6.09	12	1.44	0.05	6.09	12	1.44	0.00	0.00
23	25.03a	4.11	9	7.37	2	4.13	12	1.48	0.02	4.13	12	1.48	0.00	0.00
25	E16a	6.00	12	11.95	1	5.99	12	1.38	-0.01	5.99	12	1.38	0.00	0.00
27	E10	2.79	12	8.86	0.5	2.78	12	1.34	-0.01	2.78	12	1.34	0.00	0.00
29	E5	13.08	12	22.79	0.5	13.06	12	1.40	-0.02	13.07	12	1.40	0.00	0.00
31	1.10b	3.53	9	4.27	12	3.56	9	1.35	0.03	3.56	9	1.35	0.00	0.00
32	SE2	4.78	12	13.85	2	4.75	12	1.18	-0.03	4.75	12	1.18	0.00	0.00
34	1.09a	2.64	12	8.51	2	2.08	12	1.08	-0.56	2.61	12	1.19	-0.53	-0.11
35	1.06a	3.46	9	8.56	0.5	3.51	12	1.60	0.05	3.51	9	1.60	0.00	0.00

Appendix B

Hydraulics

Table D1 Road Crossing Flood Depth, Velocity, Velocity x Depth, and Evacuation Safety Assessment

Watercourse	Road	Model ID	2 year 9 hour			20 year 9 hour			100 year 9 hour			PMF 2 hour			500 year 9 hour			Suitable for crossing during 500yr 9hr storm*
			Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	
Bond Creek	Bringelly Rd	B_BrinRd	0.15	0.42	0.06	0.29	0.69	0.20	0.37	0.92	0.34	1.3	1.82	2.37	0.43	1.02	0.44	Vehicles
Bond Creek	Cowpasture Rd	B_Cowp	0	0	0.00	0.05	0.52	0.03	0.17	0.63	0.11	1.01	2.46	2.48	0.24	1.02	0.25	Pedestrians
Bond Creek	Edmonson Ave	B_Edmon	0	0	0.00	0.16	1.89	0.30	0.25	2.19	0.55	1.17	2.86	3.35	0.31	2.37	0.72	Not Stable
Bond Creek	Eighth Ave	B_Eighth	0.31	1.24	0.38	0.45	1.17	0.53	0.6	1.36	0.82	1.95	2.28	4.45	0.71	1.45	1.02	Not Stable
Bond Creek	Fourth Ave	B_Fourth	0.1	1.36	0.14	0.17	2.06	0.35	0.26	2.28	0.59	1.2	2.91	3.49	0.33	2.44	0.78	Not Stable
Bond Creek	Hume Highway	B_HumH	0.07	0.95	0.07	0.51	1.34	0.68	0.65	1.44	0.94	1.88	2.08	3.91	0.75	1.5	1.13	Not Stable
Bond Creek	Ninth Ave	B_Ninth	0.12	2.15	0.26	0.39	2.29	0.89	0.57	1.95	1.11	1.82	2.63	4.79	0.68	1.99	1.35	Not Stable
Bond Creek	Tenth Ave	B_Tenth	0.03	0.18	0.01	0.38	3.17	1.20	0.5	2.05	1.03	1.83	2.35	4.30	0.57	2.04	1.17	Not Stable
Bond Creek	Denham Court Rd	DCR	0.13	0.23	0.03	0.29	0.55	0.16	0.35	0.66	0.23	0.96	1.51	1.45	0.39	0.73	0.29	Pedestrians
Branch	Devonshire Rd	K_Devon	0.04	0.27	0.01	0.12	0.7	0.08	0.17	0.8	0.14	1.07	1.8	1.93	0.19	1.54	0.3	Pedestrians
Branch	Kind Street	K_King	0.06	0.71	0.04	0.17	1.37	0.23	0.19	1.47	0.28	0.51	1.44	0.73	0.21	1.55	0.33	Pedestrians
Branch	Wynyard Ave	K_Wyn	0	0	0.00	0.13	1.01	0.13	0.17	1.27	0.22	0.64	1.94	1.24	0.2	1.4	0.27	Pedestrians
Branch	Fourteenth Ave	KC13	1.52	0.57	0.87	1.75	0.94	1.65	1.81	1.02	1.85	2.54	1.51	3.84	1.87	1.1	2.06	Not Stable
Branch	Edmonson Ave /	K_ED13th	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0	Pedestrians
Kemps Creek	Fifteenth Ave	K_15th	0.15	0.17	0.03	0.57	0.77	0.44	0.73	0.94	0.69	2.32	1.67	3.87	0.83	1.04	0.87	Not Stable
Kemps Creek	Bringelly Rd	K_BringE	0	0	0.00	0.03	0.56	0.02	0.06	0.86	0.05	0.64	1.54	0.99	0.08	0.94	0.07	Pedestrians
Kemps Creek	Gumer Ave	K_Guner	0.27	0.86	0.23	0.62	1	0.62	0.78	1.11	0.87	2.37	1.78	4.22	0.9	1.18	1.06	Not Stable
Kemps Creek	Twelth Ave	K_TwevthE	0.27	0.73	0.20	0.49	1.32	0.65	0.56	1.49	0.83	1.56	2.1	3.28	0.61	1.59	0.97	Not Stable
Kemps Creek	Herley Ave	KC02	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0	Pedestrians
Trib 1	Bringelly Rd	1_BringRd	0	0	0.00	0.17	0.12	0.02	0.31	0.3	0.09	1.25	1.36	1.70	0.4	0.4	0.16	Pedestrians
Trib 2	Tenth Ave	K_10thE	0.02	0.59	0.01	0.04	0.99	0.04	0.04	1.06	0.04	0.14	1.83	0.26	0.05	1.03	0.05	Pedestrians
Trib 2	Eleventh Ave	K_11thE	0.35	0.66	0.23	0.44	1.06	0.47	0.46	1.2	0.55	0.89	1.69	1.50	0.47	1.27	0.6	Not Stable
Trib 2	Thirteenth Ave	K_13thE	0.05	1.73	0.09	0.13	2.17	0.28	0.17	2.23	0.38	0.72	1.83	1.32	0.21	2.36	0.49	Vehicles
Trib 2	Edmonson Ave	K_EdmonE	0	0.18	0.00	0.04	1.17	0.05	0.05	1.33	0.07	0.31	2.63	0.82	0.06	1.42	0.08	Pedestrians
Trib 3	Fifteenth Ave	K_15thEN	0.19	0.54	0.10	0.29	0.72	0.21	0.31	0.78	0.24	0.64	1.36	0.87	0.33	0.82	0.27	Pedestrians
Trib 3	Sixteenth Ave	K_16thEN	0	0	0.00	0.05	0.95	0.05	0.07	1.07	0.07	0.35	2.87	1.00	0.08	1.22	0.09	Pedestrians
Trib 3	Seventeenth Ave	K_17thEN	0.04	0.83	0.03	0.29	0.82	0.24	0.35	0.81	0.28	0.95	1.37	1.30	0.39	0.84	0.33	Pedestrians
Trib 3	Eighteenth Ave	K_18thEN	0.2	1.08	0.22	0.41	1.63	0.67	0.46	1.71	0.79	1.1	2.31	2.54	0.5	1.79	0.88	Not Stable
Trib 3	Fourtheenth Ave	KC14	0.03	0.28	0.01	0.05	0.66	0.03	0.05	0.71	0.04	0.19	1.35	0.26	0.06	0.75	0.04	Pedestrians

***Pedestrian and Vehicular Stability**

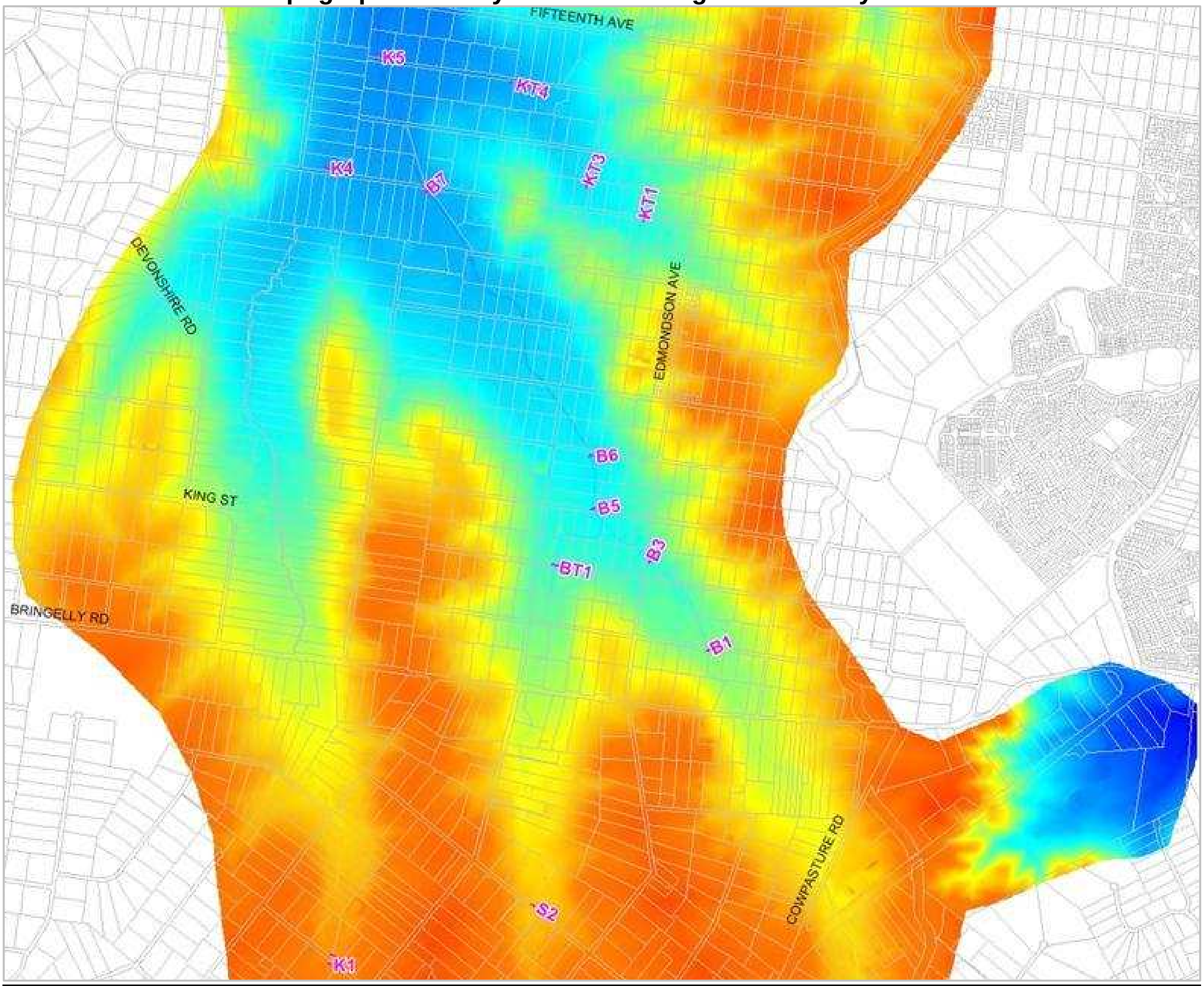
Evacuation Type	Safe VxD Range (m2/s)
Pedestrians	< 0.4
Vehicles	0.4< VxD < 0.6
Not Stable	> 0.6

Table D.2 Road Crossing Peak Water Level Height (all in m AHD)

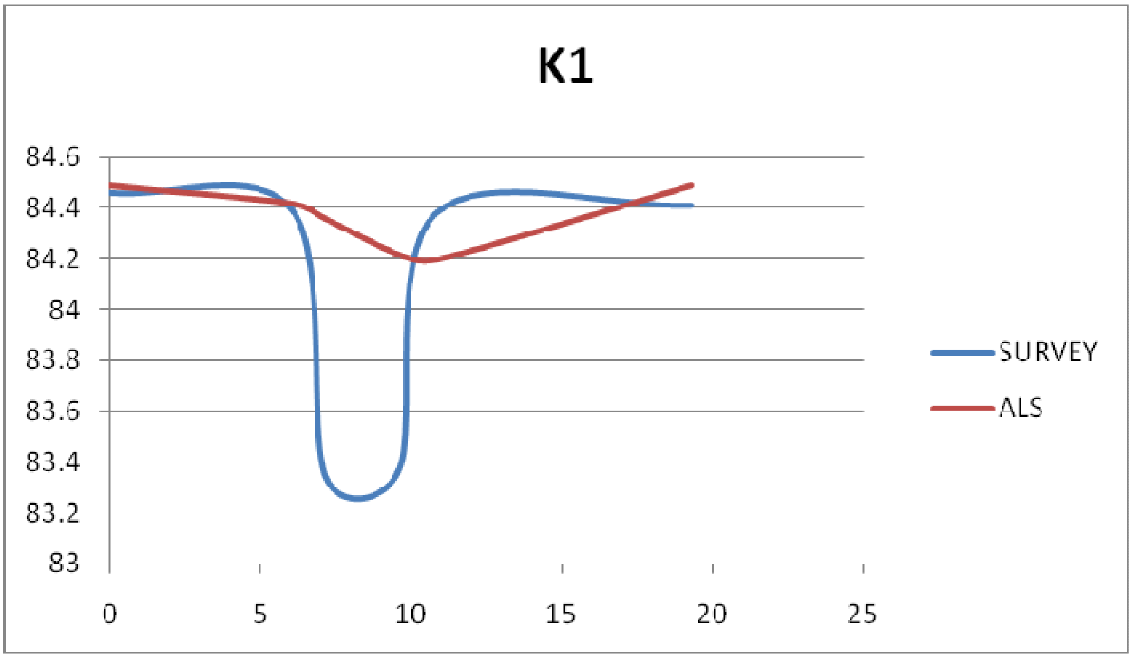
Watercourse	Road	Model ID	2 year 9 hour			20 year 9 hour			100 year 9 hour			500 year 9 hour			PMF 2 hour		
			Developed	Existing	Difference (m)	Developed	Existing	Difference (m)	Developed	Existing	Difference (m)	Developed	Existing	Difference (m)	Developed	Existing	Difference (m)
			(a)	(b)	(a) - (b)	(c)	(d)	(c)- (d)	(e)	(f)	(e) - (f)	(g)	(h)	(g) - (h)	(i)	(j)	(i) - (j)
Bond Creek	Bringelly Rd	B_BrinRd	73.65	0	*	73.79	73.77	0.02	73.87	73.88	-0.01	73.93	73.94	-0.01	74.79	74.8	-0.01
Bond Creek	Cowpasture Rd	B_Cowp	0	0	0	78.52	78.47	0.05	78.64	78.65	-0.01	78.72	78.72	0	79.48	79.48	0
Bond Creek	Edmonson Ave	B_Edmon	0	0	0	68.49	68.47	0.02	68.58	68.59	-0.01	68.64	68.65	-0.01	69.4	69.5	-0.1
Bond Creek	Eighth Ave	B_Eighth	65.81	0	*	65.96	65.93	0.03	66.11	66.1	0.01	66.21	66.19	0.02	67.33	67.46	-0.13
Bond Creek	Fourth Ave	B_Fourth	64.79	64.68	0.11	64.97	64.96	0.01	65.06	65.07	-0.01	65.13	65.12	0.01	65.89	66	-0.11
Bond Creek	Hume Highway	B_HumH	78.56	0	*	79.01	78.96	0.05	79.15	79.16	-0.01	79.25	79.26	-0.01	80.37	80.38	-0.01
Bond Creek	Ninth Ave	B_Ninth	63.58	63.43	0.15	63.99	63.97	0.02	64.17	64.19	-0.02	64.28	64.29	-0.01	65.32	65.42	-0.1
Bond Creek	Tenth Ave	B_Tenth	62.31	62.03	0.28	62.78	62.77	0.01	62.9	62.91	-0.01	62.97	62.98	-0.01	64.12	64.23	-0.11
Bond Creek	Denham Court Rd	DCR	86.13	86.1	0.03	86.29	86.27	0.02	86.35	86.35	0	86.39	86.39	0	86.96	86.96	0
Branch	Devonshire Rd	K_Devon	66.3	66.17	0.13	66.61	66.57	0.04	66.74	66.74	0	66.8	66.8	0	67.69	67.69	0
Branch	Edmonson Ave /	K_ED13th															
Branch	Kind Street	K_King	64.35	64.3	0.05	64.51	64.49	0.02	64.54	64.54	0	64.56	64.56	0	64.86	64.86	0
Branch	Wynyard Ave	K_Wyn	0	0	0	71.51	71.5	0.01	71.54	71.54	0	71.57	71.57	0	72.01	72.01	0
Branch	Fourteenth Ave	KC13	58.75	58.55	0.2	58.98	58.9	0.08	59.04	58.99	0.05	59.1	59.04	0.06	59.7	59.77	-0.07
Kemps Creek	Fifteenth Ave	K_15th	56.65	0	*	57.07	57.05	0.02	57.23	57.23	0	57.33	57.33	0	58.77	58.82	-0.05
Kemps Creek	Bringelly Rd	K_BringE	0	0	0	74.24	74.23	0.01	74.29	74.3	-0.01	74.33	74.33	0	74.89	74.89	0
Kemps Creek	Gumer Ave	K_Guner	54.77	54.65	0.12	55.12	55.1	0.02	55.28	55.31	-0.03	55.4	55.42	-0.02	56.82	56.87	-0.05
Kemps Creek	Twelth Ave	K_TwevthE	60.07	59.96	0.11	60.29	60.27	0.02	60.36	60.36	0	60.4	60.41	-0.01	61.37	61.36	0.01
Kemps Creek	Herley Ave	KC02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trib 1	Bringelly Rd	1_BringRd	0	0	0	73.1	73.05	0.05	73.39	73.22	0.17	73.34	73.28	0.06	74.1	74.19	-0.09
Trib 2	Tenth Ave	K_10thE	77.2	77.19	0.01	77.24	77.23	0.01	77.25	77.25	0	77.26	77.26	0	77.44	77.44	0
Trib 2	Eleventh Ave	K_11thE	72.44	72.39	0.05	72.56	72.54	0.02	72.58	72.57	0.01	72.59	72.59	0	72.95	73.02	-0.07
Trib 2	Thirteenth Ave	K_13thE	62.71	62.51	0.2	62.93	62.88	0.05	62.97	62.95	0.02	63.01	63	0.01	63.52	63.52	0
Trib 2	Edmonson Ave	K_EdmonE	70.16	0	*	70.29	70.26	0.03	70.32	70.31	0.01	70.34	70.33	0.01	70.68	70.68	0
Trib 3	Fifteenth Ave	K_15thEN	76.38	76.33	0.05	76.47	76.47	0	76.5	76.49	0.01	76.52	76.51	0.01	76.83	76.83	0
Trib 3	Sixteenth Ave	K_16thEN	0	0	0	71.36	71.34	0.02	71.39	71.38	0.01	71.43	71.41	0.02	71.85	71.85	0
Trib 3	Seventeenth Ave	K_17thEN	68.01	67.87	0.14	68.29	68.26	0.03	68.34	68.33	0.01	68.39	68.38	0.01	68.94	68.94	0
Trib 3	Eighteenth Ave	K_18thEN	65.58	65.48	0.1	65.81	65.78	0.03	65.86	65.84	0.02	65.9	65.89	0.01	66.5	66.5	0
Trib 3	Fourtheenth Ave	KC14	81.06	81.05	0.01	81.1	81.1	0	81.11	81.11	0	81.12	81.12	0	81.26	81.26	0

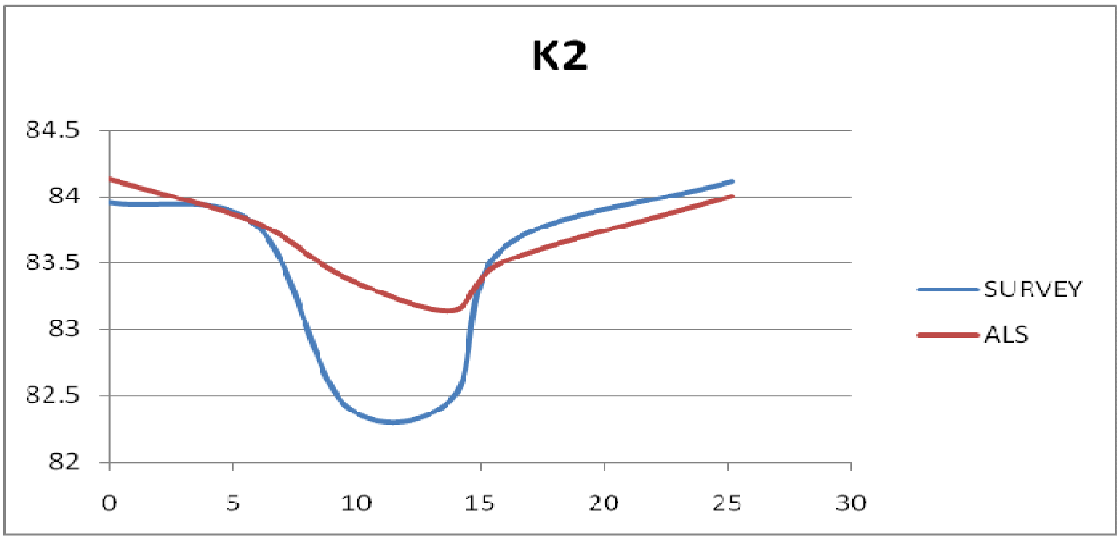
* Locations where there are flood extents for Developed scenario but not under Existing Conditions

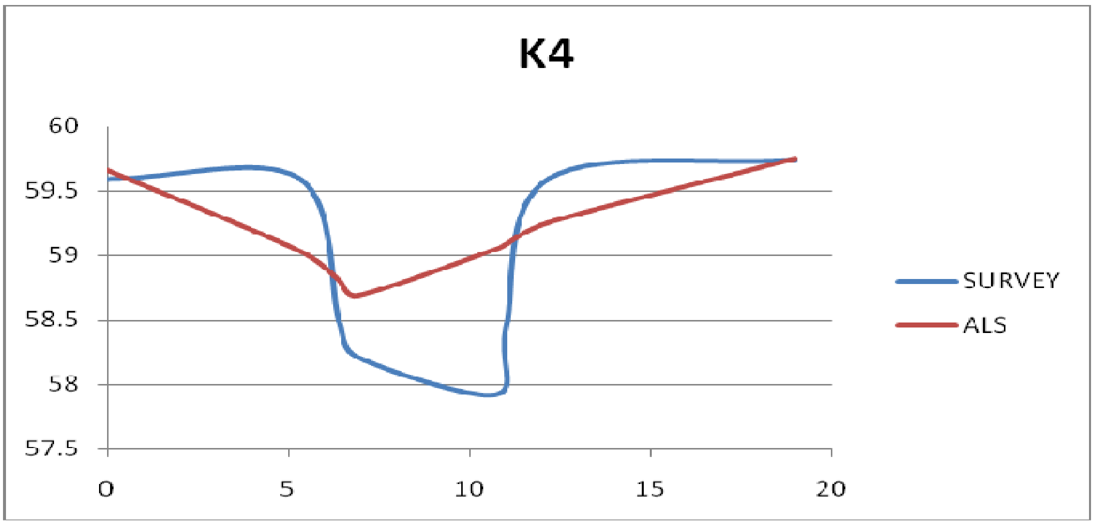
Additional Topographic Survey - Locations of ground survey cross sections

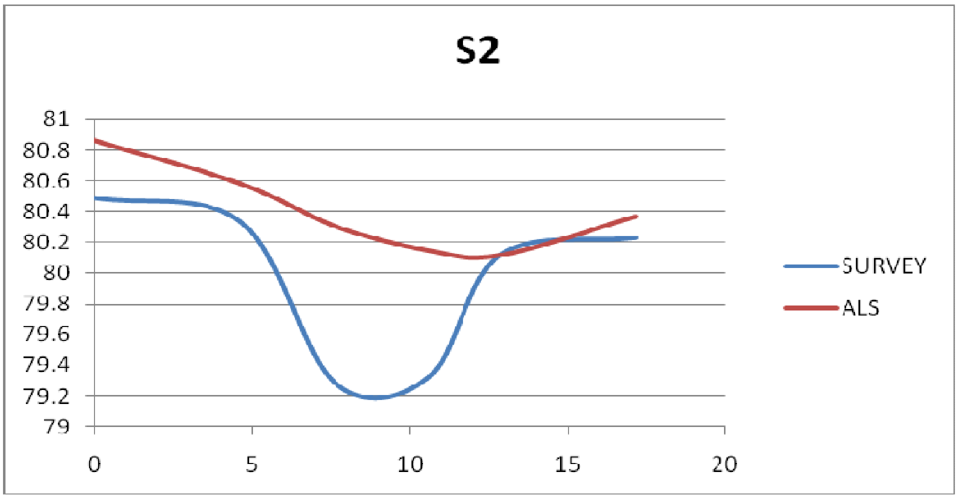


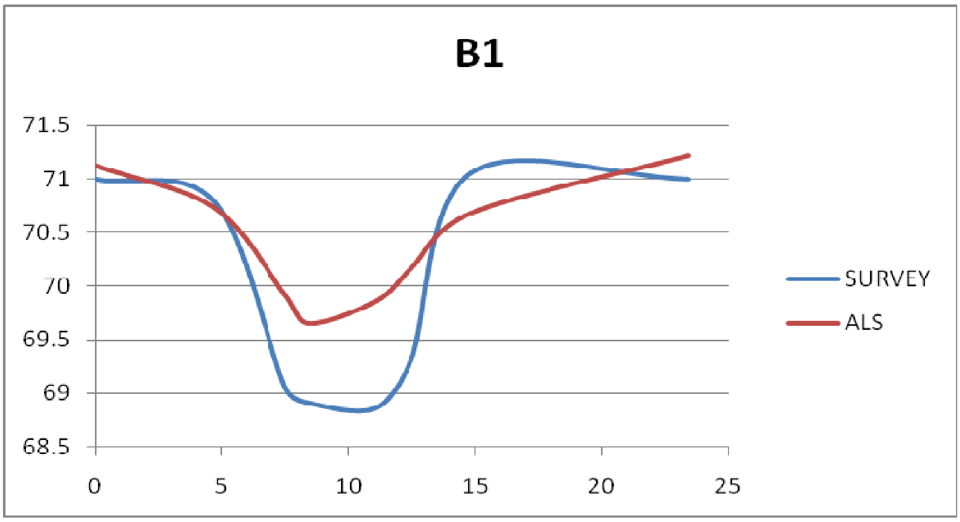
Individual cross sectional results and comparison with ALS data are shown in the following Figures.

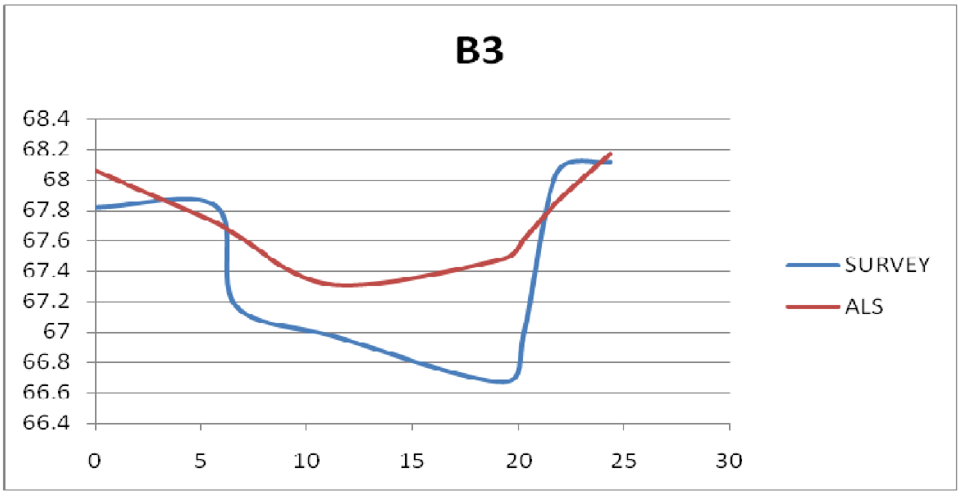

K1
84.6
84.4
84.2
84
83.8
83.6
83.4
83.2
83
0
5
10
15
20
25
SURVEY
ALS

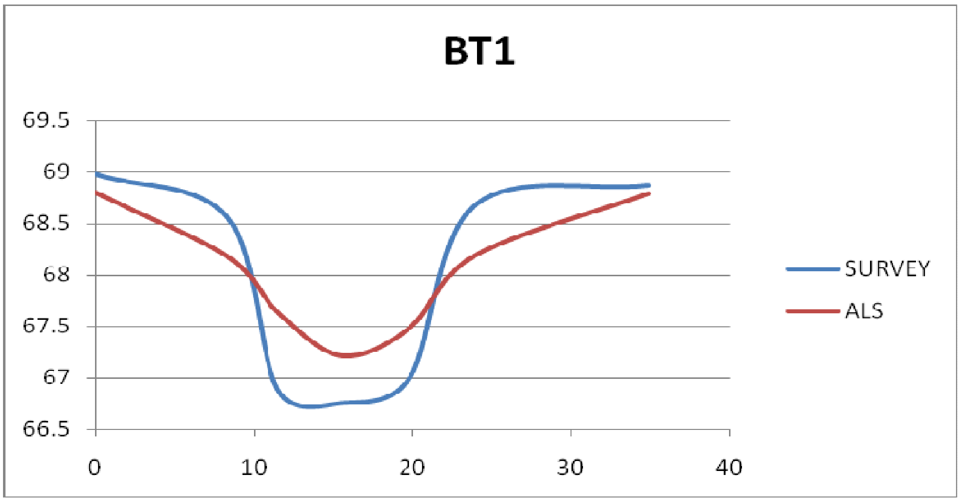

K2
84.5
84
83.5
83
82.5
82
0
5
10
15
20
25
30
SURVEY
ALS

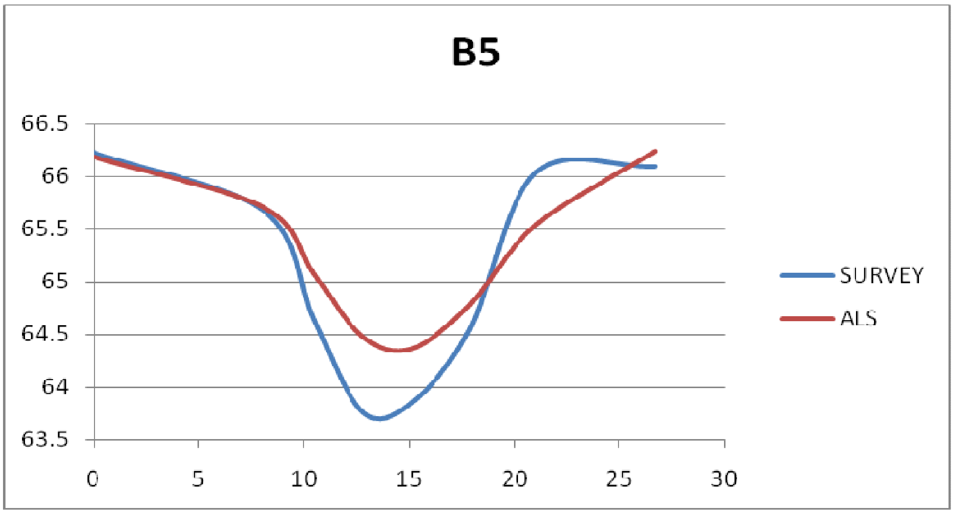

K4
60
59.5
59
58.5
58
57.5
0
5
10
15
20
SURVEY
ALS

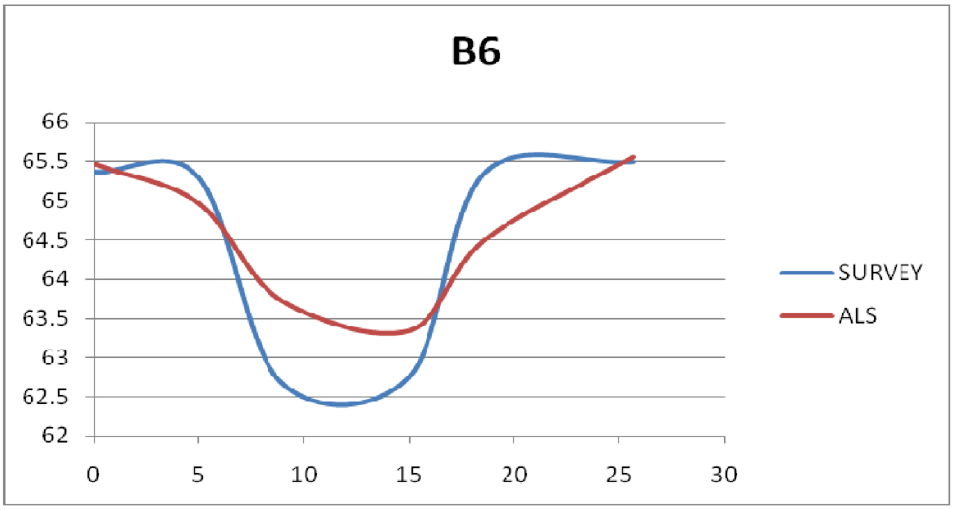

S2
81
80.8
80.6
80.4
80.2
80
79.8
79.6
79.4
79.2
79
0
5
10
15
20
SURVEY
ALS

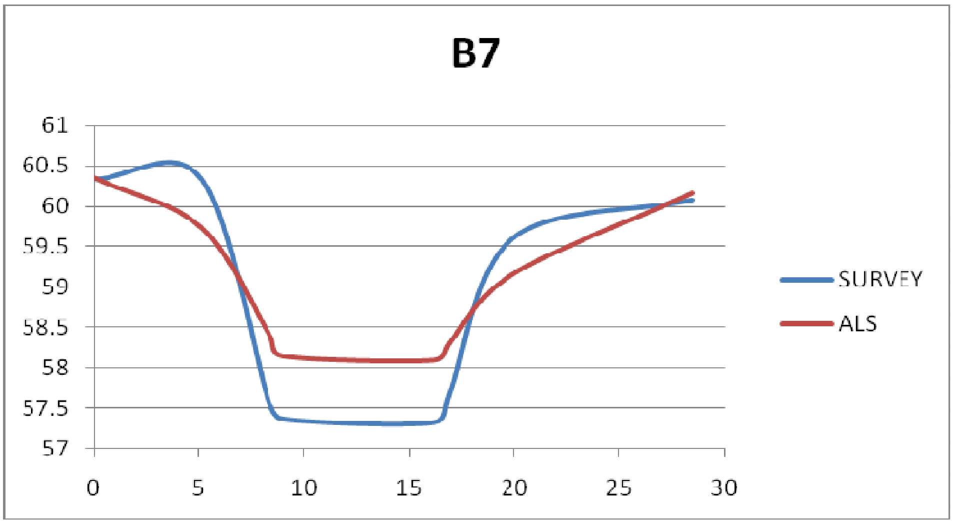

B1
71.5
71
70.5
70
69.5
69
68.5
0
5
10
15
20
25
SURVEY
ALS

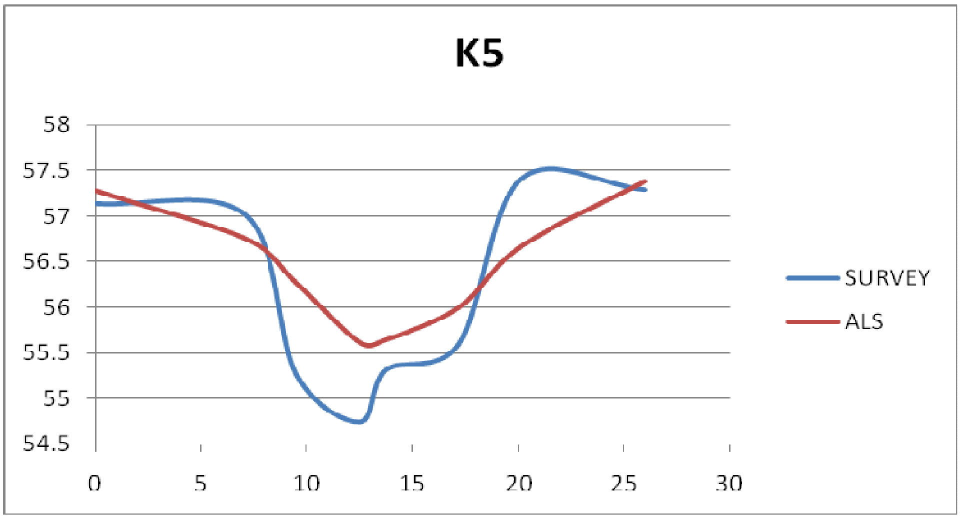

B3
68.4
68.2
68
67.8
67.6
67.4
67.2
67
66.8
66.6
66.4
0
5
10
15
20
25
30
SURVEY
ALS

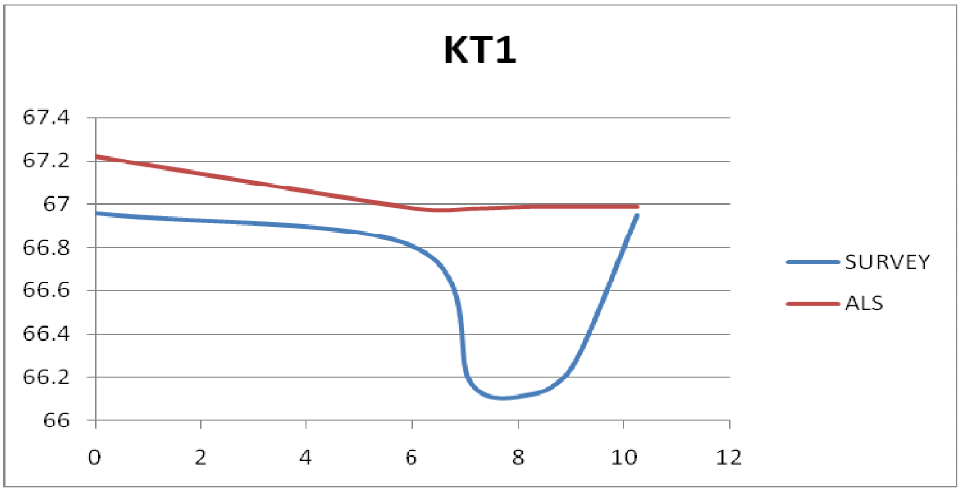

BT1
69.5
69
68.5
68
67.5
67
66.5
0
10
20
30
40
SURVEY
ALS

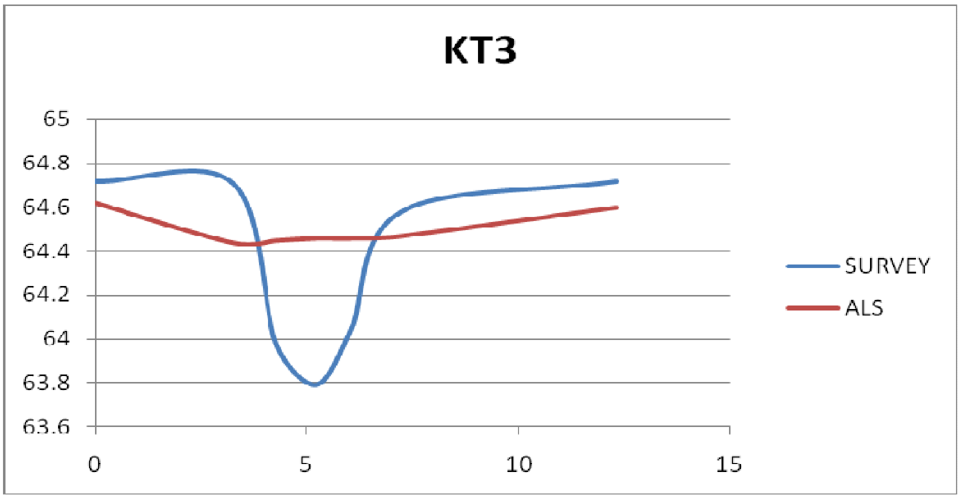

B5
66.5
66
65.5
65
64.5
64
63.5
0
5
10
15
20
25
30
SURVEY
ALS

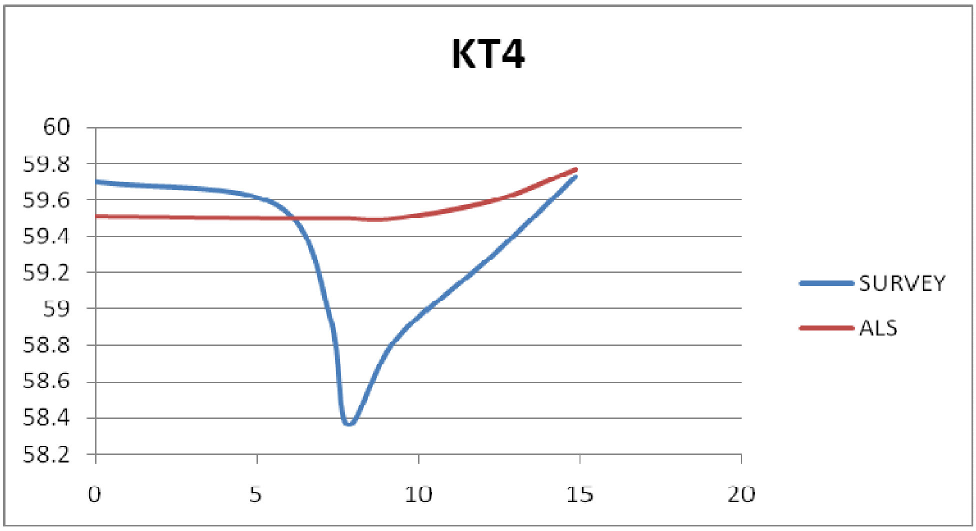

B6
66
65.5
65
64.5
64
63.5
63
62.5
62
0
5
10
15
20
25
30
SURVEY
ALS


B7
61
60.5
60
59.5
59
58.5
58
57.5
57
0
5
10
15
20
25
30
SURVEY
ALS


K5
58
57.5
57
56.5
56
55.5
55
54.5
0
5
10
15
20
25
30
SURVEY
ALS


KT1
67.4
67.2
67
66.8
66.6
66.4
66.2
66
0
2
4
6
8
10
12
SURVEY
ALS


KT3
65
64.8
64.6
64.4
64.2
64
63.8
63.6
0
5
10
15
SURVEY
ALS


KT4
60
59.8
59.6
59.4
59.2
59
58.8
58.6
58.4
58.2
0
5
10
15
20
SURVEY
ALS