Attachment 5 – Stormwater Management Strategy

Stormwater Management Strategy Murray's Rise Standen Drive, Lower Belford

March 2012

Belford Land Corporation

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A+ GRI Rating: Sustainability Report 2010

Revision	Details	Date	Amended By
A	Original	15/3/12	KC
B	Client Comments	21/3/12	SH

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Executive summary

The Murray's Rise development at Standen Drive, Lower Belford (3 km west of Branxton) in the central Hunter Valley proposes approximately 125 rural residential lots. The site is adjacent to Belford National Park and accordingly, part of the receiving environment is considered to be sensitive.

The development will be the subject of a development application to Singleton Council.

As part of the development, each future dwelling will have a 20,000 litre rainwater to:

- Support the principles of building sustainability, measured by the BASIX in accordance with State Government requirements.
- Satisfy Singleton Council requirements for stormwater management
- Provide 5,000 litre detention volume to manage peak runoff
- Reduce average annual volumetric runoff from the development site to predevelopment levels and accordingly, manage the associated potential water quality impacts of development.

In addition, each lot, as part of any future dwelling development, is to have a 5.0 m^2 infiltration trench to ensure the above objectives are fully satisfied.

Roads are should be built with swales in lieu of kerb and gutter to form the head of a road treatment train to manage water quality impacts.

Some of the existing farm dams need to be retained to provide a water quality and peak runoff detention function to ensure that stormwater from the development as a whole does not impact on the receiving environment.

Where there is an existing farm dam located downstream of the proposed road in each of the catchments, that farm dam should be retained and modified to provide 300mm depth of detention storage. Catchments that do not contain existing farm dams (4 and 5) should have a small bio retention basin to control water quality and quantity leaving the site. Subject to detailed design, outlets should be controlled by either a 100mm or 150mm diameter pipe in accordance with:

Catchment	Discharge Pipe Diameter (mm)
1	150
2	150
3	100
4	100
5	150
6	150

This stormwater management strategy shows that the proposed rural residential development, with the nominated stormwater management measures, meets the identified stormwater management objectives.

1. Introduction

1.1 Background

This stormwater management strategy is to quantify the stormwater impacts for the proposed development of approximately 125 rural residential allotments on a 140 ha parent site on the north western corner of the New England Highway and Standen Drive, Lower Belford.

The development proposal incorporates a number of stormwater management measures, including:

- Stormwater Tanks to be located on each dwelling site. The stormwater tanks will be in excess of Council's minimum requirements and will be configured to deliver significant stormwater management benefits while at the same time satisfying NSW State Government requirements for Building Sustainability under the BASIX guidelines. This report investigates the appropriate size of tank and the distribution of permanent vs. detention storage to meet all requirements.

- Stormwater Infiltration beds. In addition to waste water effluent disposal areas, small infiltration trenches are proposed to ensure that no stormwater quality impacts result from the proposed development. This report recommends the appropriate size and volume of infiltration systems.

- Road side swales. These are proposed in lieu of kerb and gutter to provide appropriate management of water quality from roads.

- Retention of some existing farm dams at strategic locations to provide final water polishing before leaving the site and to reduce the volumetric runoff generated by the post development site to ensure no impacts on downstream water quality or flooding.

- Additional dry basins for other catchments to provide the final water quality polishing and detention functions.

These measures together form the backbone of a minimal impact development that will harmoniously sit in its environment without causing any degradation of the external waterways, either in the adjacent National Park, or the surrounding rural properties.

The key to this approach will be to consider the whole of the water cycle as one, rather than separate components. For example, in this instance, the water falling on roofs will be collected to both reduce the demand on potable water and the potential impacts due to the additional generation of runoff.

Waste water is managed in a separate approach due to the specialised nature of the treatment required to sanitise waste water and make it suitable for irrigation. However, this strategy recommends that collected roof water be used for irrigation of domestic scale gardens in close proximity to the houses. It is noted that recycled sewer effluent may not be suitable for this purpose because of likely human contact.

1.2 Site description

The site comprises parent lots 11 on DP 844443, 91 and 92 on DP 1138554, parts of lots 12 and 13 DP 1100005 and part of lot 6 on DP 237936. It is located on the north western corner of the New England Highway and Standen Drive, Lower Belford. Refer Figure 1 for a locality plan of the site.

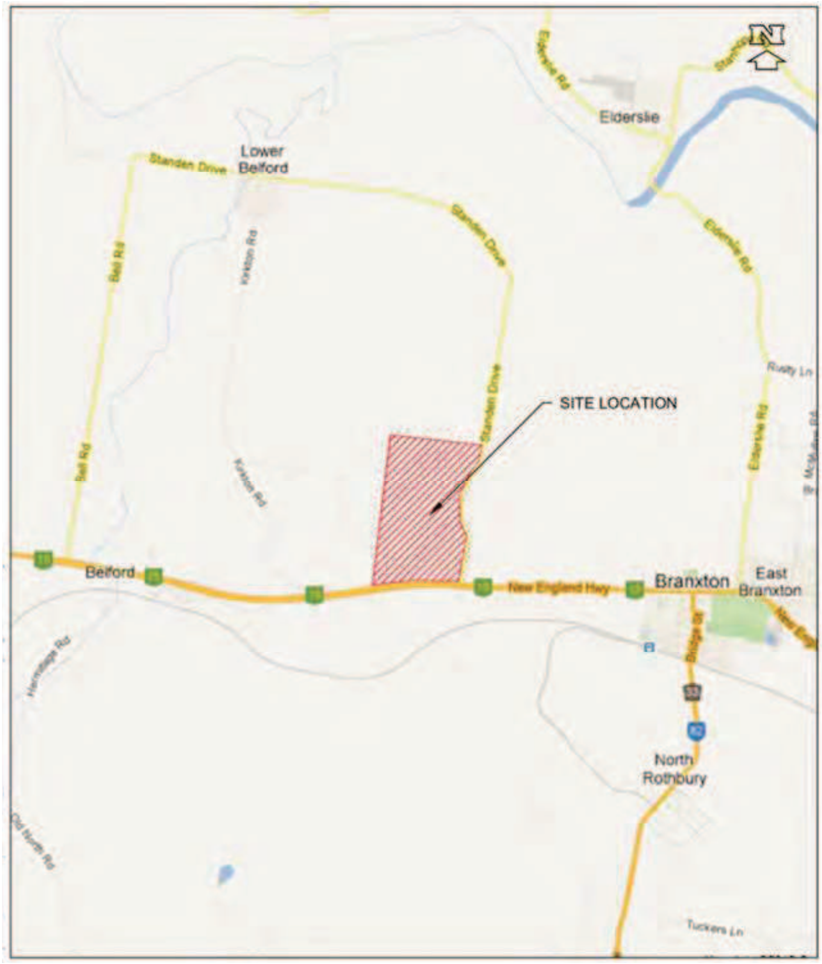


Figure 1- Locality Plan

The total parent site has an area of about 140 Ha and dimensions of about 1.2 by 0.8 kilometres. It is bounded by Standen Drive to the east, New England Highway to the South Belford National Park on part of its western boundary and private land elsewhere. The primary road connection will be off Standen Drive.

The land is in the Singleton Local Government Area approximately 3km west of the town of Branxton. It is proposed to zone the land for rural residential development, however the land is currently rural.

1.3 Catchments

The site is divided by a principal north – south running ridgeline located between 100 and 200 metres to the east of the western boundary, refer Figure 2. The western side of this ridge drains to two ephemeral creek lines. The northern one drains in a northerly direction away from the site and is the basis of catchment 8 indicated on Figure 2. The southern creek line is partly in the Belford National Park, but turns in an easterly direction at the New England Highway and discharges under Standen Drive through a major culvert. All sub catchments of the site that drain directly to this creek line are captured as catchment 7.

Figure 2 - Catchment Plan

The remaining six catchments are defined by drainage lines that cross the perimeter of the site. Four of these drainage lines are contained in culverts under Standen Drive.

1.4 Development Proposal

The proposed development is to establish 125 new rural residential allotments of between 8,000 and 20,000 square metres each. The lots will be serviced by a road network in accordance with Figure 3

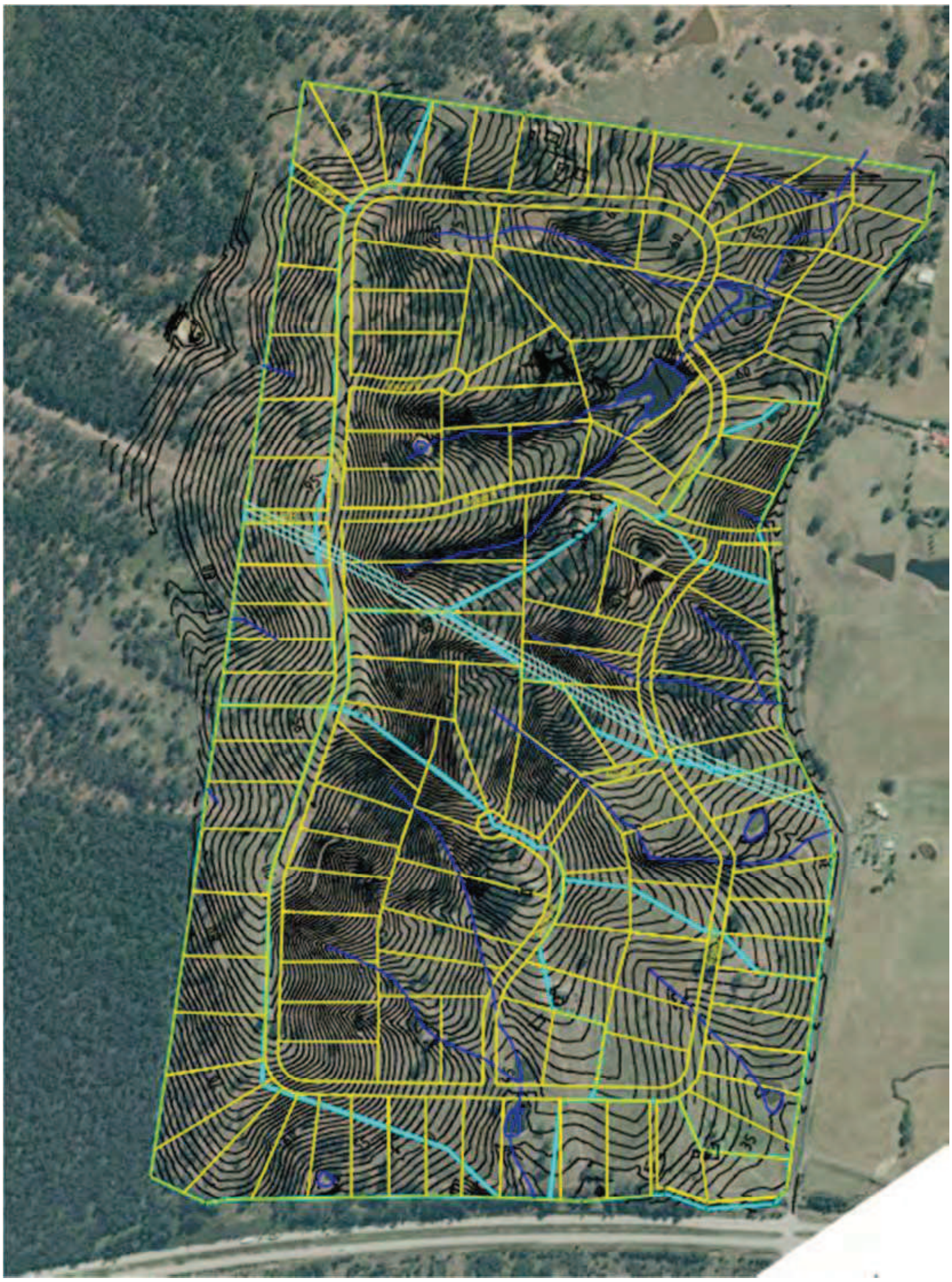


Figure 3 - Proposed Development

One of the key features of the proposed road network is the location of the western leg of the perimeter road to coincide with the main north – south running ridge line. This will ensure that no road water will be discharged into the Belford National Park to the west of the site.

In general, each lot will contain a roof water tank that will be appropriately configured so as reduce the average annual volumetric runoff from the lots impervious areas. This will be augmented by an infiltration system that will address overflows and runoff from on ground impervious areas.

Roads will be constructed with roadside swales in lieu of kerb and gutter in order to treat runoff from impervious surfaces and maximise opportunities for infiltration. Further, there are a number of existing farm dams located on the parent property that will be retained as part of the water treatment train to protect downstream aquatic environments from the impacts of road run off.

Where a catchment does not contain an existing farm dam downstream from a road, it is proposed to install a small dry detention basin with a sand filter bed that will provide the final water polishing for the catchment.

2. Methodology

2.1 Total water cycle management

The development is located in the Singleton Local Government Area and accordingly is subject to the provisions of the Singleton Development Control Plan 2011.

It is understood that Council's assessment has required the extension of the local water system from Branxton to the development site. It is therefore concluded that mains water will be available to the future house sites. Clause 12.2.32 (Page 241) of The Singleton DCP 2011 requires that future house sites will have a minimum 10,000 litre capacity tank. However, due to the more sensitive nature of the receiving environments (National Park), the subdivision will include covenants to require minimum 20,000 litre tanks for dwellings on new allotments.

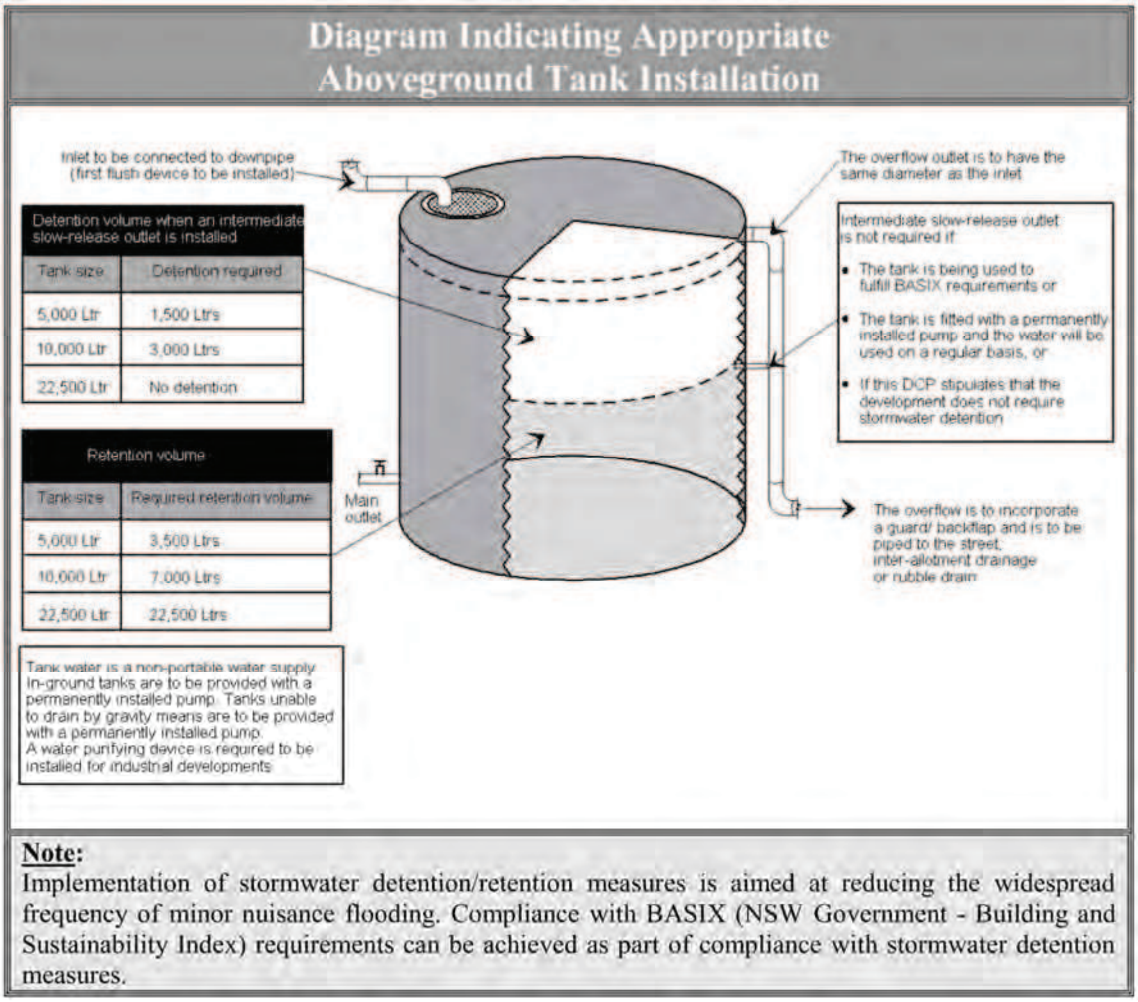


Figure 4 - Singleton roof water tank requirements (Singleton DCP 2011)

In order to quantify the success of the proposed larger tanks in managing stormwater outflows from the site, it is necessary to consider stormwater generation and water consumption together in an integrated way.

This is best done through the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), which has a continuous rainfall modelling engine. Inputs include:

- Continuous 6 minute rainfall increments from 10 April 1964 to 31 May 2011 (47 years) sourced from the bureau of Meteorology for Glendon Brook, near Singleton.
- Estimated domestic water demand for a typical allotment, calculated at Section 3.2.1

The water cycle calculations do not include disposal of effluent, which is the prerogative of a separate waste water management plan in accordance with Council's requirements.

To provide for appropriate stormwater detention so that peak flows are held at predevelopment levels, each tank has a nominated detention volume, which is controlled by a small (50mm diameter) outlet at a nominated detention outlet level. Any collected stormwater above the detention outlet is allowed to drain by gravity and this volume is always assured to be available to manage peak runoff.

2.2 Water Quality

2.2.1 Lots

Having regard for the sensitive nature of the receiving environment at sub catchment 7 (National Park) that is downstream of a number of the proposed lots, a MUSIC model has been established to represent a typical single allotment with no road catchment. The aim of this model is to demonstrate that there is no increase in average annual runoff from a single allotment.

This is achieved through a combination of a larger tank than required by Council's DCP and a supplementary infiltration trench to address any additional surplus. Captured water is drawn down through constant – non potable use in the associated dwellings. It is noted that this use will also be able to be used by future lot owners to demonstrate compliance with the State Government's BASIX regulations.

Because the average annual runoff will not be more than in the predevelopment case, it is also concluded that the discharge water quality will also be cleaner than in the predevelopment case because:

- The major impact of urbanisation is due to the increase in volumetric runoff from impervious areas, this subsequently changes the equilibrium of the downstream geomorphology. In the case of Murrays Rise, the predevelopment equilibrium will not be disturbed.
- The major source of downstream nitrification is from fertilisers used on urban gardens. However, these are much less prevalent in rural residential developments. Typically, the fertiliser runoff from an urban environment is less than for pasture land, which is the predevelopment land use in the case of Murrays Rise.
- The large lot areas and associated buffers from buildings typical of rural residential subdivision provide substantial and appropriate capacity for additional nutrients to be absorbed on lot and not cross boundaries.
- Litter generation in rural residential areas is typically less than for other urban environments because of their prestige nature.

Because the typical lot model shows that the runoff quality from lots meets Council's objectives, and all sub catchments comprise a combination of lot and road land uses, it follows that all sub catchments will demonstrate no significant impact on water quality if road runoff can also be appropriately managed.

2.2.2 Roads

The typical 20m wide road cross sections will consist of an 8m wide central pavement with 2m wide swales and 4m combination services corridor and road shoulder on each side. The swales will assist in the management of runoff from the impervious surfaces and form the head of the treatment train for runoff from the roads. Final dimensions of the road cross section will depend on conveyance of peak stormwater to be calculated at the time of the detailed engineering approval

Each sub catchment (refer Figure 3) numbered 1 to 6 contains either an existing farm dam, or a potential site for a small polishing wet or dry basin to provide final water quality management prior to runoff leaving the site.

A MUSIC Model has been built for the development to quantify the water quality impacts as a whole. For each sub catchment, this MUSIC model comprises:

- An aggregation of typical lots in each catchment, configured in accordance with the lot model to represent the housing lots.
- A separate catchment that represents the road area in the sub catchment.
- A swale to represent the roadside swales described in the typical cross section.
- A water quality pond to establish the treatment effectiveness of the farm dam or a dry basin upstream of the catchment outlet (as the case may be).

In this way, the whole development is represented as the treatment train that it is and the impacts of the whole development will be shown to be acceptable in accordance with Singleton DCP 2011, reproduced below:

Table 1

Stormwater Quality Criteria		
Pollutant	**System Intent**	**Treatment Required**
Suspended Solids	To protect ambient water quality	The stormwater management system is to reduce the average annual load by at least 80%
Total Phosphorus	To protect ambient water quality	The stormwater management system is to reduce the average annual load by at least 45%
Total Nitrogen	To protect ambient water quality	The stormwater management system is to reduce the average annual load by at least 45%
Oil and Grease	To protect the receiving system from hydrocarbons.	The stormwater management system is to be designed to ensure that there are no visible oils for flows up to 50% of the 1 year ARI peak flow in areas with concentrated hydrocarbon deposition.
Coarse Sediment	To limit the sediment loads entering the system.	The stormwater management system is to be designed such that sediment coarser than 0.125mm ø is retained for flows up to 50% of the 1 year ARI peak flow.
Litter	To protect the receiving system from anthropogenic litter.	The stormwater management system is to be designed such that litter greater than 50mm ø is retained for flows up to 50% of the 1 year ARI peak flow.

Note:
The treatment requirements detailed in this table are based on percentage reduction in urban stormwater pollutants that are typically generated from the 'in use' phase of the development in the absence of any stormwater treatment measures being implemented.

2.3 Peak Flows

2.3.1 DRAINS

In addition to average annual flows, it is also necessary to consider the impacts of peak runoff on potential downstream flooding. Peak flows are instantaneous responses to the accumulation of runoff from discrete rainfall events in the catchments. Importantly, it is unlikely that the outputs from the MUSIC model will capture peak flows appropriately. This is because:

- Rainfall is subject to a known probability distribution. The more intense peak events may not have occurred within the rainfall record used in the Music Model. I.e. there is only a 67% chance that a 100 year event will have occurred in a 100 year continuous data set.
- Runoff probability is altered by land use, which is modelled in a different (and more precise) way in peak event modelling.

It is therefore important to use an appropriate runoff model for the estimation of peak flows. Accordingly, a DRAINS model is used with input data generated by Australian Rainfall and Runoff using theoretical rainfall generated by the Bureau of Meteorology for Branxton.

The DRAINS model is constructed in a similar way to the MUSIC model in that lots are aggregated and road are described as a separate catchment. The DRAINS model also assumes that the rainwater tanks are empty to the detention level at the start of any event.

Any residual detention volume that might be required as a result of the roads is modelled in the downstream dams or dry basins. In the case of existing dams, it is proposed to install a small outlet pipe what will lower the existing level by 300mm to provide the required detention volume. The diameter of the outlet pipes is nominated at Table 9.

2.3.2 Calibration

DRAINS are a time area hydrograph model. It generates runoff in a good approximation of the physical process by considering the conversion of Hyetographs (rainfall vs. time) to Hydrographs (runoff vs. time) for different sub elements (i.e. roofs, roads, grass) and adding the hydrographs together in discrete time steps. It is not necessary to consider the critical response time of the catchment as this falls out of the process of investigating several durations of differing average rainfall intensity.

However, Time Area Hydrograph methods need to be calibrated against the Probabilistic Rational Method (PRM), the accepted benchmark hydrological model for generating single peak flows.

Accordingly, the DRAINS model is calibrated against the PRM for the largest sub catchment in a separate process at Section 4.2.2.

3. Water Quality

3.1 Objectives

The primary water quality objectives to be met by the development are:

- No increase in average annual runoff
- Match or improve predevelopment water quality for lots at the lot scale
- Provide appropriate buffers for roads within the road reserves via combination of swales and dams to achieve OEH objectives at the site boundaries.
- Meet Singleton Council stormwater quality criteria, refer Table 1.

It is possible to meet all of the above objectives using the proposed tank and lot configurations in combination with the overall treatment train for runoff generated by roads. Having regard to the intentional layout of the roads in the development so as not to generate road runoff to the adjacent Belford National Park, the above objectives apply equally to all receiving waters, i.e. no significant impacts.

3.2 Lot Scale

3.2.1 Water use

To estimate annual water consumption for the household, the Web based Water Usage Calculator published by Hunter Water Corporation was used.

In the calculations consideration is given for:

- average household with 5 residents
- water saving showers
- dual flush toilets connected to the tank water
- no dripping taps
- Lawn and garden watered every second day in Spring/Summer
- Pool top-up on a weekly basis in Spring/Summer

Annual water consumption for a single average allotment was calculated to be **800 kl**

The results are presented in **Appendix A**

3.2.2 Tank configurations

In accordance with the discussion in Section 2.1, a Standard 20,000 litre tank was adopted for each lot in the subdivision.

The tanks are assumed to have a base of 10 square meters and an overflow pipe diameter 50 mm set at 1.5 m above the floor of the tank.

Accordingly 15,000 litres are available to be used within the house and 5,000 litres are set aside for stormwater detention.

3.2.3 Infiltration

To ensure there are no stormwater quality impacts as a result of the proposed development, each Lot is to have an additional 5.0 square meters infiltration system where:

-Filter Area is 5.0 square meters

-Depth of Infiltration Media is 0.5 meters

The overflow from the tank is to be connected directly to the infiltration trench. This could take the form of a 0.7m deep, 600mm wide trench approximately 9m long backfilled with sand for 0.5m and topsoil and planting (grass is ok) for the remaining 0.2m.

3.3 Subdivision Scale

3.3.1 Road Swales

The proposed typical road swales have a top width of 2.0 meters, base width of 0.4 meters and a depth 0.2 meters with side slope ratios of 4H:1V.

Topography along the proposed road alignments is typically steep with longitudinal grades up to 10%. It is recommended that swales with bed slopes in excess of 3% have check dams to guard against erosion but this is a matter for detailed design.

3.3.2 Dams and bio retention

Where existing farm dams are located below roads, It is proposed to retain one such farm dam in each catchment. This is the case for all catchments except 4 and 5. All other farm dams may be filled in without adverse impact on water quality.

Stormwater tanks, infiltration beds and road side swales will treat most of the runoff from the development site, however, final polishing for Total Nitrogen will be required in either existing farm dams or the proposed dry basins.

Bio retention basins should have 150 square metre beds with 0.5 m of sand bedding, refer Figure 5 be provided at the outlets to for catchment No.5.

Extended detention depth will need to contain approximately 225 cubic metres but is a matter for detailed design.

MUSIC model results are shown in Appendix B.

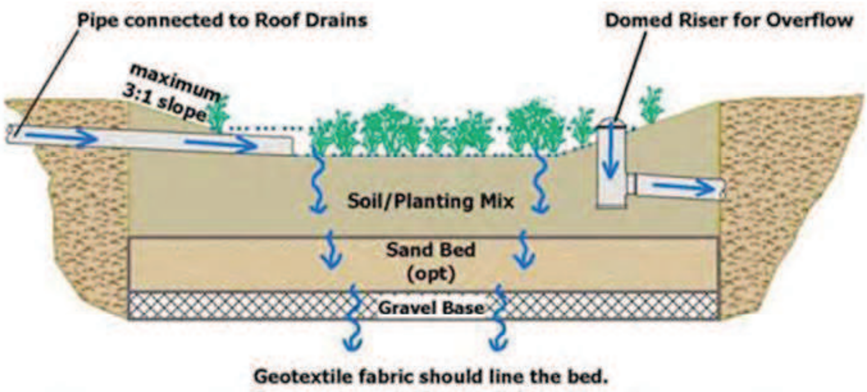


Figure 5 - Bio retention basin diagram

3.3.3 Aggregation of lots

In order to simplify the Subdivision scale MUSIC model the lots in each catchment were aggregated into a single large roof area with a single large tank, where the tank volume is the 15,000, 5,000 combination identified in section 3.2.2 multiplied by the number of proposed lots in the catchment.

Road areas were assumed to be 40% paved and are directed to swales in accordance with the cross-section described at Section 2.2.2.

3.3.4 MUSIC Modelling

Pluviograph data (6 min rainfall intensity) for Glendon Brook (61158), from Apr 1964 to May 2011), and Paterson: Tocal (61250), from Jan 1975 - Nov 2011) were obtained from the Bureau of Meteorology. These are the best interpolated data specific to the site (Latitude -32.6385, Longitude 151.4173).

MUSIC software was used to develop a stormwater quality simulation model; evaluate potential water quality impacts from proposed development areas and assess the performance of the proposed mitigation measures.

Two separate models were established; one for single lot with roof area being 100% impervious and one for all catchments.

The Model layouts are shown in Figure 6 and Figure 7.

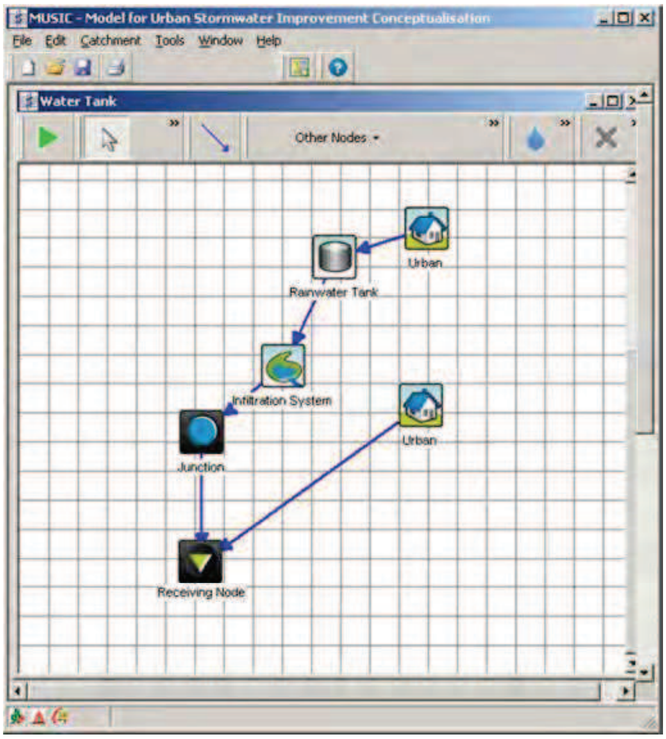


Figure 6 - MUSIC Model Layout for single property

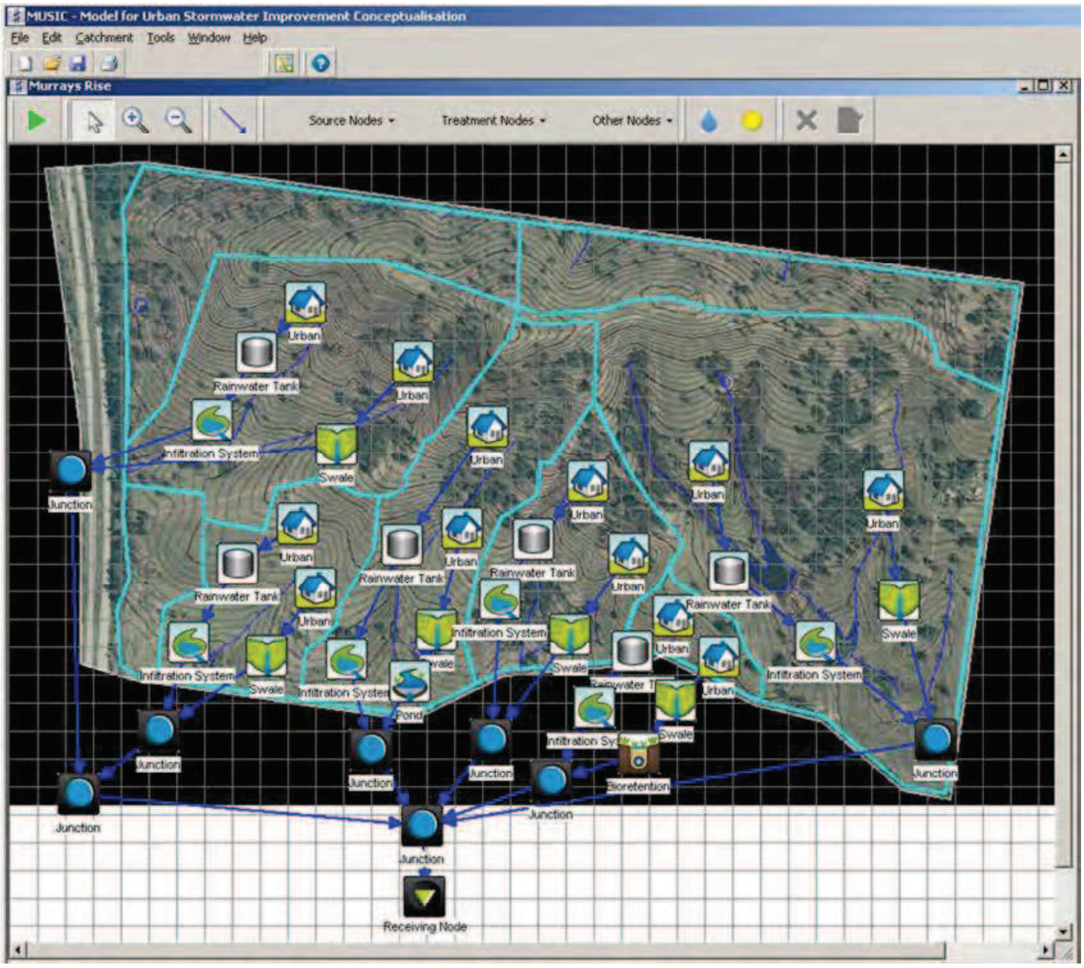


Figure 7 - MUSIC Model Layout for catchments

Adopted MUSIC model parameters are shown below:

Table 2 - Rainfall-Runoff MUSIC model parameters

Property	Default Parameters
Impervious Area Properties	
Rainfall Threshold (mm/day)	1
Pervious Area Properties	
Soil Storage capacity (mm)	150
Initial Storage (% of Capacity)	30
Field capacity (mm)	120
Infiltration Capacity Coefficient-a	200
Infiltration Capacity Coefficient-b	1
Groundwater Properties	
Initial Depth (mm)	10
Daily recharge Rate (%)	25
Daily Base Flow Rate (%)	5
Daily Deep Seepage Rate (%)	0

Table 3 - Rainwater Tank MUSIC model parameters

Parameter	Value
PET	3500
Daily Demand -(kL/day)	0.800
No. of CSTR cells	2
K (m/yr) for TSS	400
C (mg/L) for TSS	12
K (m/yr) for TP	300
C (mg/L) for TP	0.13
K (m/yr) for TN	40
C (mg/L) for TN	1.4

Table 4 - Swale MUSIC model parameters

Parameter	Value
Depth (m)	0.200
Vegetation Height (m)	0.050
Seepage Loss (mm/hr)	0
No. of CSTR cells	10
K (m/yr) for TSS	8000
C (mg/L) for TSS	20
K (m/yr) for TP	6000
C (mg/L) for TP	0.13
K (m/yr) for TN	500
C (mg/L) for TN	1.4

Table 5 - Pond MUSIC model parameters

Parameter	Value
Surface Area (sq.m)	100
Extended Detention Depth (m)	2
Permanent pool Volume (cu.m)	50
Seepage Loss (mm/hr)	0
Evaporative Loss as % of PET	100
Equivalent Pipe Diameter (mm)	300
Overflow Weir Width (m)	2
Orifice Discharge Coefficient	0.6
Weir Coefficient	1.7
No. of CSTR cells	2
K (m/yr) for TSS	400
C (mg/L) for TSS	12
K (m/yr) for TP	300
C (mg/L) for TP	0.09
K (m/yr) for TN	40

Table 6 - Bioretention MUSIC model parameters

Parameter	Value
Extended Detention Depth (m)	0.200
Surface Area (sq.m)	100
Filter Area (sq.m)	100
Unlined Filter Media Perimeter (m)	25
Filter Depth (m)	0.5
No. of CSTR cells	3
K (m/yr) for TSS	8000
C (mg/L) for TSS	20
K (m/yr) for TP	6000
C (mg/L) for TP	0.13
K (m/yr) for TN	500
C (mg/L) for TN	1.4

3.3.5 MUSIC results

The results achieved for single site are shown in Table 7.

Music Model results for catchments 1 to 6 are shown in Appendix B.

Table 7- Single house results

Catchment	Pollutant	Sources	Residual Load	% Reduction	% Reduction required
Single house	Total Suspended Solids (kg/yr)	54.8	2.02	**96.3**	**80**
	Total Phosphorus (kg/yr)	0.146	6.12E-03	**95.8**	**45**
	Total Nitrogen (kg/yr)	0.964	4.25E-02	**95.6**	**45**
	Gross Pollutants (kg/yr)	9.13	0	**100**	**N/A**

The results achieved for combining all outlets of subcatchment 1to 6are shown in Table 8.

Table 8 - All sub catchment results

Catchment	Pollutant	Sources	Residual Load	% Reduction	% Reduction required
Receiving Node	Total Suspended Solids (kg/yr)	12300	1500	**87.8**	**80**
	Total Phosphorus (kg/yr)	24.7	7.2	**70.9**	**45**
	Total Nitrogen (kg/yr)	172	76.6	**55.4**	**45**
	Gross Pollutants (kg/yr)	1700	0	**100**	**N/A**

These results indicate that the water quality requirements set by Council are achieved.

3.4 Conclusion

The proposed rainwater tank together with the infiltration system on each of the proposed lots supports the principles of building sustainability. When considered in concert with the retained farm dams and proposed dry basins, the proposal satisfies Singleton Council's requirements for water quality and peak flow objectives at both the lot and subdivision scales.

4. Peak Flows

4.1 Objectives

As set by Singleton Development Control Plan the following objectives to be met by the development:

1. Frequency and severity of flooding downstream is not to be increased as a result of development
2. The design should meet or reduce post developed flows to existing receiving waterways, by considering all storm durations for the 5 year, 20 year and 100 year ARI storm events.

4.2 Drains Modelling

A rainfall and runoff catchment model was developed using DRAINS software.

The existing and post-developed site conditions were quantified for 5, 20 and 100 year Average Recurrence Interval (ARI) storm events.

4.2.1 Catchment configurations

Each of the identified sub catchments (refer Figure 2) were modelled as 100% grass in the predevelopment DRAINs model in order to establish the predevelopment base case peak flow rate. The model was calibrated against the Probabilistic Rational Method, refer Section 4.2.2.

Each sub catchment was then modelled in the following way to represent the post developed conditions:

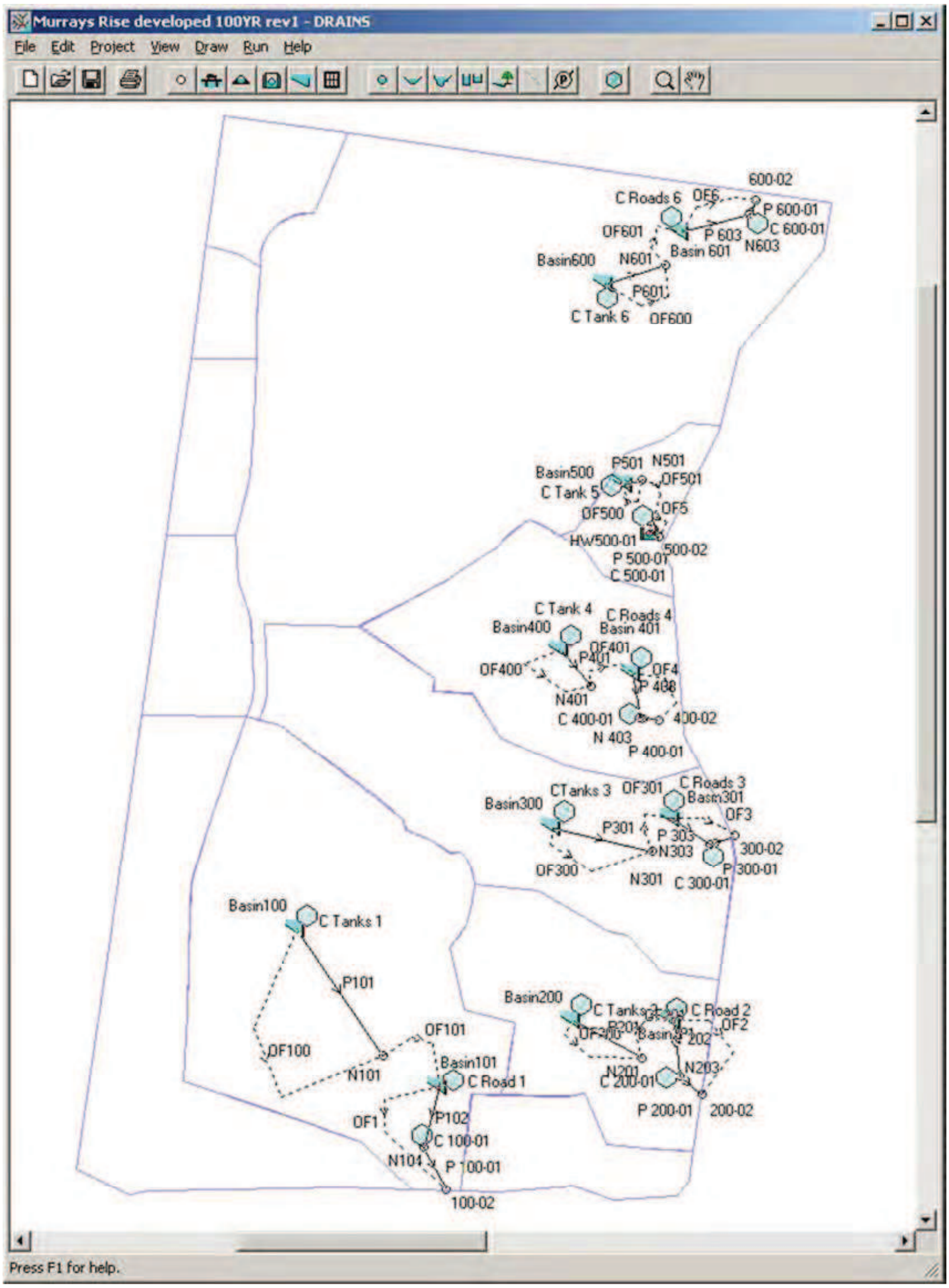
1. Roof areas were aggregated and formed as a 100% paved catchment with an area equal to 400m^2 for each lot in the sub catchment. This was discharged to an aggregated tank storage comprising 5,000 litres for each lot in the sub catchment. The adopted orifice dimension was chosen to give a cross sectional area equal to the combined cross sectional areas of the proposed standard 50mm diameter orifice for each tank.
2. Road areas were calculated as 40% of the road reserve modelled as 100% paved surfaces. There were discharged to a detention basin represented by the surface area of each of the farm dams that are to be retained with a 300mm detention depth discharged through a pipe of diameter as shown below

Table 9 – Dam outlet pipe diameter

Catchment	Discharge Pipe Diameter (mm)
1	150
2	150
3	100
4	100
5	150
6	150

3. The remaining area for the sub catchment was modelled as 100% grassed in accordance with the predevelopment conditions.

Figure 7 DRAINS Model layout



4.2.2 Calibration

The Probabilistic Rational Method for Eastern New South Wales was used to calculate peak flow rates for 5, 20 and 100 years ARI events.

Calibration for catchment No.4 in the DRAINS model to the Probabilistic Rational Method was achieved by adjusting Antecedent Moisture Condition to the point where peak flows matched in both methods.

4.2.3 Drains Results

The peak flow results modelled with DRAINS for the existing and post developed catchments for 5, 20 and 100 years recurrence intervals are shown at Appendix C

The pre-developed and post-developed peak flow summaries for 5, 20 and 100 year ARI are shown in Table 10.

Table 10 - Peak Flows

Catchment No	pre developed conditions	post developed conditions	pre developed conditions	post developed conditions	pre developed conditions	post developed conditions
	5 YR ARI	5 YR ARI	20 YR ARI	20YR ARI	100 YR ARI	100 YR ARI
1	0.79	0.77	1.03	1.02	2.69	1.27
2	0.35	0.33	0.45	0.46	1.18	0.56
3	0.57	0.56	0.74	0.74	1.94	0.90
4	0.40	0.40	0.51	0.51	1.34	0.66
5	0.20	0.20	0.26	0.27	0.34	0.34
6	1.51	1.42	1.96	1.87	5.12	2.27

4.3 Conclusion

Post developed peak flow rates will not be increased in the 5, 20 or 100 year event.

5. Recommendations

1. Each of the future dwellings on the site should incorporate a 20,000 litre tank with all above ground roofs connected. These should have a 50mm diameter outlet at ¾ tank height so as to retain 15,000 litres for non-potable internal and garden use and have 5,000 litres for stormwater detention.

2. Each lot should also have a 5m^2 infiltration trench (say 600mm wide x 9m long) at a low point near the building envelope and the overflow from the rainwater tank as well as any hard surface ground drainage points should be directly connected.

3. Houses should be plumbed so that laundry, toilets and domestic scale garden watering are sourced from the tank.

4. All roads should have swales in lieu of kerb and gutter. Swales in excess of 3% longitudinal grade should have check dams to guard against scour and erosion.

5. Existing dams for catchments No.1, 2, 3 and 6 should be retained to achieve peak flow and water quality objectives. These should be slightly modified to have 300mm of detention depth above their permanent storages and this volume should be controlled by discharge pipes in accordance with table in Section 4.2.1.

6. The catchment No.4 and 5 should have dry basins with similar configurations for fluctuating volumes and outlet pipes in accordance with Table 9.

Appendix A

Water Use Calculations

Annual water usage calculations sourced from Water Usage Calculator created by Hunter Water

Water usage over 12 month period

	Usage (%)	Usage (kL)
Bathroom	68%	544
Kitchen	3%	24
Laundry	8%	64
Lawn / Garden	17%	136
Pool	3%	24
Car / Boat	1%	8
TOTAL	100%	800

Appendix B

Music Modelling Results

Catchment	Pollutant	Sources	Residual Load	% Reduction
1	Flow (ML/yr)	14.6	11.3	**22.9**
	Total Suspended Solids (kg/yr)	3.06E+03	328	**89.3**
	Total Phosphorus (kg/yr)	6.19	1.76	**71.7**
	Total Nitrogen (kg/yr)	42.3	19.2	**54.7**
	Gross Pollutants (kg/yr)	418	0	**100**
2	Flow (ML/yr)	5.72	3.44	**39.9**
	Total Suspended Solids (kg/yr)	1.18E+03	139	**88.2**
	Total Phosphorus (kg/yr)	2.43	0.601	**75.3**
	Total Nitrogen (kg/yr)	16.3	6.26	**61.7**
	Gross Pollutants (kg/yr)	163	0	**100**
3	Flow (ML/yr)	7.41	3.75	**49.4**
	Total Suspended Solids (kg/yr)	1.50E+03	167	**88.9**
	Total Phosphorus (kg/yr)	3.13	0.595	**81**
	Total Nitrogen (kg/yr)	21.5	6.24	**71.0**
	Gross Pollutants (kg/yr)	212	0	**100**
4	Flow (ML/yr)	4.55	2.73	**40**
	Total Suspended Solids (kg/yr)	9.67E+02	101	**89.5**
	Total Phosphorus (kg/yr)	1.89	0.46	**75.7**
	Total Nitrogen (kg/yr)	13	4.73	**63.6**
	Gross Pollutants (kg/yr)	130	0	**100**
5	Flow (ML/yr)	1.98	0.969	**51.1**
	Total Suspended Solids (kg/yr)	410	26.3	**93.6**
	Total Phosphorus (kg/yr)	0.825	0.219	**73.5**
	Total Nitrogen (kg/yr)	5.75	1.58	**72.6**
	Gross Pollutants (kg/yr)	56.5	0	**100**
6	Flow (ML/yr)	25.1	22.2	**11.3**
	Total Suspended Solids (kg/yr)	5.19E+03	735	**85.8**
	Total Phosphorus (kg/yr)	10.2	3.57	**65.1**
	Total Nitrogen (kg/yr)	73	38.6	**47.1**
	Gross Pollutants (kg/yr)	7.16E+02	0	**100**

Appendix C

Drains Modelling Results

DRAINS results prepared 13 March, 2012 from Version 2011.13

RESULTS 5YEAR ARI
EXISTING CATCHMENT

PIT / NODE DETAILS

Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW100-01	38.01		0.793		1.84	0.000	None
100-02	36.92		0.000				
HW200-01	32.99		0.349		1.00	0.000	None
200-02	32.09		0.000				
HW300-01	35.26		0.572		0.74	0.000	None
300-02	33.15		0.000				
HW400-01	40.33		0.396		0.15	0.000	None
400-02	38.28		0.000				
HW500-01	51.14		0.199		0.86	0.000	None
500-02	49.27		0.000				
HW600-01	49.90		1.514		0.07	0.000	None
600-02	47.24		0.000				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C 100-01	0.793	0.000	0.793	10.00	20.00	0.00	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C 200-01	0.349	0.000	0.349	5.00	20.00	0.00	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C 300-01	0.572	0.000	0.572	5.00	20.00	0.00	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C 400-01	0.396	0.000	0.396	5.00	20.00	0.00	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C 500-01	0.199	0.000	0.199	5.00	10.00	0.00	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C 600-01	1.514	0.000	1.514	10.00	20.00	0.00	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.00 impervious + 111 pervious = 111 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Ru cu.m (Runoff	Pervious Runoff cu.m (Runoff %)
AR&R 5 ye	11003.63	0.42 (0.0%)	0.00 (0.0%)	0.42 (0.0%)
AR&R 5 ye	16644.15	93.49 (0.6%)	0.00 (0.0%)	93.49 (0.6%)
AR&R 5 ye	20805.19	450.68 (2.2%)	0.00 (0.0%)	450.68 (2.2%)
AR&R 5 ye	24041.55	1089.83 (4.5%)	0.00 (0.0%)	1089.83 (4.5%)
AR&R 5 ye	26815.57	1538.26 (5.7%)	0.00 (0.0%)	1538.26 (5.7%)
AR&R 5 ye	28849.86	1220.41 (4.2%)	0.00 (0.0%)	1220.41 (4.2%)
AR&R 5 ye	34703.05	1828.93 (5.3%)	0.00 (0.0%)	1828.93 (5.3%)
AR&R 5 ye	39058.27	3479.59 (8.9%)	0.00 (0.0%)	3479.59 (8.9%)
AR&R 5 ye	45604.97	3528.48 (7.7%)	0.00 (0.0%)	3528.48 (7.7%)
AR&R 5 ye	50820.14	4675.63 (9.2%)	0.00 (0.0%)	4675.63 (9.2%)
AR&R 5 ye	58920.29	5514.66 (9.4%)	0.00 (0.0%)	5514.66 (9.4%)
AR&R 5 ye	67908.14	7867.55 (11.6%	0.00 (0.0%)	7867.55 (11.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P 100-01	0.793	2.75	37.614	36.917	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 200-01	0.349	2.90	32.641	32.091	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 300-01	0.570	4.26	34.680	33.146	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 400-01	0.394	3.87	39.475	38.275	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 500-01	0.199	4.43	50.637	49.267	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 600-01	1.504	6.99	49.016	47.248	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1	0	0	9.896	0	0	0	0	
OF2	0	0	9.896	0	0	0	0	
OF3	0	0	9.896	0	0	0	0	
OF4	0	0	19.793	0	0	0	0	
OF5	0	0	16.551	0	0	0	0	
OF6	0	0	17.194	0	0	0	0	

DETENTION BASIN DETAILS

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

CONTINUITY CHECK for AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
HW100-01	992.37	993.43	0.00	-0.1
100-02	993.43	993.43	0.00	0.0
HW200-01	437.09	437.29	0.00	-0.0
200-02	437.29	437.29	0.00	0.0
HW300-01	715.80	716.18	0.00	-0.1
300-02	716.18	716.18	0.00	0.0
HW400-01	495.95	496.25	0.00	-0.1
400-02	496.25	496.25	0.00	0.0
HW500-01	140.34	140.33	0.00	0.0
500-02	140.33	140.33	0.00	0.0
HW600-01	1894.07	1895.50	0.00	-0.1

DRAINS results prepared 15 March, 2012 from Version 2011.13

RESULTS 5 YEAR ARI POST-DEVELOPED CATCHMENT

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N101	47.61		0.245				
N201	37.58		0.09				
N301	37.58		0.154				
N401	47.56		0.07				
HW500-01	51.14		0.201		0.86	0	None
500-02	49.25		0				
N601	57.59		0.324				
N501	66.98		0.001				
N104	37.66		0.726				
100-02	36.96		0				
N203	32.59		0.323				
200-02	32.04		0				
N303	34.64		0.538				
300-02	33.11		0				
N 403	39.43		0.375				
400-02	38.23		0				
N603	49.05		1.399				
600-02	48.38		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C Tanks 1	0.251	0.251	0	5	10	5	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C Tanks 2	0.151	0.151	0	5	10	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
CTanks 3	0.176	0.176	0	5	10	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C Tank 4	0.113	0.113	0	5	10	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C 500-01	0.201	0.041	0.181	5	10	0	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C Tank 6	0.452	0.452	0	5	10	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C Tank 5	0.038	0.038	0	5	0	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C Road 1	0.324	0.324	0	10	0	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C 100-01	0.726	0	0.726	0	20	0	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C Road 2	0.081	0.081	0	10	0	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C 200-01	0.323	0	0.323	0	20	0	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C Roads 3	0.121	0.121	0	10	0	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C 300-01	0.538	0	0.538	0	20	0	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C Roads 4	0.073	0.073	0	8	0	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C 400-01	0.375	0	0.375	0	20	0	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
C Roads 6	0.534	0.534	0	10	0	0	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
C 600-01	1.399	0	1.399	0	20	0	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1

Outflow Volumes for Total Catchment (8.10 impervious + 103 pervious = 111 total ha)

Storm	Total Rainf cu.m	Total Runc cu.m (Run	Impervious cu.m (Run	Pervious Runoff cu.m (Runoff %)
AR&R 5 ye	11002.44	722.71 (6.(	722.28 (89	0.43 (0.0%)
AR&R 5 ye	16642.35	1220.65 (7	1134.03 (9	86.62 (0.6%)
AR&R 5 ye	20802.94	1855.36 (8	1437.79 (9	417.57 (2.2%)
AR&R 5 ye	24038.95	2683.78 (1	1674.05 (9	1009.73 (4.5%)
AR&R 5 ye	26812.67	3301.86 (1	1876.55 (9	1425.31 (5.7%)
AR&R 5 ye	28846.74	3155.97 (1	2025.06 (9	1130.91 (4.2%)
AR&R 5 ye	34699.3	4147.39 (1	2452.34 (9	1695.05 (5.3%)
AR&R 5 ye	39054.05	5995.25 (1	2770.28 (9	3224.97 (8.9%)
AR&R 5 ye	45600.04	6518.54 (1	3248.19 (9	3270.35 (7.7%)
AR&R 5 ye	50814.64	7962.20 (1	3628.92 (9	4333.28 (9.2%)
AR&R 5 ye	58913.92	9331.09 (1	4219.93 (9	5111.16 (9.4%)
AR&R 5 ye	67900.8	12167.11 (	4875.22 (9	7291.89 (11.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P101	0.066	4.16	48.248	47.608	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
P201	0.025	3.14	38.201	37.576	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
P301	0.067	4.17	38.223	37.583	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
P401	0.035	3.45	48.187	47.56	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
P 500-01	0.2	5.37	50.616	49.247	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P601	0.096	4.52	58.222	57.592	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
P501	0	0	67.607	66.982	AR&R 5 year, 4.5 hours storm, average 13.6 mm/h, Zone 1
P102	0.056	4.03	42.608	41.858	AR&R 5 year, 3 hours storm, average 17.7 mm/h, Zone 1
P 100-01	0.774	2.72	37.658	36.961	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P202	0.021	2.48	33.873	33.623	AR&R 5 year, 3 hours storm, average 17.7 mm/h, Zone 1
P 200-01	0.333	3.49	32.593	32.044	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 303	0.026	3.02	41.235	40.655	AR&R 5 year, 3 hours storm, average 17.7 mm/h, Zone 1
P 300-01	0.563	5.15	34.639	33.106	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 403	0.023	2.6	47.388	46.955	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 400-01	0.395	4.73	39.434	38.234	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1
P 603	0.043	3.32	53.9	53.55	AR&R 5 year, 4.5 hours storm, average 13.6 mm/h, Zone 1
P 600-01	1.421	5.82	49.049	48.384	AR&R 5 year, 2 hours storm, average 22.9 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF100	0.245	0.245	9.896	0.067	0.02	17.38	0.37	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
OF101	0.294	0.576	41.333	0.076	0.05	19.18	0.7	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
OF200	0.09	0.09	0.652	0.044	0.01	12.89	0.29	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
OF201	0.115	0.176	41.333	0.047	0.02	13.43	0.5	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
OF300	0.154	0.154	17.141	0.044	0.02	12.89	0.49	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
OF301	0.206	0.311	41.333	0.059	0.04	15.76	0.6	AR&R 5 year, 25 minutes storm, average 58 mm/h, Zone 1
OF400	0.07	0.07	1.13	0.033	0.01	10.56	0.39	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
OF401	0.103	0.159	41.333	0.045	0.02	13.07	0.49	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
OF5	0	0	16.551	0	0	0	0	
OF600	0.324	0.324	17.141	0.06	0.04	15.94	0.6	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
OF601	0.419	0.829	36.478	0.079	0.07	19.9	0.93	AR&R 5 year, 1.5 hours storm, average 27.4 mm/h, Zone 1
OF500	0.001	0.001	19.397	0.005	0	1.65	0.17	AR&R 5 year, 4.5 hours storm, average 13.6 mm/h, Zone 1
OF501	0.001	0.201	36.478	0.044	0.03	12.89	0.64	AR&R 5 year, 4.5 hours storm, average 13.6 mm/h, Zone 1
OF1	0	0	3.577	0	0	0	0	
OF2	0	0	9.896	0	0	0	0	
OF3	0	0	9.896	0	0	0	0	
OF4	0	0	19.793	0	0	0	0	
OF6	0	0	17.194	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin100	48.58	120.5	0.311	0.066	0.245
Basin200	38.35	85	0.115	0.025	0.09
Basin300	38.81	85.3	0.221	0.067	0.154
Basin400	48.67	68.3	0.105	0.035	0.07
Basin600	58.48	263.7	0.42	0.096	0.324

DRAINS results prepared 14 March, 2012 from Version 2011.13

RESULTS 20YEAR ARI
EXISTING CATCHMENT

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW100-01	38.16		1.029		1.69	0.000	None
100-02	36.99		0.000				
HW200-01	33.25		0.453		0.74	0.000	None
200-02	32.09		0.000				
HW300-01	35.71		0.742		0.29	0.000	None
300-02	33.15		0.000				
HW400-01	40.63		0.514		-0.15	0.058	Headwall height/system capacity
400-02	38.26		0.058				
HW500-01	51.48		0.260		0.52	0.000	None
500-02	49.27		0.000				
HW600-01	50.28		1.965		-0.31	0.172	Headwall height/system capacity
600-02	47.23		0.172				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C 100-01	1.029	0.000	1.029	10.00	20.00	0.00	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C 200-01	0.453	0.000	0.453	5.00	20.00	0.00	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C 300-01	0.742	0.000	0.742	5.00	20.00	0.00	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C 400-01	0.514	0.000	0.514	5.00	20.00	0.00	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C 500-01	0.260	0.000	0.260	5.00	10.00	0.00	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C 600-01	1.965	0.000	1.965	10.00	20.00	0.00	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.00 impervious + 111 pervious = 111 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Ru cu.m (Runoff	Pervious Runoff cu.m (Runoff %)
AR&R 20 y	14609.87	64.34 (0.4%)	0.00 (0.0%)	64.34 (0.4%)
AR&R 20 y	22007.27	282.67 (1.3%)	0.00 (0.0%)	282.67 (1.3%)
AR&R 20 y	27462.85	772.08 (2.8%)	0.00 (0.0%)	772.08 (2.8%)
AR&R 20 y	31438.95	1702.60 (5.4%)	0.00 (0.0%)	1702.60 (5.4%)
AR&R 20 y	35137.65	2157.91 (6.1%)	0.00 (0.0%)	2157.91 (6.1%)
AR&R 20 y	38281.54	1970.47 (5.1%)	0.00 (0.0%)	1970.47 (5.1%)
AR&R 20 y	44939.20	1718.50 (3.8%)	0.00 (0.0%)	1718.50 (3.8%)
AR&R 20 y	50820.14	3743.69 (7.4%)	0.00 (0.0%)	3743.69 (7.4%)
AR&R 20 y	66576.60	5771.72 (8.7%)	0.00 (0.0%)	5771.72 (8.7%)
AR&R 20 y	77561.74	8569.10 (11.0%	0.00 (0.0%)	8569.10 (11.0%)
AR&R 20 y	90377.73	14380.35 (15.9%	0.00 (0.0%)	14380.35 (15.9%)
AR&R 20 y	100530.66	18724.25 (18.6%	0.00 (0.0%)	18724.25 (18.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P 100-01	1.031	2.92	37.686	36.989	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 200-01	0.452	3.77	32.640	32.091	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 300-01	0.740	5.54	34.680	33.146	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 400-01	0.456	4.90	39.455	38.255	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 500-01	0.259	5.76	50.637	49.267	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 600-01	1.788	8.86	49.001	47.230	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1	0	0	29.922	0	0	0	0	
OF2	0	0	29.922	0	0	0	0	
OF3	0	0	29.922	0	0	0	0	
OF4	0.058	0.058	20.253	0.029	0.01	9.73	0.41	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
OF5	0	0	16.280	0	0	0	0	
OF6	0.172	0.172	17.330	0.038	0.03	11.63	0.72	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1

DETENTION BASIN DETAILS

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

CONTINUITY CHECK for AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
HW100-01	1224.49	1225.69	0.00	-0.1
100-02	1225.69	1225.69	0.00	0.0
HW200-01	539.34	539.50	0.00	-0.0
200-02	539.50	539.50	0.00	0.0
HW300-01	883.24	883.60	0.00	-0.0
300-02	883.60	883.60	0.00	0.0
HW400-01	611.96	612.16	0.00	-0.0
400-02	612.16	612.16	0.00	0.0
HW500-01	175.59	175.57	0.00	0.0
500-02	175.57	175.57	0.00	0.0
HW600-01	2337.12	2338.51	0.00	-0.1
600-02	2338.51	2338.51	0.00	0.0

DRAINS results prepared 15 March, 2012 from Version 2011.13								RESULTS 20 YEAR ARI POST-DEVELOPED CATCHMENT

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surfa Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N101	47.61		0.304				
N201	37.58		0.119				
N301	37.58		0.2				
N401	47.56		0.117				
HW500-01	51.56		0.277		0.44	0	None
500-02	49.27		0				
N601	57.61		0.652				
N501	66.99		0.003				
N104	37.75		0.942				
100-02	37.05		0.019				
N203	32.63		0.42				
200-02	32.09		0.018				
N303	34.68		0.698				
300-02	33.14		0.014				
N 403	39.48		0.487				
400-02	38.27		0				
N603	49.11		1.815				
600-02	48.44		0.022				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C Tanks 1	0.33	0.33	0	5	10	5	AR&R 20 year, 15 minutes storm, average 99 mm/h, Zone 1
C Tanks 2	0.198	0.198	0	5	10	0	AR&R 20 year, 15 minutes storm, average 99 mm/h, Zone 1
CTanks 3	0.231	0.231	0	5	10	0	AR&R 20 year, 15 minutes storm, average 99 mm/h, Zone 1
C Tank 4	0.149	0.149	0	5	10	0	AR&R 20 year, 15 minutes storm, average 99 mm/h, Zone 1
C 500-01	0.277	0.062	0.215	5	10	0	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
C Tank 6	0.594	0.594	0	5	10	0	AR&R 20 year, 15 minutes storm, average 99 mm/h, Zone 1
C Tank 5	0.049	0.049	0	5	0	0	AR&R 20 year, 15 minutes storm, average 99 mm/h, Zone 1
C Road 1	0.424	0.424	0	10	0	0	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
C 100-01	0.942	0	0.942	0	20	0	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C Road 2	0.106	0.106	0	10	0	0	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
C 200-01	0.42	0	0.42	0	20	0	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C Roads 3	0.159	0.159	0	10	0	0	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
C 300-01	0.698	0	0.698	0	20	0	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C Roads 4	0.096	0.096	0	8	0	0	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
C 400-01	0.487	0	0.487	0	20	0	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
C Roads 6	0.7	0.7	0	10	0	0	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
C 600-01	1.815	0	1.815	0	20	0	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1

Outflow Volumes for Total Catchment (8.10 impervious + 103 pervious = 111 total ha)

Storm	Total Rainf cu.m	Total Runc cu.m (Run	Impervious cu.m (Run	Pervious Runoff cu.m (Runoff %)
AR&R 20 y	14608.29	1045.18 (7	985.53 (92	59.65 (0.4%)
AR&R 20 y	22004.88	1787.46 (8	1525.54 (9	261.92 (1.3%)
AR&R 20 y	27459.88	2639.15 (9	1923.80 (9	715.35 (2.8%)
AR&R 20 y	31435.55	3791.57 (1	2214.07 (9	1577.51 (5.4%)
AR&R 20 y	35133.85	4483.53 (1	2484.07 (9	1999.47 (6.1%)
AR&R 20 y	38277.4	4539.59 (1	2713.58 (9	1826.02 (5.1%)
AR&R 20 y	44934.34	4792.20 (1	3199.59 (9	1592.61 (3.8%)
AR&R 20 y	50814.64	7098.65 (1	3628.90 (9	3469.74 (7.4%)
AR&R 20 y	66569.4	10128.03 (	4779.15 (9	5348.89 (8.7%)
AR&R 20 y	77553.35	13521.00 (	5580.93 (9	7940.07 (11.0%)
AR&R 20 y	90367.95	19844.51 (	6516.34 (9	13328.17 (15.9%)
AR&R 20 y	100519.8	24611.43 (	7256.71 (9	17354.72 (18.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P101	0.073	4.27	48.254	47.612	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
P201	0.028	3.25	38.204	37.579	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P301	0.07	4.22	38.225	37.585	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
P401	0.038	3.55	48.19	47.562	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
P 500-01	0.272	5.83	50.642	49.272	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
P601	0.135	4.98	58.25	57.609	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
P501	0.001	1.29	67.613	66.988	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1
P102	0.065	4.11	42.622	41.872	AR&R 20 year, 3 hours storm, average 23.3 mm/h, Zone 1
P 100-01	0.998	2.83	37.753	37.061	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P202	0.029	2.67	33.887	33.637	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1
P 200-01	0.438	3.75	32.635	32.085	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 303	0.027	3.16	41.292	40.655	AR&R 20 year, 3 hours storm, average 23.3 mm/h, Zone 1
P 300-01	0.724	5.51	34.678	33.142	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 403	0.028	3.27	47.634	46.955	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1
P 400-01	0.511	5.02	39.475	38.275	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
P 603	0.055	3.44	53.922	53.573	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1
P 600-01	1.846	6.25	49.11	48.441	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF100	0.304	0.304	29.922	0.073	0.03	18.64	0.4	AR&R 20 year, 15 minutes storm, average 99 mm/h, Zone 1
OF101	0.365	0.784	41.333	0.086	0.07	21.15	0.77	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
OF200	0.119	0.119	3.577	0.05	0.02	13.97	0.31	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
OF201	0.147	0.237	41.333	0.053	0.03	14.51	0.56	AR&R 20 year, 2 hours storm, average 30 mm/h, Zone 1
OF300	0.2	0.2	22.502	0.049	0.03	13.79	0.53	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
OF301	0.257	0.414	41.333	0.066	0.04	17.2	0.65	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
OF400	0.117	0.117	6.196	0.04	0.02	11.99	0.45	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
OF401	0.151	0.234	41.333	0.053	0.03	14.51	0.55	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
OF5	0	0	16.28	0	0	0	0	
OF600	0.652	0.652	22.502	0.079	0.06	19.9	0.73	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
OF601	0.763	1.393	36.478	0.098	0.11	23.67	1.07	AR&R 20 year, 25 minutes storm, average 76 mm/h, Zone 1
OF500	0.003	0.003	19.13	0.009	0	2.84	0.22	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1
OF501	0.004	0.277	36.478	0.051	0.04	14.15	0.69	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1
OF1	0.019	0.019	3.577	0.026	0	8.53	0.17	AR&R 20 year, 3 hours storm, average 23.3 mm/h, Zone 1
OF2	0.018	0.018	29.922	0.025	0	8.23	0.18	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1
OF3	0.014	0.014	29.922	0.022	0	7.33	0.17	AR&R 20 year, 3 hours storm, average 23.3 mm/h, Zone 1
OF4	0	0	20.253	0	0	0	0	
OF6	0.022	0.022	17.33	0.018	0.01	6.14	0.39	AR&R 20 year, 6 hours storm, average 15.1 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin100	48.65	120.5	0.378	0.073	0.304
Basin200	38.39	89.3	0.147	0.028	0.119
Basin300	38.87	85.4	0.27	0.07	0.2
Basin400	48.74	68.4	0.155	0.038	0.117
Basin600	58.78	264	0.787	0.135	0.652

DRAINS results prepared 14 March, 2012 from Version 2011.13

RESULTS 100YEAR ARI EXISTING CATCHMENT

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW100-01	40.07		2.685		-0.22	0.100	Headwall height/system capacity
100-02	37.36		0.100				
HW200-01	34.52		1.183		-0.54	0.393	Headwall height/system capacity
200-02	32.24		0.393				
HW300-01	36.88		1.937		-0.88	0.829	Headwall height/system capacity
300-02	33.23		0.829				
HW400-01	41.31		1.342		-0.83	0.759	Headwall height/system capacity
400-02	38.30		0.759				
HW500-01	52.02		0.342		-0.02	0.002	Headwall height/system capacity
500-02	49.29		0.002				
HW600-01	51.77		5.125		-1.80	2.415	Headwall height/system capacity
600-02	47.31		2.415				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C 100-01	2.685	0.000	2.685	5.00	10.00	0.00	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
C 200-01	1.183	0.000	1.183	5.00	10.00	0.00	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
C 300-01	1.937	0.000	1.937	5.00	10.00	0.00	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
C 400-01	1.342	0.000	1.342	5.00	10.00	0.00	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
C 500-01	0.342	0.000	0.342	5.00	10.00	0.00	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
C 600-01	5.125	0.000	5.125	5.00	10.00	0.00	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.00 impervious + 111 pervious = 111 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Ru cu.m (Runoff	Pervious Runoff cu.m (Runoff %)
AR&R 100	19510.64	559.28 (2.9%)	0.00 (0.0%)	559.28 (2.9%)
AR&R 100	29404.66	1361.32 (4.6%)	0.00 (0.0%)	1361.32 (4.6%)
AR&R 100	36339.73	2418.12 (6.7%)	0.00 (0.0%)	2418.12 (6.7%)
AR&R 100	41795.31	4304.20 (10.3%	0.00 (0.0%)	4304.20 (10.3%)
AR&R 100	49932.45	2317.65 (4.6%)	0.00 (0.0%)	2317.65 (4.6%)
AR&R 100	59086.73	2185.10 (3.7%)	0.00 (0.0%)	2185.10 (3.7%)
AR&R 100	66576.60	3959.99 (5.9%)	0.00 (0.0%)	3959.99 (5.9%)
AR&R 100	78393.95	4505.66 (5.7%)	0.00 (0.0%)	4505.66 (5.7%)
AR&R 100	102860.83	14148.50 (13.8%	0.00 (0.0%)	14148.50 (13.8%)
AR&R 100	120337.21	24335.59 (20.2%	0.00 (0.0%)	24335.59 (20.2%)
AR&R 100	134484.75	31859.92 (23.7%	0.00 (0.0%)	31859.92 (23.7%)
AR&R 100	157786.53	49392.79 (31.3%	0.00 (0.0%)	49392.79 (31.3%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P 100-01	2.584	4.12	38.780	37.361	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
P 200-01	0.790	4.16	32.785	32.236	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
P 300-01	1.107	6.09	34.761	33.227	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
P 400-01	0.583	5.16	39.501	38.302	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
P 500-01	0.340	6.18	50.664	49.294	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
P 600-01	2.707	9.91	49.082	47.310	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1	0.100	0.100	29.922	0.046	0.01	13.25	0.29	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
OF2	0.393	0.393	29.922	0.081	0.03	20.25	0.42	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
OF3	0.829	0.829	29.922	0.110	0.06	26.00	0.52	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
OF4	0.759	0.759	20.253	0.080	0.07	20.08	0.84	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
OF5	0.002	0.002	16.280	0.008	0.00	2.54	0.23	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1
OF6	2.415	2.415	17.330	0.112	0.16	26.36	1.48	AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1

DETENTION BASIN DETAILS

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

CONTINUITY CHECK for AR&R 100 year, 9 hours storm, average 15.8 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Chan (cu.m)	Difference %
HW100-01	10514.40	10516.47	0.00	-0.0
100-02	10516.47	10516.47	0.00	0.0
HW200-01	4631.12	4631.45	0.00	-0.0
200-02	4631.43	4631.43	0.00	0.0
HW300-01	7584.12	7584.73	0.00	-0.0
300-02	7584.73	7584.73	0.00	0.0
HW400-01	5254.76	5255.12	0.00	-0.0
400-02	5255.12	5255.12	0.00	0.0
HW500-01	1339.39	1339.55	0.00	-0.0
500-02	1339.55	1339.55	0.00	0.0
HW600-01	20068.20	20070.90	0.00	-0.0
600-02	20070.75	20070.75	0.00	0.0

DRAINS results prepared 15 March, 2012 from Version 2011.13

RESULTS 100 YEAR ARI POST-DEVELOPED

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surfa Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N101	47.62		0.413				
N201	37.58		0.165				
N301	37.59		0.285				
N401	47.56		0.143				
HW500-01	52.02		0.351		-0.02	0.002	Headwall height/system capacity
500-02	49.29		0.002				
N601	57.62		0.868				
N501	66.99		0.007				
N104	37.85		1.106				
100-02	37.16		0.108				
N203	32.67		0.493				
200-02	32.12		0.043				
N303	34.71		0.82				
300-02	33.17		0.05				
N 403	39.51		0.572				
400-02	38.31		0.056				
N603	49.16		2.132				
600-02	48.48		0.089				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
C Tanks 1	0.442	0.442	0	5	10	5	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
C Tanks 2	0.265	0.265	0	5	10	0	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
CTanks 3	0.31	0.31	0	5	10	0	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
C Tank 4	0.199	0.199	0	5	10	0	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
C 500-01	0.351	0.083	0.268	5	10	0	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
C Tank 6	0.796	0.796	0	5	10	0	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
C Tank 5	0.066	0.066	0	5	0	0	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
C Road 1	0.527	0.527	0	10	0	0	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
C 100-01	1.106	0	1.106	0	20	0	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
C Road 2	0.132	0.132	0	10	0	0	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
C 200-01	0.493	0	0.493	0	20	0	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
C Roads 3	0.198	0.198	0	10	0	0	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
C 300-01	0.82	0	0.82	0	20	0	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
C Roads 4	0.119	0.119	0	8	0	0	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
C 400-01	0.572	0	0.572	0	20	0	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
C Roads 6	0.87	0.87	0	10	0	0	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
C 600-01	2.132	0	2.132	0	20	0	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1

Outflow Volumes for Total Catchment (8.10 impervious + 103 pervious = 111 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Run	Impervious cu.m (Run	Pervious Runoff cu.m (Runoff %)
AR&R 100	19508.53	2515.69 (1	1343.29 (9	1172.40 (6.5%)
AR&R 100	29401.48	2713.26 (9	2065.56 (9	647.70 (2.4%)
AR&R 100	36335.8	3722.38 (1	2571.83 (9	1150.55 (3.4%)
AR&R 100	41790.79	5233.03 (1	2970.08 (9	2262.95 (5.8%)
AR&R 100	49927.05	5071.49 (1	3564.10 (9	1507.40 (3.3%)
AR&R 100	59080.34	5878.06 (9	4232.35 (9	1645.72 (3.0%)
AR&R 100	66569.4	8188.15 (1	4779.14 (9	3409.00 (5.5%)
AR&R 100	78385.46	9347.63 (1	5641.76 (9	3705.87 (5.1%)
AR&R 100	87871.6	13310.89 (	6334.40 (9	6976.49 (8.6%)
AR&R 100	102849.7	20508.06 (	7427.08 (9	13080.99 (13.7%)
AR&R 100	120324.2	31069.08 (	8704.51 (9	22364.57 (20.1%)
AR&R 100	134470.2	39207.55 (	9737.51 (9	29470.04 (23.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P101	0.083	4.43	48.262	47.618	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
P201	0.032	3.38	38.207	37.582	AR&R 100 year, 1.5 hours storm, average 47.1 mm/h, Zone 1
P301	0.075	4.3	38.229	37.588	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
P401	0.04	3.6	48.192	47.564	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
P 500-01	0.34	6.18	50.665	49.294	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
P601	0.152	5.16	58.263	57.616	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
P501	0.002	1.53	67.616	66.991	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
P102	0.069	4.1	42.631	41.904	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
P 100-01	1.158	2.83	37.851	37.156	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
P202	0.032	2.74	33.893	33.643	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
P 200-01	0.515	3.89	32.667	32.115	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
P 303	0.028	3.25	41.328	40.655	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
P 300-01	0.851	5.73	34.707	33.171	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
P 403	0.03	3.48	47.721	46.955	AR&R 100 year, 4.5 hours storm, average 24.1 mm/h, Zone 1
P 400-01	0.6	5.15	39.51	38.309	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1
P 603	0.059	3.39	53.936	53.604	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
P 600-01	2.177	6.51	49.156	48.484	AR&R 100 year, 2 hours storm, average 39.6 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)			Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF100	0.413	0.413	29.922	0.083	0.04	20.61	0.43	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
OF101	0.479	0.978	41.333	0.094	0.08	22.77	0.82	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
OF200	0.165	0.165	3.577	0.057	0.02	15.41	0.33	AR&R 100 year, 1.5 hours storm, average 47.1 mm/h, Zone 1
OF201	0.196	0.298	41.333	0.058	0.03	15.58	0.59	AR&R 100 year, 1.5 hours storm, average 47.1 mm/h, Zone 1
OF300	0.285	0.285	22.502	0.057	0.03	15.41	0.58	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
OF301	0.345	0.531	41.333	0.073	0.05	18.64	0.69	AR&R 100 year, 20 minutes storm, average 113 mm/h, Zone 1
OF400	0.143	0.143	6.196	0.044	0.02	12.71	0.47	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
OF401	0.178	0.286	41.333	0.057	0.03	15.41	0.58	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
OF5	0.002	0.002	16.28	0.008	0	2.54	0.21	AR&R 100 year, 5 minutes storm, average 211 mm/h, Zone 1
OF600	0.868	0.868	22.502	0.089	0.07	21.87	0.79	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
OF601	0.989	1.786	36.478	0.109	0.12	25.82	1.14	AR&R 100 year, 15 minutes storm, average 131 mm/h, Zone 1
OF500	0.007	0.007	19.13	0.013	0	4.34	0.24	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
OF501	0.009	0.351	36.478	0.056	0.04	15.23	0.73	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
OF1	0.108	0.108	3.577	0.048	0.01	13.61	0.3	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
OF2	0.043	0.043	29.922	0.034	0.01	10.74	0.23	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
OF3	0.05	0.05	29.922	0.035	0.01	11.09	0.24	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1
OF4	0.056	0.056	20.253	0.029	0.01	9.73	0.39	AR&R 100 year, 4.5 hours storm, average 24.1 mm/h, Zone 1
OF6	0.089	0.089	17.33	0.03	0.02	10.02	0.59	AR&R 100 year, 6 hours storm, average 20.2 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin100	48.76	0	0.496	0.083	0.413
Basin200	38.45	0	0.197	0.032	0.165
Basin300	38.97	0	0.36	0.075	0.285
Basin400	48.78	0	0.183	0.04	0.143
Basin600	58.94	0	1.02	0.152	0.868

Attachment 6 – Public Authority Submissions

NSW GOVERNMENT | Planning

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10/24149
Department Generated Correspondence (Y)

Contact: Amy Blakely
Phone: (02) 4904 2700
Fax: (02) 4904 2701
Email: Amy.Blakely@planning.nsw.gov.au
Postal: PO Box 1226, Newcastle NSW 2300

Our ref: PP_2010_SINGL_011_00 (09/04150)
Your ref: LA65/2008

Mr Scott Greensill
General Manager
Singleton Council
PO Box 314
SINGLETON NSW 2330

Dear Mr Greensill,

Re: Planning Proposal to rezone land at Standen Drive, Lower Belford

I am writing in response to your Council's letter dated 18 November 2010 requesting a Gateway Determination under section 56 of the Environmental Planning and Assessment Act 1979 ("EP&A Act") in respect of the planning proposal to amend the Singleton Local Environmental Plan 1996 to rezone approximately 130ha of land described as Lot 11 DP 844443; part of Lot 12 DP 1100005; part of Lot 13 DP 1100005; Part of Lot 6 DP 237936; Lot 91 DP 1138554; and Lot 92 DP 1138554 located at Standen Drive, Lower Belford from 1(a) Rural to Environmental Living.

As delegate of the Minister for Planning, I have now determined that the planning proposal should proceed subject to the conditions contained in the attached Gateway Determination.

The Director General's delegate has also agreed that the planning proposal's inconsistencies with S117 Direction 1.2 Rural Zones are of minor significance. No further approval is required in relation to this Direction.

Council is to finalise the final boundary for the proposal and determine the minimum lot size for the development in consultation with DECCW and the CMA prior to finalising and exhibiting the draft LEP. All supporting information and studies prepared in relation to the site should also be made available to agencies and the community during the exhibition of the draft LEP.

The amending Local Environmental Plan (LEP) is to be finalised within 12 months of the week following the date of the Gateway Determination. Council should aim to commence the exhibition of the Planning Proposal within four (4) weeks from the week following this determination. Council's request for the Department to finalise the LEP should be made six (6) weeks prior to the projected publication date.

Should you have any queries in regard to this matter, please contact Amy Blakely of the Regional Office of the Department on (02) 4904 2700.

Yours sincerely,

17.12.10

Tom Gellibrand
Deputy Director General
Plan Making & Urban Renewal

NSW GOVERNMENT | Planning

Gateway Determination

***Planning Proposal (Department Ref: PP_2010_SINGL_011_00)**: to rezone approximately 130ha of land described as Lot 11 DP 844443; part of Lot 12 DP 1100005; part of Lot 13 DP 1100005; Part of Lot 6 DP 237936; Lot 91 DP 1138554; and Lot 92 DP 1138554 located at Standen Drive, Lower Belford from 1(a) Rural to Environmental Living.*

I, the Deputy Director General, Plan Making & Urban Renewal as delegate of the Minister for Planning, have determined under section 56(2) of the EP&A Act that an amendment to the Singleton Local Environmental Plan 1996 to rezone approximately 130ha of land described as Lot 11 DP 844443; part of Lot 12 DP 1100005; part of Lot 13 DP 1100005; Part of Lot 6 DP 237936; Lot 91 DP 1138554; and Lot 92 DP 1138554 located at Standen Drive, Lower Belford from 1(a) Rural to Environmental Living should proceed subject to the following conditions:

1. The RPA is to consult with DECCW and the CMA to identify and agree the final boundary for the planning proposal and the minimum lot size applicable for the proposal prior to proceeding to exhibition.

2. Community consultation is required under sections 56(2)(c) and 57 of the Environmental Planning and Assessment Act 1979 ("EP&A Act") as follows:

   a. the planning proposal must be made publicly available for **28 days**;
   b. all supporting material and background studies prepared in relation to the site must be made available for the community and agencies to review during the exhibition period with the planning proposal;
   c. the relevant planning authority must comply with the notice requirements for public exhibition of planning proposals and the specifications for material that must be made publicly available along with planning proposals as identified in section 4.5 of *A Guide to Preparing LEPs (Department of Planning 2009).*

3. Counsultation is required with the following public authorities under section 56(2)(d) of the EP&A Act:

   - NSW Department of Environment, Climate Change and Water (DECCW)
   - Aboriginal Land Council
   - Catchment Management Authority (CMA) – Hunter/Central Rivers
   - Department of Industry and Investment (Agriculture)
   - Roads and Traffic Authority (RTA)

   Each public authority is to be provided with a copy of the planning proposal and any relevant supporting material. Each public authority is to be given at least 21 days to comment on the proposal, or to indicate that they will require additional time to comment on the proposal. Public authorities may request additional information or additional matters to be addressed in the planning proposal.

4. A public hearing is not required to be held into the matter by any person or body under section 56(2)(e) of the EP&A Act. This does not discharge Council from any obligation it may otherwise have to conduct a public hearing (for example, in response to a submission or if reclassifying land).

5. A public hearing is not required to be held into the matter by any person or body under section 56(2)(e) of the EP&A Act. This does not discharge Council from any obligation it may otherwise have to conduct a public hearing (for example, in response to a submission or if reclassifying land).

6. The timeframe for completing the LEP is to be **12 months** from the week following the date of the Gateway determination.

Dated 17th day of December 2010.

Tom Gellibrand
Deputy Director General
Plan Making & Urban Renewal
Delegate of the Minister for Planning

NSW GOVERNMENT | Planning & Infrastructure

Ms Lindy Hyam
General Manager
Singleton Council
PO Box 314
Singleton NSW 2330

Our ref: 11/19607
Your ref: LA74/2009, LA67/2009, LA65/2008

Dear Ms Hyam

Multiple Planning Proposals – Gateway Determination Extensions

I refer to your requests on 12 October 2011 seeking an extension of time to complete the following Planning Proposals

- PP_2011_SINGL_001 Reclassification and rezoning of Council owned land (LA 74/2009)
- PP_2010_SINGL_006 Rezoning of 144 and 118 Elderslie Road, Branxton (LA 67/2009)
- PP_2010_SINGL_011 Rezoning of Standen Drive, Lower Belford (LA 65/2008)

I have determined as the delegate of the Minister, in accordance with section 56(7) of the Environmental Planning and Assessment Act, 1979, to amend the Gateway Determination's as follows;

Gateway Determination dated 17 February 2011 for PP_2011_SINGL_001 - The Gateway Determination is amended by extending the time for the completion of the Planning Proposal by an additional four months. The Planning Proposal is now due for completion by 24 March 2012.

Gateway Determination dated 23 December 2010 for PP_2010_SINGL_006 - The Gateway Determination is amended by extending the time for the completion of the Planning Proposal by an additional twelve months The Planning Proposal is now due for completion by 30 December 2012.

Gateway Determination dated 17 December 2010 for PP_2010_SINGL_011 - The Gateway Determination is amended by extending the time for the completion of the Planning Proposal by an additional eight months. The Planning Proposal is now due for completion by 24 August 2012.

The State Government is committed to reducing the time taken to complete local environmental plans by tailoring the steps in the process to the complexity of the proposal and by providing clear and publicly available justification for each plan at an early stage. I understand that the Regional Office is working with your staff to ensure any further delays to Planning Proposals in Singleton are minimised. If you have any questions in relation to this matter, please contact Mr Michael Leavey, Regional Director Hunter and Central Coast, on (02) 4904 2700.

Yours sincerely

1/12/11

Tom Gellibrand
Deputy Director General
Plan Making and Urban Renewal

Pearson, Gary

From: Paul Maher <Paul.Maher@planning.nsw.gov.au>
Sent: Monday, 13 August 2012 9:35 AM
To: Pearson, Gary
Cc: Katrine O'Flaherty
Subject: Fwd: RE: Murrays Rise/ Standen Drive Planning Proposal

Jdu|/

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Environmental Planning Officer
Department of Planning and Infrastructure
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Dear Paul,

I refer to our meeting with Singleton Council on the 16 July 2012, OEH's subsequent letter of the 27 July 2012, and to your email below, with the attached map. OEH has no objections to the planning proposal going on exhibition if it includes the "alternative solution" which includes increasing the size of lots at the strategic points indicated on the attached map on the common boundary to the National Park, to ensure retention of vegetation and connection to the Endangered Ecological Community in the centre of the site.

Regards,
Karen

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Environmental Planning Officer
Department of Planning and Infrastructure

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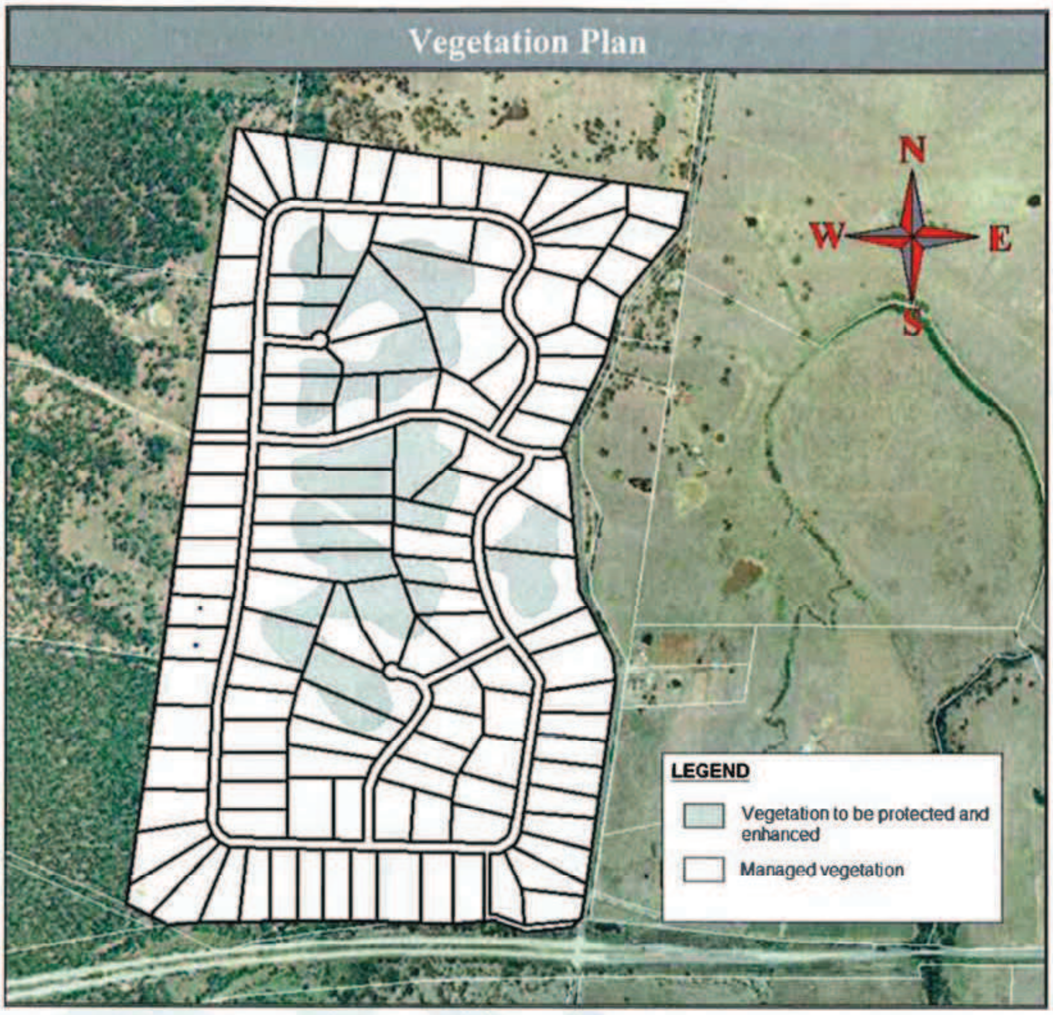
DRAFT



6.3. Impacts on biodiversity as a result of subdivision works (i.e. road construction etc.) are to be avoided at the outset. Where unavoidable, impacts are to be offset through rehabilitation works which restore or reclaim degraded land.

Such rehabilitation works are to be carried out within the areas of the site identified in the Vegetation Plan as "Vegetation to be protected and enhanced". Such rehabilitation works are to be undertaken as part of the subdivision works.

6.4. Vegetation within the area identified in the Vegetation Plan as "Vegetation to be protected and enhanced" is to be protected by placing a relevant restriction on the removal of vegetation, within that area, through an appropriate legal instrument that is linked to the title of the land in perpetuity.

6.5. Impacts on vegetation should be avoided upfront. It is acknowledged that some disturbance of vegetation may be necessary to provide for roads, development envelopes, facilities and driveway accesses.

Office of Environment & Heritage
NSW GOVERNMENT

Your reference: LA65/2008
Our reference: DOC12/19679;FIL06/927-06
Contact: Karen Thumm, 4908 6829

Mr Scott Greensill
General Manager
Singleton Council
PO Box 314
SINGLETON NSW 2330

Attention: Gary Pearson

Dear Mr Greensill

RE: PLANNING PROPOSAL AND PROPOSAL TO AMEND THE SINGLETON DEVELOPMENT CONTROL PLAN FOR PROPOSED MURRAY'S RISE ENVIRONMENTAL LIVING ESTATE.

I refer to your letter dated 15 May 2012 and our previous correspondence on this matter dated 24 January and 11 October 2011. The Gateway determination which has been issued for this Planning Proposal requests that Council consult with the Office of Environment and Heritage (OEH) in relation to the minimum lot size and the final boundary. I apologise for the delay in our response. OEH has undertaken a review of the updated planning proposal which was the subject of Gateway and its associated Development Control Plan (DCP). In summary, OEH's concerns relating to biodiversity raised in previous correspondence have not been addressed.

Biodiversity

Final boundary

OEH has not raised concerns previously relating to the plan boundary, and has no comments to provide on this aspect of the Planning Proposal.

Minimum lot size

As stated in previous correspondence OEH supports the recommendations in Cumberland Ecology's ecological report which include *inter alia* rehabilitation of degraded vegetation, retention of existing vegetation attributable to endangered ecological communities (EECs), improvement of the connectivity to Belford National Park (NP) to the west of the site, and weed control. Please note that the land to the south west of the property in question is no longer Belford State Forest, but is now Belford National Park.

OEH notes, however, that our recommendations for larger lot size in order to allow for the conservation and rehabilitation of vegetation on site have not been heeded. OEH has particular concerns that the smaller lot size will inevitably result in impacts on biodiversity as well as reduce the connectivity and buffers to the National Park to the west. The present proposal is of an intensity that is more in line with an R5 zone, rather than the proposed E4 (Environmental Living). The reduction in lot size is not consistent with Environmental Living, as there will inevitably be a loss of vegetation in the majority of lots and adverse impacts on the edges of the significant remnant vegetation patches.

Furthermore, the majority of the conservation measures in the Planning Proposal are recommended, but are only enforceable if they are supported by a legally binding e.g. 88B-E covenant. The area covered by the covenant shown in the DCP, however, is restricted to the centre of the property and does not cover the areas recommended by the ecological report. In particular the vegetation along the southern and western edges of the property is not included in the designated area earmarked for protection. This results in the conservation measures being unenforceable over the majority of the site and contrasts with the recommendations of the ecology report. The DCP thus does not protect vegetation links from the remnants on site to the west in the National Park. The EEC vegetation in the centre of the property is likely to become fragmented and isolated from adjacent vegetation.

It is noted that the potential for dedication of land to the adjacent Belford National Park as an offset has been raised with the proponent, but has not been presented as an option to date. As an E4 zone is subject to the *Native Vegetation Act 2003,* it is recommended that the proponent seek advice from the Catchment Management Authority. Clearing of the EEC vegetation on site may trigger a 'red light' under this legislation.

Development Control Plan
OEH repeats that it does not consider a DCP amendment to be an adequate mechanism for providing certainty to good conservation outcomes for high conservation values. As stated previously in correspondence to Council, the DCP should use the expression 'improve or maintain', rather than 'maintain and/or improve', in order to be in line with NSW government policy. Furthermore, the statements that impacts are to be offset through rehabilitation works which restore or reclaim degraded land and "where clearing is necessary, the re-establishment of an equivalent amount of vegetation is required" (Singleton DCP) do not reflect OEH's offsetting requirements. While rehabilitation is encouraged and supported, the time lag before rehabilitated land becomes a functioning eco-system is considerable (in the realm of decades). Rehabilitation cannot be considered to be as valuable as the conservation of vegetation in its natural state. This is reflected in our planning tools, such as the BioBanking calculator, which gives credit for rehabilitation, but does not value rehabilitation as highly as the dedication of vegetated land in good condition to conservation in perpetuity.

Aboriginal Cultural Heritage
The importance of protecting Aboriginal cultural heritage is reflected in the provisions of the *National Parks and Wildlife Act 1974* (NPW Act). The NPW Act clearly establishes that Aboriginal objects and places are protected and may not be damaged, defaced or disturbed without appropriate authorisation. Importantly, approvals under Part 3 of the *Environmental Planning and Assessment Act 1979* do not absolve the proponent of their obligations under the NPW Act. Therefore, an important component of the environmental assessment process undertaken in support of the proposed LEP amendment is the consideration of potential impacts to Aboriginal cultural heritage.

OEH assessed the potential impacts to Aboriginal cultural heritage of the Planning Proposal documented in the *Proposed Subdivision: 'Murrays Rise' at Lower Belford, NSW, Indigenous Archaeological and Cultural Heritage Assessment Report* prepared by McCardle Heritage Pty Ltd, and dated November 2011 and notes the lack of surface Aboriginal cultural heritage evident within the project area. OEH further notes the documented survey coverage was 36% of the ridge area, 35% of the slope area and 48% of the drainage area.

The Aboriginal cultural heritage assessment report noted that past land use disturbances would have displaced the Aboriginal cultural heritage evidence expected to be present in the landforms of the area. OEH reminds the applicant that Aboriginal cultural heritage is protected under Part 6 of the NPW Act whether it is in a disturbed context when identified or not. OEH reminds the applicant that the absence of visible Aboriginal cultural heritage does not negate the possibility for the presence of Aboriginal cultural heritage in less visible areas. As such OEH recommends Council consider including a precautionary statement in the DCP to ensure that the *Special Requirements for Significant Sites* table includes directions for the management of any Aboriginal cultural heritage that may be identified during subsequent assessment and development with the planning proposal area (example included below).

Special requirements for Significant Sites	
Aboriginal Cultural Heritage	• Should subsequent assessment and development activities on the subject land identify Aboriginal cultural heritage, the applicant will be required to manage any likely impacts in accordance with the provisions of Part 6 of the NPW Act or its equivalent legislation pertaining to the protection of Aboriginal heritage relevant at the time.

General advice

OEH notes that the provisions of the NPW Act have recently been amended and to ensure the proponent is familiar with the new requirements during the development and any subsequent assessment processes. Further advice regarding Aboriginal cultural heritage can be found on OEH's web-site at: http://www.environment.nsw.gov.au/cultureandheritage.htm.

OEH also reminds the proponent that, in the event that any inadvertent damage does occur to any Aboriginal cultural heritage as a result of any proposed works, there is potential for an offence under Part 6 of the NPW Act, irrespective of any development determination granted under the EP&A Act.

Conclusion

Providing the matters raised above are addressed by the proponent, OEH has no further concerns or comments regarding the Aboriginal cultural heritage assessment for the rezoning proposal.

If you have any enquiries concerning this advice, please contact Karen Thumm, Conservation Planning Officer for biodiversity issues, on 4908 6829, or Rosalie Neve, Aboriginal Planning Heritage Officer, for Aboriginal cultural heritage issues, on 6659 8221.

Yours sincerely

Karen Th 15/6/2012

KAREN THUMM
A/Head - Hunter Planning Unit
Office of Environment Heritage

Catchment Management Authority
Hunter–Central Rivers

Gary Pearson

Strategic Landuse Planner

PO Box 314

Singleton NSW 2330

Subject : 'Preliminary Draft DCP Section for Murray's Rise Environmental Living Estate'

Dear Gary

Thank you for opportunity to comment on the proposal DCP on the above mentioned area.

The proposal needs to consider and reflect The Catchment Action Plan (CAP) as this is a whole-of-government approach to natural resource management which has been endorsed by the NSW Government. It is a regional plan that provides a roadmap to ensure that natural resources are protected and enhanced for the enjoyment and viability of future generations. The CAP is currently under review. The Singleton Shire Council and State Departments need to be considering the guiding principles of the current CAP and be aware the new Cap is under being developed. The new CAP is due for completion in 2013.

Biodiversity Conservation and Improvement Works

The CMA generally supports the objectives, criteria and development of a vegetation plan. This plan will not only need to assess the vegetation within the proposal and the impact of the development It will need to assess off site impact (close to conservation areas), including connectivity, and threaten species. The proposal has detail on the fauna impact of the proposal but needs to supply more information on the impact on the flora.

The clearing of native vegetation for road and other infrastructure works may require consent under the Native Vegetation Act 2003. If consent is required then offsets will be needed to ensure that certain environmental outcomes are improved or maintained. Since there has not been any assessment for clearing it is not known if the vegetation targeted for **"protection and enhancement"** is sufficient to satisfy the requirement to maintain or improve environmental outcomes. Please refer to the Native Vegetation Act 2003. The Native Vegetation Regulation 2005, and the Native Vegetation Regulation 2005 Environmental Outcomes Assessment Methodology at http:www. envrionment.nsw.gov.vegetation/nvmanagment.htm. The Catchment Management Authority is responsible for carrying out assessments under the Native Vegetation Act 2003 for proposed clearing of native vegetation.

Proposal Boundary Area and Minimum Lot Size

The proposed Life Style zoning for this area is likely to require assessment under the Native Vegetation Act 2003. The CMA has no comment in respect of the development boundary and minimum lot sizes for the development at the exhibition stage. Prior to any clearing an assessment under the NVA 2003 will need to be undertaken.

Stormwater and Water Quality Management

The CMA generally supports the objective and criteria for stormwater and water quality management. The CMA Salinity Hazard Maps show the area lies within Branxton H3 area. This area has a **high salinity hazard**. The CMA believes the proposal requires a Salinity Management Plan, as well as Stormwater Management Plan and Erosion, Sediment and Rehabilitation Plans. The criteria will need to ensure both soil erosion and salinity issues are addressed both on and offsite.

Significant Development Sites (Section 8)

In Section 8 (Significant Development Sites) of the proposal the CMA generally agrees with the objective s and criteria for significant development sites. However the proponent while mentioning threatened species fauna habitat it is does not make mention of threatened flora or endangered ecological communities (EEC's) which occur in the Belford area.

General Comment

It is a requirement of the CMA that where ever possible the location of all building and sewerage effluent facilities be within cleared areas. The exact location of these will need to be shown on the diagram plans. This would assist and be essential if the proposal needs to be assessed under the NVA 2003.

Yours faithfully

S. C. Eccles

Upper Hunter
Catchment Coordinator

30/08/12

Transport Roads & Traffic Authority

402RZ8; 1
11/1413
SW / BK

RECEIVED 20 OCT 2011 SINGLETON COUNCIL

General Manager
Singleton Council
DX 7063
SINGLETON

Attention: Mr Gary Pearson

NEW ENGLAND HIGHWAY (HW9): PLANNING PROPOSAL, LOT 11 DP844443, LOTS 12-13 DP1100005, PART OF LOT 6 DP237936, LOTS 91-92 DP1138554, 7, 5, 133, & 147A AND 147B STANDEN DRIVE, LOWER BELFORD (LA65/2008)

Dear Mr Pearson,

I refer to your letter dated 14 September 2011 (Your reference: LA65/2008), received on 16 September 2011, regarding the subject planning proposal forwarded to the Roads and Traffic Authority (RTA) for consideration.

RTA Responsibilities and Obligations

The RTA's primary interests are in the road network, traffic and broader transport issues. In particular, the efficiency and safety of the classified road system, the security of property assets and the integration of land use and transport.

In accordance with the *Roads Act 1993*, the RTA has powers in relation to road works, traffic control facilities, connections to roads and other works on the classified road network. The New England Highway (HW9) is a classified (State) road and part of the National Land Transport Network. RTA concurrence is required for connections to classified roads with Council consent, under Section 138 of the Act. Council is the roads authority for this road and all other public roads in the area.

RTA Response and Requirements

The RTA has reviewed the information provided and considers it acceptable for the purposes of the planning proposal. The RTA would have no objections to the planning proposal and considers that Council can progress this into the Singleton LEP as an amendment.

Notwithstanding the above, the RTA still requires the developer to resolve State infrastructure issues, consistent with Part 11, Clause 39A- Arrangements for designated State public infrastructure. In this regard the developer will be required to enter into a Voluntary Planning Agreement (VPA) with the Department of Planning and Infrastructure for contributions towards designated State public infrastructure (State roads) prior to any development / subdivision proceeding on the site. Until such an agreement is executed, satisfactory arrangements, consistent with Clause 39A, have not been established for State public infrastructure.

As with the infrastructure requirements previously considered for other identified land release areas, the RTA requires that broader contributions to State road infrastructure, consistent with the currently exhibited draft State Infrastructure Contributions scheme, be included in the VPA. For Council's information, the Department of Planning and Infrastructure is currently negotiating a VPA with the proponent.

The following comments are offered for Council's consideration in determining the proposal:

- The Hunter Expressway is currently under construction and is due for completion in 2013 / 2014. This project includes changes to the intersection of the New England Highway and Standen Drive, as shown in the attached letter, which was released to the community in May this year. Accordingly, there are no direct access requirements for the planning proposal to manage the impacts on the road network.

  Comment: The RTA expects to release an updated letter to householders in late October/early November. This letter will include a more detailed diagram that will show the final design of the layout at the intersection of the New England Highway and Standen Drive. It will also show the new service road from Standen Drive to Branxton.

- No direct access shall be permitted for any lot to the New England Highway. All access shall be via local roads.

- The developer should take into account Direction 3.4 (*Integrating Land Use Development and Transport*) issued under Section 117 (2) under the *Environmental Planning and Assessment Act 1979.* In particular, consideration should be given to the provision of adequate access to public transport, especially for the elderly and opportunities for pedestrians and cyclist connections to the surrounding area.

- Council should ensure that the applicant is aware of the potential for road traffic noise to impact on future development of the site. In this regard, the applicant, not the RTA, is responsible for providing noise attenuation measures in accordance with the Department of Environment, Climate Change and Water's *NSW Road Noise Policy 2011*, should the applicant seek assistance at a later date.

Please contact me on 4924 0240 if you require further advice.

Yours sincerely,

Dave Young
Manager, Land Use Development
Infrastructure Services
Hunter Region

18 October 2011

Enc. RTA letter dated May 2011

Cc Mr James Shelton
Department of Planning and Infrastructure

To the householder

MAY 2011

Australian Government
Nation Building Program

NSW GOVERNMENT | Transport Roads & Traffic Authority

Dear resident,

Hunter Expressway –
Proposed changes to access at Standen Drive, west of Branxton

Abigroup started major construction in mid-April on the 27 kilometre western section of the Hunter Expressway, from Kurri Kurri to the New England Highway, west of Branxton.

Standen Drive intersects the New England Highway just west of Black Creek. The alignment of the new Hunter Expressway will join the New England Highway near the Standen Drive intersection. The RTA proposes to improve access to the New England Highway at Standen Drive for motorists travelling east towards Branxton and west towards Singleton.

Features of the proposal

A diagram of the proposal is shown over the page. The features of the proposed safety improvements include:

- A dedicated service road for motorists travelling between Standen Drive and the New England Highway. This road will start near the northern intersection of Standen Drive and link into the New England Highway near Black Creek.
- A left-turn deceleration lane will be provided on each side of the New England Highway for eastbound and westbound motorists turning into Standen Drive.
- For motorists who currently turn right out of Standen Drive to travel west and east, offset U-turn bays will be installed on the New England Highway on both sides of Standen Drive, immediately adjacent to the intersection.
- An emergency crossover bay will also be built to the west of the Standen Drive intersection.
- The proposed changes will provide safer turning movements from Standen Drive onto the New England Highway in all directions by removing the conflicting turning movements at the intersection.
- Traffic will be able to travel to and from Standen Drive in all the directions that are currently available, with some changes to lane configurations and turning movements.

RTA seeks community comments

The RTA invites your comments on the proposed changes to access arrangements at Standen Drive. Comments can be submitted to RTA Project Officer Kate Hagan via post, email or phone.

Post: Kate Hagan,
Locked Bag 30, Newcastle NSW 2300
Email: Kate_Hagan@rta.nsw.gov.au
Phone: 02 4924 0234

Comments will be received until Friday 17 June 2011.

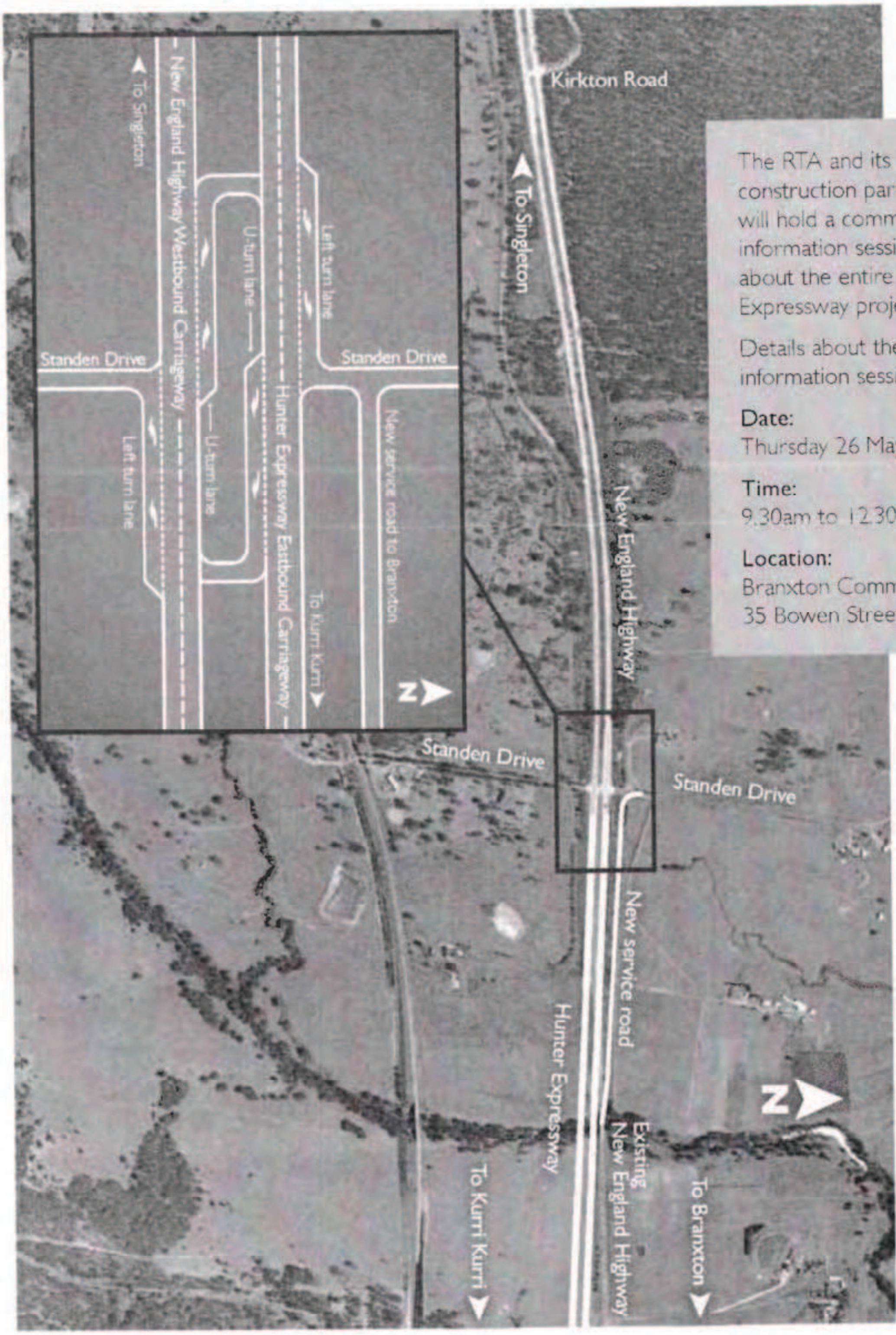
Timing of the work

The Hunter Expressway is scheduled for completion before the end of 2013. The project will be completed and opened to traffic in its entirety. The proposed work at Standen Drive would be built in the later stages of the project and be completed before the 2013 opening of the Hunter Expressway.

Yours faithfully

Hudson Bawden
Hunter Expressway Communications Manager

Hunter Expressway – Proposed changes to access at Standen Drive, west of Branxton



The RTA and its construction partners will hold a community information session about the entire Hunter Expressway project.

Details about the information session are:

Date:
Thursday 26 May 2011

Time:
9.30am to 12.30pm

Location:
Branxton Community Hall
35 Bowen Street, Branxton

Tell us what you think. We have a new website **www.rta.nsw.gov.au/roadprojects**. We hope this site makes it easier to find the project information you need. We are interested in your feedback. Email us at Project_Customer_Services@rta.nsw.gov.au

For further enquiries:
Level 1, 47 Darby Street Newcastle NSW 2300
Locked Bag 30, Newcastle NSW 2300 DX7813 Newcastle
www.rta.nsw.gov.au | 13 22 12 | T 02 4924 0472 | F 02 4924 0291
E hudson_bawden@rta.nsw.gov.au

Attachment 7 – NSW Housing Statistics

A9. Median Sale Prices - Rural Local Government Areas - All Dwellings - Mar 2010

notes: (s) 30 or less sales lodged; (-) 10 or less sales lodged; (n) not available due to small number

		Change in Median	
Statistical	**Median**	**Qtly**	**Ann**
Sub-Division and			
Local Government Area	**$'000s**	**%**	**%**
Hunter SD Bal	**340**	**6.3**	**9.7**
Dungog 335	s	n	n
Gloucester 260	s	n	n
Great Lakes	350	5.7	9.0
Muswellbrook 301		5.1	11.3
Singleton 379		2.7	17.3
Upper Hunter Shire	315	20.0	34.0
Nowra-Bomaderry	**282**	**4.3**	**4.3**
Shoalhaven 325		-1.5	12.8
Illawarra SD Bal	**376**	**-1.1**	**15.7**
Shoalhaven 325		-1.5	12.8
Wingecarribee 450		4.7	26.8
Tweed Heads and Tweed Coast	**427**	**-4.0**	**9.5**
Tweed 423		-5.8	8.4
Lismore	**318**	**1.9**	**13.2**
Lismore 330		3.8	15.0
Richmond-Tweed SD Bal	**420**	**-4.5**	**12.0**
Ballina 433		-7.0	10.9
Byron 569		5.9	21.1
Kyogle 273		13.8	15.2
Lismore 330		3.8	15.0
Richmond Valley	290	0.3	16.5
Tweed 423		-5.8	8.4
Coffs Harbour	**340**	**1.2**	**7.9**
Coffs Harbour	350	-0.3	6.4
Clarence	**330**	**1.5**	**9.6**
Bellingen 362		5.2	22.7
Coffs Harbour	350	-0.3	6.4
Clarence Valley	305	-1.9	7.0
Nambucca 320		8.9	12.1
Port Macquarie	**370**	**1.9**	**12.8**
Hastings 366		-2.4	12.6
Hastings	**305**	**-1.9**	**9.1**
Greater Taree	260	-6.1	4.0
Hastings 366		-2.4	12.6
Kempsey 299		13.7	26.2
Tamworth	**240**	**-7.7**	**2.1**
Tamworth Regional	250	-3.8	5.5
Northern Slopes	**235**	**5.6**	**12.5**
Gunnedah 253		8.6	5.2
Gwydir	-	n	n
Inverell 176		-12.9	-7.6
Liverpool Plains	125 s	n	n
Tamworth Regional	250	-3.8	5.5

A9. Median Sale Prices - Rural Local Government Areas - All Dwellings - Mar 2010

notes: (s) 30 or less sales lodged; (-) 10 or less sales lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area	Median $'000s		Change in Median Qtly %	Ann %
Northern Tablelands	**230**		**-4.4**	**9.5**
Armidale-Dumaresq	283		-3.4	13.2
Glen Innes Severn	155		n	-11.4
Guyra 143		s	n	n
Inverell 176			-12.9	-7.6
Tenterfield 224		s	n	n
Uralla 299		s	n	n
Walcha -			n	n
North Central Plain	**215**		**2.4**	**16.2**
Moree Plains	195		-5.8	18.2
Narrabri 240		s	n	n
Dubbo	**248**		**-2.2**	**7.0**
Dubbo 250			-2.0	8.0
Central Macquarie	**245**		**-1.6**	**36.1**
Dubbo 250			-2.0	8.0
Gilgandra 135		s	n	n
Mid-Western Regional	269		-8.7	8.2
Narromine 164		s	n	n
Warrumbungle Shire	165	s	n	n
Wellington 142		s	n	n
Macquarie-Barwon	**98**	**s**	**n**	**n**
Bogan -			n	n
Coonamble -			n	n
Walgett -			n	n
Warren -			n	n
Upper Darling	**190**	**s**	**n**	**n**
Bourke -			n	n
Brewarrina -			n	n
Cobar 218		s	n	n
Bathurst	**285**		**-1.2**	**12.6**
Bathurst Regional	292		0.9	14.5
Orange	**288**		**-1.5**	**2.9**
Orange 288			-1.5	2.9
Central Tablelands (excl. Bathurst-Orange)	**210**		**-7.7**	**0.0**
Bathurst Regional	292		0.9	14.5
Blayney	220	s	n	n
Cabonne	213		-32.5	11.8
Lithgow City	190		-11.2	-2.6
Mid-Western Regional	269		-8.7	8.2
Oberon -			n	n
Lachlan	**180**		**2.9**	**20.0**
Bland 203		s	n	n
Cowra 195			5.4	16.6
Forbes 179		s	n	n
Lachlan -			n	n
Parkes 218			13.0	-0.7
Weddin 115		s	n	n
Queanbeyan	**430**		**1.8**	**16.9**
Palerang	508		-4.2	3.6
Queanbeyan 413			3.5	14.8
Southern Tablelands (excl. Queanbeyan)	**265**		**-3.6**	**13.5**
Boorowa -			n	n
Goulburn Mulwaree	255		-1.9	13.3
Harden -			n	n
Palerang	508		-4.2	3.6
Upper Lachlan	278	s	n	n
Yass Valley	340		-21.4	-0.7
Young 226			13.7	2.7
Lower South Coast	**335**		**3.1**	**8.2**
Bega Valley	338		12.5	16.4
Eurobodalla 335			-1.5	6.3
Snowy	**235**		**-12.1**	**8.5**
Bombala -			n	n
Cooma-Monaro 230		s	n	n
Snowy River	349		21.4	51.4

A9. Median Sale Prices - Rural Local Government Areas - All Dwellings - Mar 2010

notes: (s) 30 or less sales lodged; (-) 10 or less sales lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area	Median		Change in Median Qtly	Change in Median Ann
	$'000s		%	%
Wagga Wagga	**273**		**-2.3**	**9.2**
Wagga Wagga	279		-1.7	10.3
Central Murrumbidgee	**189**		**-5.5**	**1.2**
Coolamon 140		s	n	n
Cootamundra 206			n	21.5
Gundagai -			n	n
Junee 159		s	n	n
Lockhart -			n	n
Narrandera 243		s	n	n
Temora 142		s	n	n
Tumut 242		s	n	n
Wagga Wagga	279		-1.7	10.3
Lower Murrumbidgee	**225**		**-6.3**	**4.7**
Carrathool -			n	n
Griffith 280			3.7	13.8
Hay 92		s	n	n
Leeton 212		s	n	n
Murrumbidgee -			n	n
Albury	**248**		**-6.4**	**7.6**
Albury 250			-5.3	6.4
Greater Hume Shire	205	s	n	n
Upper Murray (excl. Albury)	**220**		**7.3**	**25.7**
Corowa 230			-4.3	6.9
Greater Hume Shire	205	s	n	n
Tumbarumba -			n	n
Urana -			n	n
Central Murray	**210**		**2.3**	**24.3**
Berrigan 150		s	n	n
Conargo -			n	n
Deniliquin 195			-1.3	21.9
Jerilderie -			n	n
Murray 265			n	n
Wakool 242		s	n	n
Murray-Darling	**165**	**s**	**n**	**n**
Balranald -			n	n
Wentworth 185		s	n	n
Far West	**99**		**-21.2**	**-17.9**
Broken Hill	101		-22.1	-25.0
Central Darling	-		n	n
Rest of NSW	**309**		**-0.3**	**13.2**
New South Wales	**418**		**-1.6**	**16.1**

A5. Median Weekly Rents - Rural Local Government Areas - All Dwellings - Jun 2010

notes: (s) 30 or less bonds lodged; (-) 10 or less bonds lodged; (n) not available due to small number

	All Dwellings											
Statistical Sub-Division and Local Government Area*	One Bedroom			Two Bedrooms			Three Bedrooms			Four + Bedrooms		
		Change			Change			Change			Change	
	Median $	Qtly %	Ann %	Median $	Qtly %	Ann %	Median $	Qtly %	Ann %	Median $	Qtly %	Ann %
Hunter SD Balance	153	-4.7	8.9	220	4.8	12.8	280	3.7	7.7	370	5.7	12.1
Dungog	-	n	n	230 s	n	n	235 s	n	n	-	n	n
Gloucester	-	n	n	165 s	n	n	-	n	n	-	n	n
Great Lakes	160 s	n	n	220	4.8	14.3	275	1.9	5.8	320	-7.2	0.0
Muswellbrook	129 s	n	n	200 s	n	n	280	7.7	16.7	390	11.4	n
Singleton	-	n	n	245	n	2.1	330	3.1	6.5	400	n	5.3
Upper Hunter Shire	-	n	n	170 s	n	n	240	-4.0	9.1	360 s	n	n
Nowra-Bomaderry	150 s	n	n	190	-5.0	0.0	270	0.0	8.0	340	6.3	6.3
Shoalhaven	155	10.7	10.7	210	3.7	7.7	269	3.4	7.5	350	6.1	12.9
Illawarra SD Balance	170	11.5	13.3	220	4.8	4.8	275	1.9	7.8	360	2.9	9.1
Shoalhaven	155	10.7	10.7	210	3.7	7.7	269	3.4	7.5	350	6.1	12.9
Wingecarribee	185 s	n	n	230	4.5	-2.1	320	6.7	10.3	410	0.0	5.1
Tweed Heads and Tweed Coast	220	2.3	-2.2	290	0.0	1.8	350	-2.8	0.0	450	0.0	5.9
Tweed	215	4.9	7.5	285	-1.7	1.8	350	0.0	1.4	440	2.3	4.8
Lismore	130 s	n	n	220	2.3	10.0	300	1.7	7.1	350	25.0	9.4
Lismore	130	-13.3	n	220	1.1	10.0	300	1.7	7.1	350	16.7	9.4
Richmond-Tweed SD Balance	180	0.0	4.3	270	0.0	5.9	350	0.0	2.9	400	-3.6	-4.8
Ballina	185 s	n	n	275	-1.8	1.9	365	1.4	4.3	420	-1.2	-0.6
Byron	200 s	n	n	350	1.4	13.8	430	2.4	7.5	520	4.0	0.0
Kyogle	-	n	n	178 s	n	n	250 s	n	n	270 s	n	n
Lismore	130	-13.3	n	220	1.1	10.0	300	1.7	7.1	350	16.7	9.4
Richmond Valley	-	n	n	190	0.0	2.7	270	0.0	3.8	305 s	n	n
Tweed	215	4.9	7.5	285	-1.7	1.8	350	0.0	1.4	440	2.3	4.8
Coffs Harbour	190	5.6	2.7	250	4.2	8.7	330	3.1	10.0	420	5.0	10.5
Coffs Harbour	190	5.6	2.7	250	4.2	8.7	320	0.0	6.7	400	1.3	6.7
Clarence	150	-6.3	-6.3	220	4.8	10.0	280	0.0	7.7	330	-2.9	10.0
Bellingen	-	n	n	220 s	n	n	280	n	n	-	n	n
Coffs Harbour	190	5.6	2.7	250	4.2	8.7	320	0.0	6.7	400	1.3	6.7
Clarence Valley	150 s	n	n	220	0.0	10.0	280	0.0	7.7	300	-6.3	3.4
Nambucca	145 s	n	n	200	8.1	11.1	265	1.9	10.4	293 s	n	n
Port Macquarie	165	n	n	240	4.3	9.1	340	0.0	13.3	405	-3.0	2.5
Hastings	160	0.0	0.0	240	2.1	11.6	330	3.1	13.8	398	-0.6	7.4
Hastings	143	5.6	14.0	195	0.0	5.4	250	0.0	4.2	320	0.0	6.7
Greater Taree	150	15.4	25.0	190	0.0	5.6	250	0.0	4.2	300	-3.2	7.1
Hastings	160	0.0	0.0	240	2.1	11.6	330	3.1	13.8	398	-0.6	7.4
Kempsey	125 s	n	n	180	2.9	1.4	230	0.0	4.5	280 s	n	n
Tamworth	145 s	n	n	200	0.0	8.1	270	0.0	8.0	330	6.5	0.0
Tamworth Regional	145 s	n	n	200	2.6	8.1	265	1.9	6.0	325	4.8	-1.5
Northern Slopes	123 s	n	n	160	0.0	0.0	210	5.0	10.5	255	-5.6	15.9
Gunnedah	125 s	n	n	190 s	n	n	250	13.6	13.6	270 s	n	n
Gwydir	-	n	n	-	n	n	-	n	n	-	n	n
Inverell	125 s	n	n	160 s	n	n	250	8.7	19.0	278 s	n	n
Liverpool Plains	-	n	n	-	n	n	200 s	n	n	255 s	n	n
Tamworth Regional	145 s	n	n	200	2.6	8.1	265	1.9	6.0	325	4.8	-1.5
Northern Tablelands	125	4.2	13.6	175	2.9	6.1	250	4.2	13.6	300	-3.2	13.2
Armidale Dumaresq	145 s	n	n	190	2.7	5.6	273	-1.8	4.8	350	-2.8	2.2
Glen Innes Severn	-	n	n	150 s	n	n	195 s	n	n	-	n	n
Guyra	-	n	n	-	n	n	-	n	n	-	n	n
Inverell	125 s	n	n	160 s	n	n	250	8.7	19.0	278 s	n	n
Tenterfield	-	n	n	174 s	n	n	200 s	n	n	-	n	n
Uralla	-	n	n	-	n	n	230 s	n	n	-	n	n
Walcha	-	n	n	-	n	n	-	n	n	-	n	n
North Central Plain	110 s	n	n	140	0.0	3.7	225	7.1	7.1	280 s	n	n
Moree Plains	118 s	n	n	140	-6.7	-6.7	220	0.0	0.0	290 s	n	n
Narrabri	110 s	n	n	140	0.0	7.7	240 s	n	n	-	n	n
Dubbo	150 s	n	n	170	-2.9	0.0	250	0.0	4.2	320	-5.9	3.2
Dubbo	150 s	n	n	170	-2.9	0.0	250	0.0	4.2	320	-5.9	3.2
Central Macquarie	113 s	n	n	175	4.5	16.7	210	-12.5	5.0	240	-12.7	-4.0
Dubbo	150 s	n	n	170	-2.9	0.0	250	0.0	4.2	320	-5.9	3.2
Gilgandra	-	n	n	-	n	n	-	n	n	-	n	n
Mid-Western Regional	-	n	n	185	-7.5	5.7	270	0.0	22.7	345	6.2	7.8
Narromine	-	n	n	-	n	n	180 s	n	n	-	n	n
Warrumbungle Shire	-	n	n	130 s	n	n	165 s	n	n	-	n	n

A5. Median Weekly Rents - Rural Local Government Areas - All Dwellings - Jun 2010

notes: (s) 30 or less bonds lodged; (-) 10 or less bonds lodged; (n) not available due to small number

	All Dwellings											
Statistical Sub-Division and Local Government Area*	One Bedroom			Two Bedrooms			Three Bedrooms			Four + Bedrooms		
	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %
Wellington	-	n	n	155 s	n	n	170	n	6.3	210 s	n	n
Macquarie-Barwon	-	n	n	160	10.3	6.7	170 s	n	n	200 s	n	n
Bogan	-	n	n	-	n	n	170 s	n	n	-	n	n
Coonamble	-	n	n	-	n	n	-	n	n	-	n	n
Walgett	-	n	n	160 s	n	n	-	n	n	-	n	n
Warren	-	n	n	-	n	n	-	n	n	-	n	n
Upper Darling	120 s	n	n	135	n	n	190	n	5.6	255 s	n	n
Bourke	-	n	n	-	n	n	-	n	n	-	n	n
Brewarrina	-	n	n	-	n	n	-	n	n	-	n	n
Cobar	-	n	n	140 s	n	n	195 s	n	n	260 s	n	n
Bathurst	140	0.0	n	203	1.3	6.6	260	4.0	4.0	350	2.9	6.1
Bathurst Regional	140	0.0	n	200	0.0	6.7	260	4.0	4.0	350	2.9	6.1
Orange	140	-9.7	-17.6	220	4.8	10.0	270	0.0	3.8	360	-5.3	0.0
Orange	140	-9.7	-17.6	220	4.8	10.0	270	0.0	3.8	360	-5.3	0.0
Central Tablelands	130 s	n	n	168	4.7	8.1	200	0.0	2.6	273	0.9	14.7
Bathurst Regional	140	0.0	n	200	0.0	6.7	260	4.0	4.0	350	2.9	6.1
Blayney	-	n	n	163 s	n	n	230 s	n	n	-	n	n
Cabonne	-	n	n	165 s	n	n	180 s	n	n	-	n	n
Lithgow City	-	n	n	170	-5.6	6.3	200	-9.1	0.0	300 s	n	n
Mid-Western Regional	-	n	n	185	-7.5	5.7	270	0.0	22.7	345	6.2	7.8
Oberon	-	n	n	175 s	n	n	220 s	n	n	-	n	n
Lachlan	113 s	n	n	140	-3.4	7.7	190	2.7	5.6	245	4.3	2.1
Bland	-	n	n	-	n	n	200 s	n	n	-	n	n
Cowra	-	n	n	145 s	n	n	185	0.0	2.8	-	n	n
Forbes	-	n	n	150 s	n	n	180 s	n	n	-	n	n
Lachlan	-	n	n	-	n	n	-	n	n	-	n	n
Parkes	-	n	n	130	-8.8	-3.7	215	7.5	10.3	280 s	n	n
Weddin	-	n	n	-	n	n	-	n	n	-	n	n
Queanbeyan	210	-4.5	5.0	300	3.4	7.1	400	0.0	3.9	523	4.5	0.5
Palerang	-	n	n	-	n	n	380 s	n	n	480 s	n	n
Queanbeyan	210	-2.3	7.7	300	3.4	7.1	410	2.5	6.5	528	-2.3	1.4
Southern Tablelands	125 s	n	n	170	-2.9	3.0	230	-2.1	4.5	308	2.5	9.8
Boorowa	-	n	n	-	n	n	-	n	n	-	n	n
Goulburn Mulwaree	135 s	n	n	170	0.0	7.9	250	0.0	12.4	300	n	11.1
Harden	-	n	n	-	n	n	-	n	n	-	n	n
Palerang	-	n	n	-	n	n	380 s	n	n	480 s	n	n
Upper Lachlan	-	n	n	-	n	n	185 s	n	n	-	n	n
Yass Valley	-	n	n	250 s	n	n	298 s	n	n	420 s	n	n
Young	-	n	n	170	0.0	0.0	210	-4.5	n	295 s	n	n
Lower South Coast	155	n	n	200	5.3	5.3	270	3.8	8.0	320	10.3	10.3
Bega Valley	-	n	n	190	5.6	5.6	270	3.8	12.5	290 s	n	n
Eurobodalla	150	n	n	215	7.5	13.2	280	7.7	12.0	333	7.3	10.8
Snowy	350 s	n	n	270	50.0	8.0	253	16.1	1.0	370	n	32.1
Bombala	-	n	n	-	n	n	-	n	n	-	n	n
Cooma-Monaro	-	n	n	140 s	n	n	220	2.3	7.3	-	n	n
Snowy River	370 s	n	n	475	115.9	-1.0	700	180.0	100.0	460	n	n
Wagga Wagga	150 s	n	n	208	-7.8	-1.2	280	-5.1	1.8	368	0.7	-0.7
Wagga Wagga	150 s	n	n	210	-6.7	0.0	280	-5.1	1.8	368	0.7	-0.7
Central Murrumbidgee	100 s	n	n	165	10.0	10.0	180	-10.0	-5.3	230	-8.0	0.0
Coolamon	-	n	n	-	n	n	-	n	n	-	n	n
Cootamundra	-	n	n	142 s	n	n	180 s	n	n	-	n	n
Gundagai	-	n	n	160 s	n	n	-	n	n	-	n	n
Junee	-	n	n	150 s	n	n	195 s	n	n	-	n	n
Lockhart	-	n	n	-	n	n	-	n	n	-	n	n
Narrandera	-	n	n	-	n	n	-	n	n	-	n	n
Temora	-	n	n	-	n	n	140 s	n	n	-	n	n
Tumut	-	n	n	180 s	n	n	245 s	n	n	-	n	n
Wagga Wagga	150 s	n	n	210	-6.7	0.0	280	-5.1	1.8	368	0.7	-0.7
Lower Murrumbidgee	120	-4.0	n	165	0.0	6.5	225	-2.2	3.4	290	16.0	18.4
Carrathool	-	n	n	-	n	n	-	n	n	-	n	n
Griffith	145 s	n	n	170	-10.5	3.0	250	0.0	8.7	295 s	n	n
Hay	-	n	n	130 s	n	n	-	n	n	-	n	n
Leeton	-	n	n	150	0.0	0.0	200 s	n	n	230 s	n	n
Murrumbidgee	-	n	n	-	n	n	-	n	n	-	n	n

A5. Median Weekly Rents - Rural Local Government Areas - All Dwellings - Jun 2010

notes: (s) 30 or less bonds lodged; (-) 10 or less bonds lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area*	One Bedroom			Two Bedrooms			Three Bedrooms			Four + Bedrooms		
	Median	Change Qtly	Ann	Median	Change Qtly	Ann	Median	Change Qtly	Ann	Median	Change Qtly	Ann
	$	%	%	$	%	%	$	%	%	$	%	%
Albury	125	0.0	n	165	-8.3	-2.9	250	-3.8	4.2	330	-5.7	3.1
Albury	125	0.0	n	163	-9.7	-4.4	250	-3.8	2.0	340	-2.9	6.3
Greater Hume Shire	-	n	n	140 s	n	n	180 s	n	n	-	n	n
Upper Murray	-	n	n	150	0.0	0.0	203	1.3	3.8	245 s	n	n
Corowa Shire	-	n	n	160 s	n	n	230	2.2	9.5	-	n	n
Greater Hume Shire	-	n	n	140 s	n	n	180 s	n	n	-	n	n
Tumbarumba	-	n	n	-	n	n	173 s	n	n	-	n	n
Urana	-	n	n	-	n	n	-	n	n	-	n	n
Central Murray	115 s	n	n	145	3.6	0.0	185	-7.5	-2.6	220	n	n
Berrigan	-	n	n	130 s	n	n	180	n	n	-	n	n
Conargo	-	n	n	-	n	n	-	n	n	-	n	n
Deniliquin	-	n	n	115	n	-8.0	178 s	n	n	220 s	n	n
Jerilderie	-	n	n	-	n	n	-	n	n	-	n	n
Murray	-	n	n	180 s	n	n	255 s	n	n	-	n	n
Wakool	-	n	n	-	n	n	-	n	n	-	n	n
Murray-Darling	-	n	n	145 s	n	n	180 s	n	n	-	n	n
Balranald	-	n	n	-	n	n	-	n	n	-	n	n
Wentworth	-	n	n	145 s	n	n	180 s	n	n	-	n	n
Far West	85 s	n	n	140	-6.7	0.0	180	0.0	0.0	220 s	n	n
Broken Hill	-	n	n	140	-6.7	0.0	180	-4.0	0.0	235 s	n	n
Central Darling	-	n	n	-	n	n	-	n	n	-	n	n
Rest of NSW	150	3.4	7.1	200	0.0	5.3	270	1.9	8.0	350	2.9	9.4
NEW SOUTH WALES	340	4.6	6.3	350	0.0	7.7	350	1.4	9.4	440	3.5	10.0