



Yarrowonga West Catchment Drainage Master Plan



Photo: Yarrowonga 2012 Floods

August 2023

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To Be Approved

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REFERENCES:

Aluvium Report: Yarrowonga Framework Plan: Stormwater Drainage Strategy September 2019
BMT-WBM Report: Yarrowonga Flood Study

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APPENDIX 1- Preliminary Concept Plans

APPENDIX 2- BMT WBM Report- Flood Effected Properties in the 5 and 100 year Events

APPENDIX 3 – Preliminary Estimate of Costs Summary & Details

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1 BACKGROUND

Yarrawonga is located in northern Victoria on the Murray River and was flooded in February / March 2012 from high intensity storms. As a result, The Moira Shire Council developed goals to “improve the flood resilience of the catchment’s people and infrastructure” in the likelihood of another large storm event.

This Master Plan focuses on solving existing capacity issues within the West of Yarrawonga, following the initiatives recommended in the Alluvium Report “Yarrawonga Framework Plan: Stormwater Drainage Strategy September 2019” and Yarrawonga Flood Study prepared by BMT WBM, whilst also providing a drainage strategy for future residential and industrial development within the catchment.

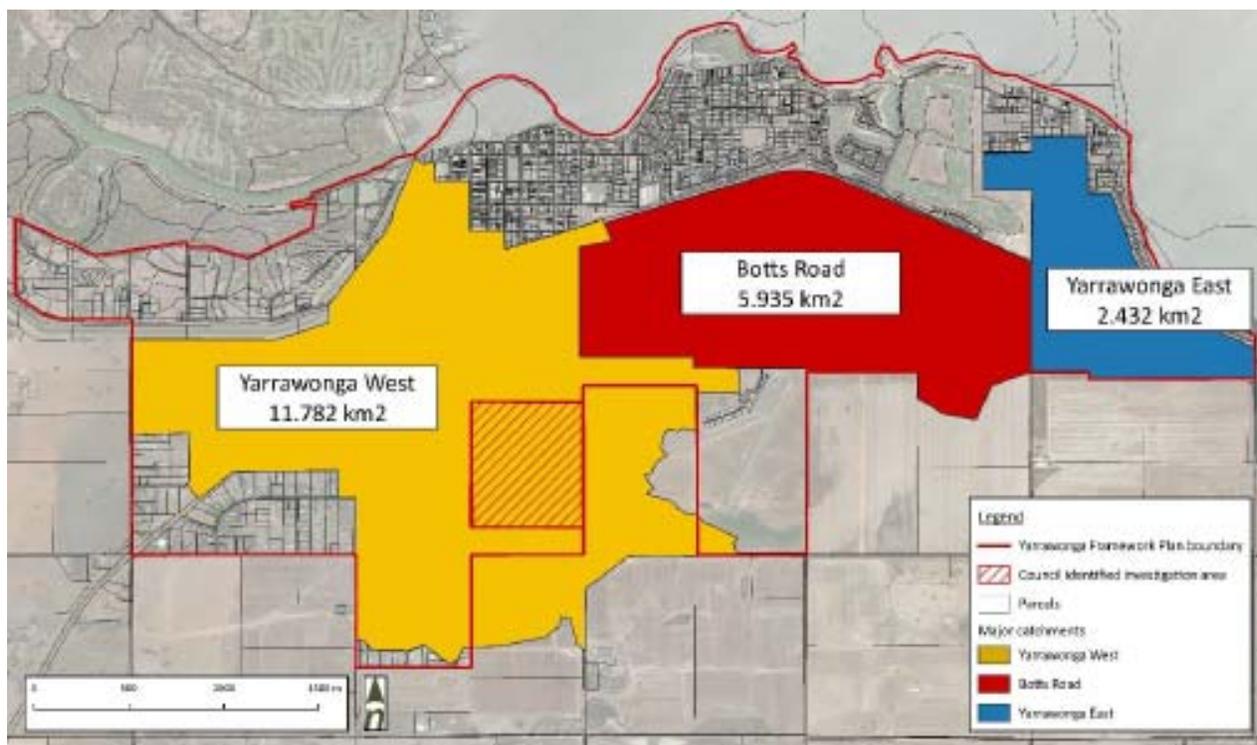


Figure 1: Yarrawonga Catchment Overview (Alluvium Report Sept 2019)

The Yarrawonga West Catchment as shown in yellow above is bound by:

- Reillys Road to the West
- Piper Street to the North
- Yarrawonga Aerodrome to the East and
- Channel Road to the South

Yarrawonga is on a trend for moderate incremental growth into the future, with lifestyle and natural attractions of the area as unique growth opportunities.

Growth scenarios for Yarrawonga (BMT WBM Report) indicate that the local population will increase to 12,159 people by the year 2030, a growth in population of 85%. With this future growth in Yarrawonga, there will be an increased strain on the undersized drainage system with the increase in impervious area as a result of new buildings.

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Yarrowonga West Catchment Drainage Master Plan

The expected growth in the Yarrowonga West drainage catchment is shown in Figures 2 and 3. These developments will require major infrastructure upgrades to existing roads, drainage and utilities.

For developers to proceed, a drainage strategy and direction from the Moira Shire Council is required so developers can contribute to the drainage infrastructure costs through Developer Contributions Schemes (if appropriate) or other agreed means.

However, Council has to address the existing drainage issues and flooding so that development can continue in the West drainage catchment.

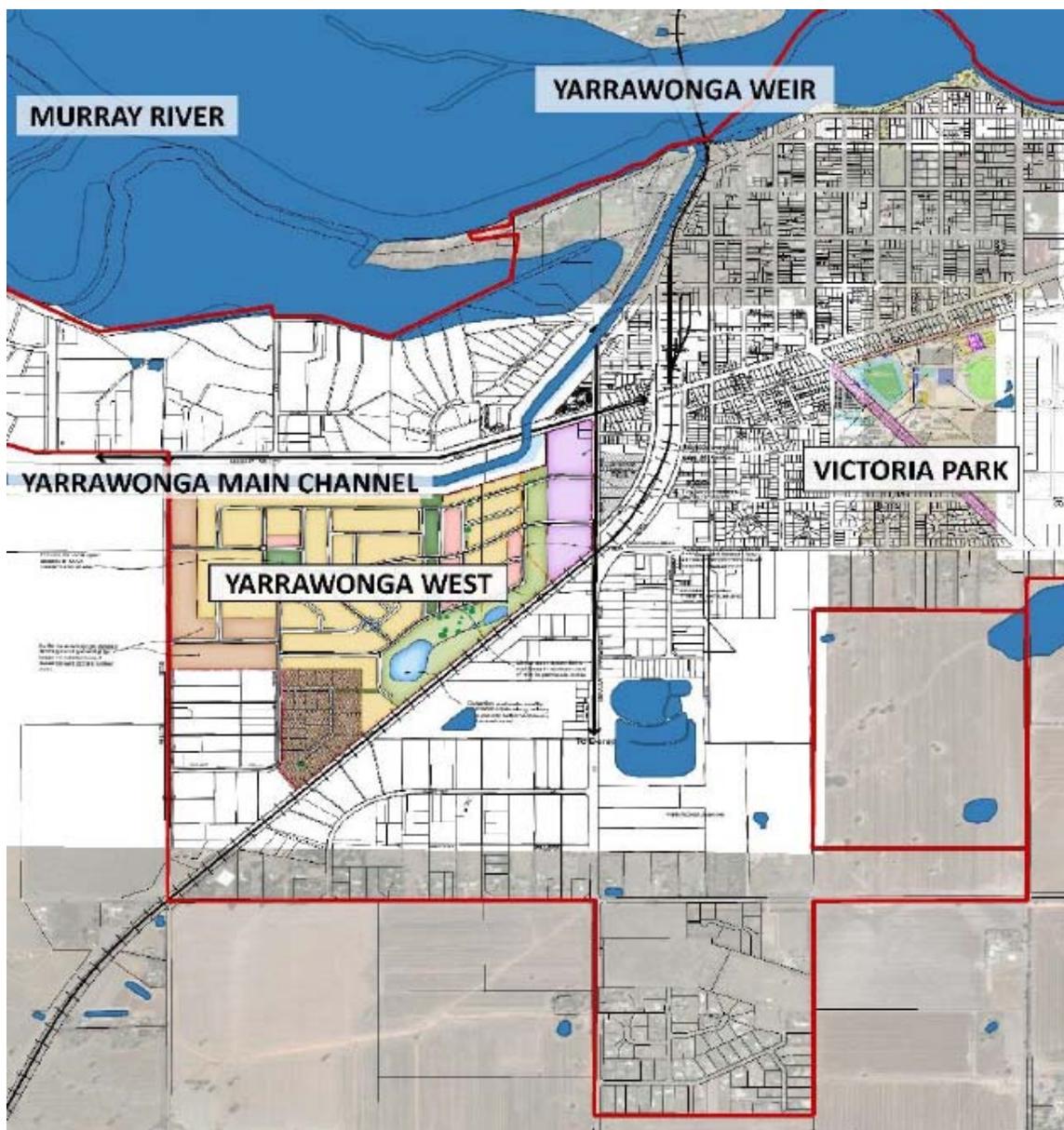


Figure 2: Yarrowonga West growth Areas (Alluvium Report 2019)

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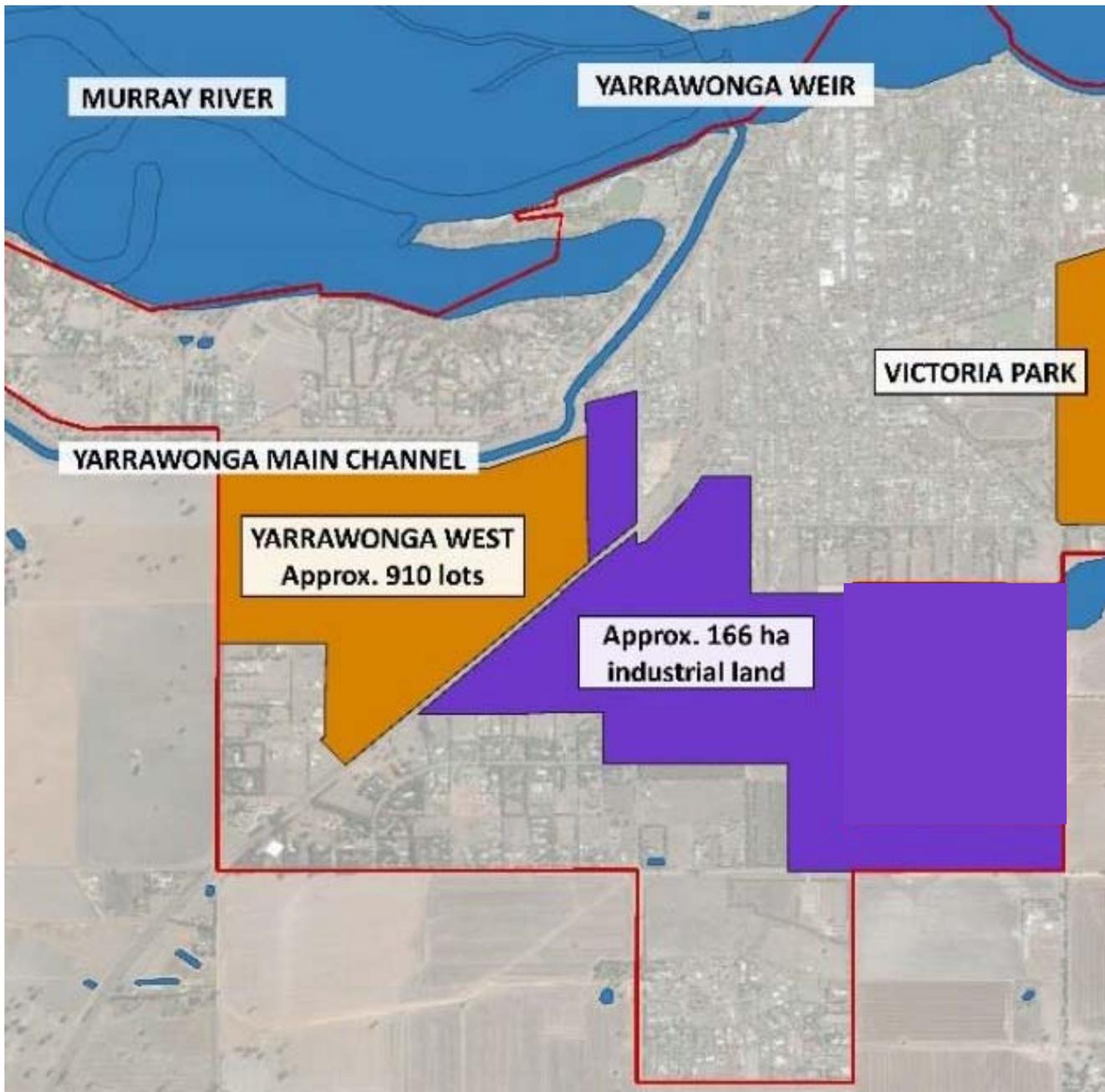


Figure 3: Yarrowonga West preliminary precinct structure plan (Alluvium Report 2019)

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2 FLOOD PRONE AREAS

The number of properties affected by flooding of depth greater than 10 mm in the Yarrowonga West catchment is 395 in a 5-year ARI and 1030 in the 100-year ARI (1%AEP) event as shown in Appendix 2. The number of properties identified and mapped to be affected by flooding is based on the cadastral property overlay shown in the Flood Depth Plan Appendix 2.

The 5 year ARI event results in modest flooding in Councils road reserves. Discharge exceeds the capacity of the table drains in many locations, resulting in minor overland flow through properties. Surcharging of Council pipe assets resulted in minor flooding within low lying areas.

One area experiencing more significant overland flooding on properties is the Murray Valley Highway and Gilmore Street intersection. The 100 year ARI (1%AEP) results show an increase in overland flooding compared to the 5 year ARI event with pipes beyond their capacity.

The rural area has experienced a more noticeable increase in flood depth than the urban area. The region bounded by the railway to the west, Murray Valley Highway to the north, and McLeod Street to the south has also seen a significant increase in both the extent and depth of flooding, with water levels rising by approximately 70mm.

Cahills Road at the far East extent of the catchment is also an area of concern for Council, typically water will sit within the table drains and only recede with evaporation or infiltration, due to a lack of gravity outfall.



Figure 4: 2012 Floods- South Road

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3 SCOPE REQUIREMENTS

The primary purpose of this report is to produce a Drainage Master Plan (DMP) for the Yarrowonga West urban, industrial and rural areas. This plan aims, where practical, to minimise exposure of private property to unacceptable levels of risk for events up to, and including, 1 in 100-year Average Recurrence Interval (ARI) flood event.

To achieve this, the plan will:

- Establish the areas of flooding in Yarrowonga West Catchment from the local runoff;
- Develop flood mitigation measures that will alleviate flooding in Yarrowonga West Catchment;
- Cost the flood mitigation; and
- Develop a prioritised Flood and Drainage Master Plan for Yarrowonga West Catchment.

A drainage strategy is required to inform the preparation of a Framework Plan for the Yarrowonga West Catchment and to guide industrial and urban growth within the catchment. This will allow the drainage framework to guide Council with what flood mitigation works are required to improve the existing drainage network and also guide proposed development within the Yarrowonga West Catchment to respond to complex flood conditions.

The strategy will outline what drainage infrastructure is required, including pipelines, overland flow paths, retarding basins, waterways, wetlands and gross pollution traps, so that land identified in the strategy can be set aside for these purposes to protect properties from further flooding in the future.

A drainage strategy ensures that planning for urban development is conducted on a catchment basis and meets appropriate standards for flood protection and environmental performance, including protection and enhancement of waterway and biodiversity values.

The Council has adopted the use of the Infrastructure Design Manual (IDM) for all new developments, including the requirements for retardation basin design. Adoption of IDM design criteria is to reduce Council's risk of flooding in large storm events in newly developed areas but will not prevent flooding downstream at the current undeveloped rate.

The Drainage Master Plan is required to guide Council and Developers to meet the Infrastructure Design Manual standards to ensure consistent standards for infrastructure design is used within Moirá Shire. The IDM key objectives are set out under the section Urban Drainage and Stormwater Treatment, and consider three main areas:

- Strategic approach;
- Flow management; and
- Management of water quality

The stormwater drainage assessment will focus on minimising the risk of further flooding impact on existing urban, industrial and commercial areas for a 1 in 100-year storm event. Key focuses will be on storing and treating storm water from each sub catchment in major flood events.

This assessment also considers the impacts on the 1% Annual Exceedance Probability (AEP) events (1 in 100 years average recurrence interval). Any storm events in excess of the 1 in 100 year will still cause some flooding but should be contained.

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Recommendations from the Alluvium Report below (Figure 5) have been adopted and included into the Yarrawonga West Catchment Drainage Master Plan recommendations.

The Alluvium Report recommended the use of 3 No. wetland systems within low lying areas of future development. However, the Alluvium Report recommendation does not suggest any solutions for the ongoing flooding within existing residential and Industrial areas which this Master Plan needs to address.

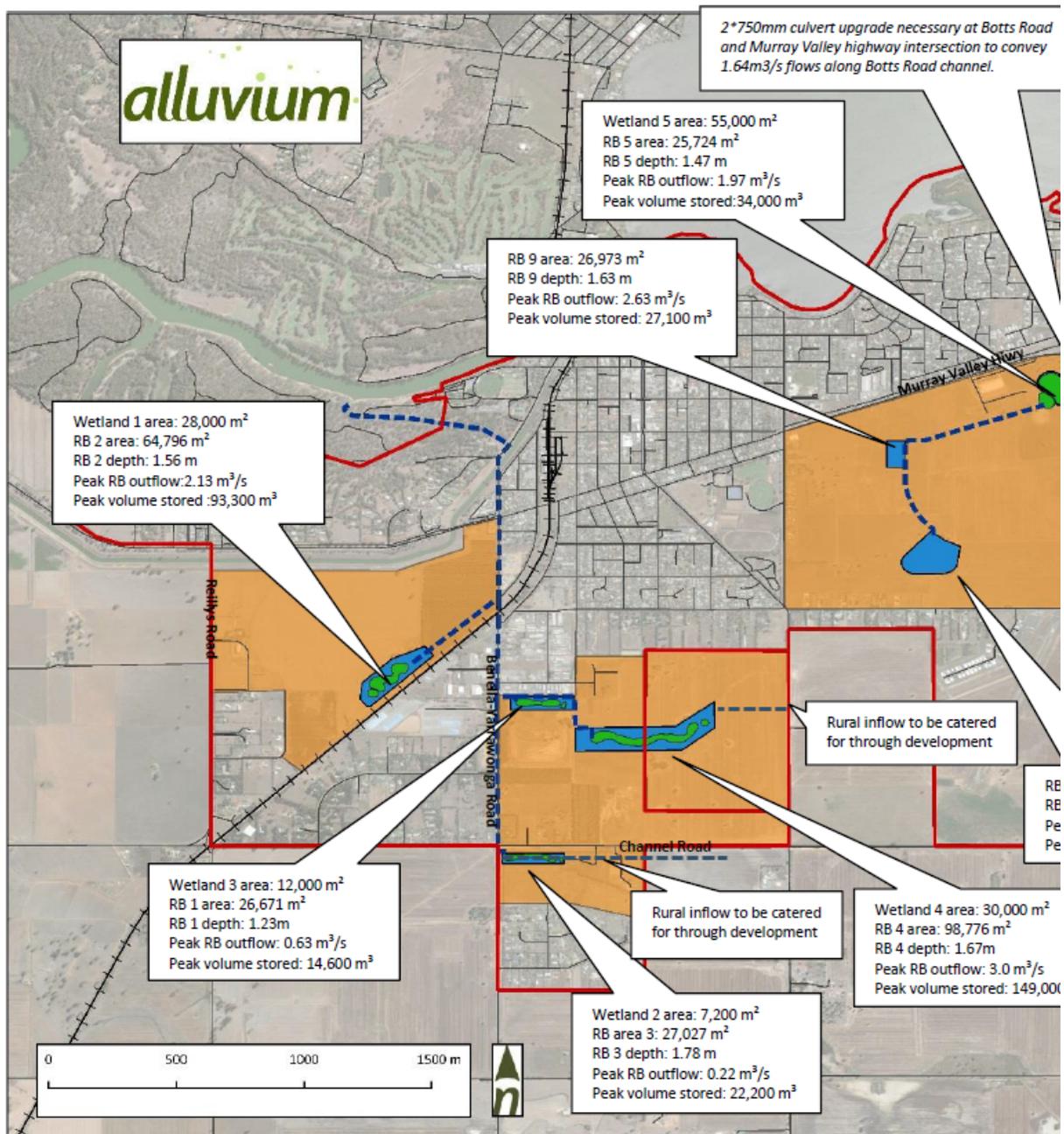


Figure 5: Yarrawonga Preliminary Analysis (Alluvium Report Sept 2019- Growth Areas Option 1) – Existing Developed Flood Prone Areas not considered in the Alluvium Report.

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4 EXISTING CONDITIONS

The Yarrowonga West Catchment Plan in Figure 6 shows all nodes and sub-catchment areas.

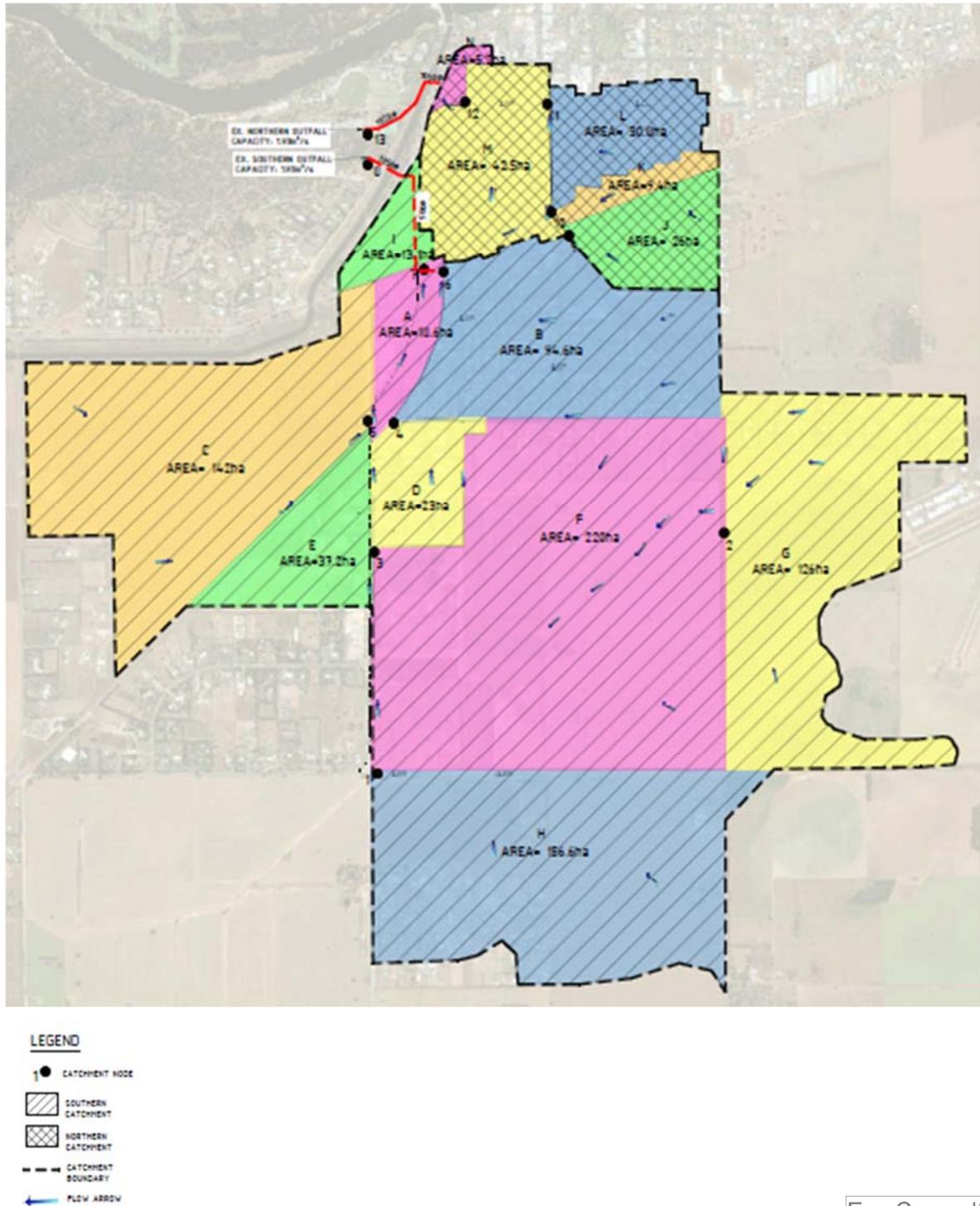


Figure 6: Yarrowonga West Catchment Plan

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4.1 Southern Outfall

- Catchment H is a semi developed area with 41.5ha of Low-density Residential Living, 110.3ha of Farming land and 4.8ha of Public open space. The overland flow travels north from the residential area via an open swale towards a farming channel. This flow then travels towards Node 1. The flow travels North under Channel Road and into a private dam. This dam fills to its maximum capacity then spills into a pit and travels West under Benalla-Yarrowonga Road to a surcharge pit, then flows into an open channel and travels north down Benalla-Yarrowonga Road. However, this system is not sustainable as the private dam often overflows and floods the property and surrounding area.
- Catchment G consists of 16.8ha of Low density living and 109.2ha of farming land. The overland flow travels from the Aerodrome and surrounding farming land to a small culvert under Old Wilby Road at node 2, then flows into catchment F.
- Catchment F flows along a depression towards the old North East Water sewerage treatment plant, where it pools, once deep enough, flows around the treatment basins and onto Benalla-Yarrowonga Road near node 3. Catchment F consists of 43.6ha of Industrial zone, 107.7ha of farming land, 35.1ha of low density living and 33.6ha of Public use zones.
- Catchment E consists of 37.2ha of industrial area. Overland flows travel along the open channel on Benalla-Yarrowonga Road and towards node 5.
- Similarly, catchment D consists of 23ha of industrial zone. The flows travel towards node 4 through open channel then to node 5.
- Catchment C is an undeveloped farming zone with 142ha. Flows travel towards the railway line, then into the open channel at node 5.
- Catchment B is fully developed, consisting of 74ha of residential zone, 3ha of railway reserve, 5ha of industrial, 9ha of schools and 3.6ha of parks. Catchment B is very flat and overland flow often pools in low lying areas. Generally, the flows travel east to west along Dunlop Street, McLean Street, McLeod Street and South Road towards the railway corridor. Stormwater then makes its way to node 6 and pools up within the railway reserve. Some of Catchment B's flow travel from node 6 to 7 through a 900mm dia pipe. Then through another 900mm dia pipe to the Yarrowonga main channel along Pearce Street.
- Catchment A consists of 13.3ha of railway reserve and 5.3ha of residential area. The overland flow travels east into the existing open channel towards node 7. Node 7 includes overland flows from catchments A, B, C, D, E, F, G and H.
- Catchment I consists of 12ha of residential housing and 1.1 ha of parks. All overland flow enters pits along Pearce Street and travel along a 900mm dia pipe towards the Main Channel crossing where the pipe is upsized to 1050mm dia. All catchments A to I are discharged through the southern outfall system.

4.2 Northern Outfall

- Catchment J consists of 23.6ha of public use zones and 2.42ha of residential zones. The overland flow travels towards the intersection of Gilmore Street and Dunlop Street (node 9).

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- Catchment K consists of 9.3ha of residential housing. The overland flow heads west towards the intersection of Gilmore Street and Murray Valley Highway (node 10). Contributing flows include both J and K.
- Catchment L includes 30.8ha of residential housing. The overland flow travels west towards Belmore Street, then North towards the intersection of Belmore and Piper Street (node 11).
- Catchment M includes 42.5ha of residential housing. Flows travel from node 10 north to Lott Street, then head west down Lott Street and travel north to Sharp Street towards node 12.
- Catchment N consists of 5.2ha of residential housing. The overland flow heads west towards Piper Street. They then travel south to the Main Channel crossing where the pipe is upsized to 1050mm on Irvine Parade. All catchments J to M are discharged through the Northern outfall system.

4.3 Existing Natural Storage

Currently there is a natural water storage to the south of the Murray Valley Highway (Figure 7), within the Vic Track Railway Reserve and is the natural low point for Catchment B and D with a natural storage of approximately 12,000m³. However, with future Bridge works and the possibility of an amended B-Double route, this natural storage cannot be relied upon longer term. Therefore, the Drainage Master Plan has not included this natural storage capacity for the improvement of Yarrowonga West drainage.



Figure 7: Natural Storage within Vic Track Railway Reserve.

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5 ISSUES

A stormwater catchment analysis of the Yarrowonga West Drainage Sub Catchments using the Rational Method and the Kinematic Wave Equation has allowed flows to be calculated at each nodal point (Refer to Appendix 1 Catchment plan). The results from each node provided in Tables 1 & 2 below.

NODE	DESCRIPTION	CONTRIBUTING CATCHMENTS	Total Area ha	TIME OF CONCENTRATION		5 YEAR FLOW			100 YEAR FLOW		
				Critical Catchment	Adopted tc min	A _s ha	I mm/hr	Q m ³ /s	A _s ha	I mm/hr	Q m ³ /s
1	Channel-Benella Rd	H	156.60	1	152.4	27.39	13.0	0.99	34.60	24.5	2.35
2	Old Wilby Road	G	126.00	2	194.2	16.76	11.0	0.51	21.17	20.6	1.21
3	Melaleuca Atreet South	F G H	502.60	1	179.1	112.83	11.6	3.65	142.52	21.8	8.63
4	South Road West	D	23.00	4	46.6	19.67	28.8	1.57	24.84	55.6	3.83
5	Railway	C D E F G H	704.80	3	191.7	186.46	11.1	5.74	235.52	20.8	13.58
6	Benella Road Ex housing	B	94.60	6	65.8	60.47	23.1	3.88	76.38	44.2	9.38
7	Outfall	A B C D E F G H	818.00	5	210.8	254.87	10.4	7.34	321.94	19.4	17.33
8	Channel Crossing	A B C D E F G H I	831.10	7	218.8	263.11	10.1	7.38	332.35	18.9	17.41

Table1: Southern Outfall:

NODE	DESCRIPTION	CONTRIBUTING CATCHMENTS	Total Area ha	TIME OF CONCENTRATION		5 YEAR FLOW			100 YEAR FLOW		
				Critical Catchment	Adopted tc min	A _s ha	I mm/hr	Q m ³ /s	A _s ha	I mm/hr	Q m ³ /s
9	Dunlop Street Roundabout	J	26.02	9	70.7	9.46	22.0	0.58	11.94	42.1	1.40
10	MVH Roundabout	J K	35.40	9	72.6	15.83	21.7	0.95	20.00	41.3	2.30
11	Belmore/Orr Street	L	30.80	11	76.7	20.84	20.9	1.21	26.33	39.8	2.91
12	Sharp/Orr Street	J K L M	108.70	12	68.3	65.42	22.5	4.10	82.63	43.1	9.89
13	Outfall	J K L M N	113.90	12	72.2	68.95	21.7	4.16	87.09	41.5	10.04

Table2: Northern Outfall:

The results show, the current flow at the Yarrowonga Main Channel drainage syphon crossings for a 100 year flow rate of 17.41m³/s and 10.04m³/s for the South and North respectively. However, the maximum capacity of both existing 1050mm dia reinforced concrete pipes (RCP) is 1.93m³/s, indicating there will be major pooling of stormwater behind the syphon causing significant surcharge issues upstream. As recorded in the 2012 floods, the surcharging pits caused a majority of the property damage in low lying areas due to stormwater backing up at the Yarrowonga Main channel syphon crossings. The capacity issues are provided in Table 3 below.

Rainfall Event Capacity	Southern Outfall (m ³ /s)		Northern Outfall (m ³ /s)	
	Existing Syphon	Current Flow	Existing Syphon	Current Flow
Q _{3month}	1.48		0.83	
Q ₁	3.56		1.98	
Q ₂	4.96		2.76	
Q ₅	7.38		4.16	
Q ₁₀	8.99		5.10	
Q ₂₀	11.12		6.34	
Q ₅₀	14.69		8.44	
Q ₁₀₀	17.41		10.04	
Q _{CAP-1050mm dia outfall}	1.93		1.93	

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Table 3: Outfall Rainfall Capacity Vs Rainfall Events

Table 3 shows the Southern and Northern Outfalls have capacity constraints. The Southern Outfall is an existing 1050mm dia that can only handle a 3-month rainfall event before causing flooding at the choke point (Node 7). Rainfall events greater than a 3-month event will cause upstream flooding issues.

For the Northern Outfall, the existing 1050mm dia RCP can only handle a 1-year or 63% AEP. Rainfall events greater than a 1-year event will cause upstream flooding issues.

All of the low-lying areas upstream of the two outfall syphon pipes will experience flash flooding and property damage with storm events greater than a 1-year event, this can be seen most commonly between Gilmore Street and Murray Valley Highway, South Road, McLeod Street, Acacia Street, Heyington Place, McLean Street, Sharp Street, Jackson Street, Cahills Road, Tom Street and Belmore Street.

If there is no strategy in place to fix the current and future flooding issues, the increased growth and development proposed for the Yarrowonga West catchment will further impact flooding in the area,.

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6 DRAINAGE STRATEGY

The Drainage Strategy implementation process would include the following steps:

1. Arrange preparation of a functional design for the retention basin and wetlands nutrient filter based on the catchment and in keeping with current design practices and requirements such as three month event treatment, hold 1% AEP event period of retention, freeboard, etc. The functional design should also include MUSIC modelling to take into account the environmental aspects of the basin designs. If possible, the basins should be designed in a manner to negate the need for a gross pollutant trap at the discharge location. The functional design would need to identify the total amount of land required for the fully developed basin arrangement suitable for the entire catchment.
2. Develop concept basin drawings from which developers and their consultants can use as a basis for detailed design for Southern Sub Catchments C,F,G & H.
3. The basin network functional design is to include a series of telemetry pump stations (with standby pumps) and rising mains to the existing outfall structures.
4. Design and construct retention basins, pump stations, rising mains with outfalls to the discharge point with a capacity suitable for the ultimate developed catchment. The cost of these works would be contributed to by Council and Developers where appropriate.
5. Prepare a Developer Drainage Contribution Scheme to levy developers to pay for the drainage scheme for Basins 2, 3 and 4 and associated works. The cost of preparing these documents, designs and assessments should also be included in the Developer Contributions so Council can recoup all costs.

The functional designs would include a discharge volume assessment from each developer or parcel of land to enable each basins volume to be constructed as required i.e. may be staged as part of the planning permit requirements. The planning requirements would also require the developers to pay scheme

contributions to Council to allow development to continue in the Yarrowonga West Drainage Catchment Area.

The permit conditions would require the Developers and their Consultants to design the basin volume based on the area contributing. Construction would be managed by the Consultant and audited by Council.

The development and implementation of the Drainage Scheme would involve a considerable amount of time to prepare, obtain approval from Council and then lodge the Developer Contributions Scheme with the Minister for approval.

Council will need to purchase additional land required for retention basins either by negotiation or compulsory acquisition under the Local Government Act. The process could take in the order of 18 to 24 months and would be subject to consultation with impacted stakeholders.

Developer Contributions or Section 173 Agreements for Basins 2,3 and 4

To accompany the Drainage Developer Contributions Plan (DCP), Council will need to complete Development Overlay Plans for the Yarrowonga West Growth areas, which will allow for a Development Contributions Plan (DCP) to be implemented for the construction of basins 2, 3 and 4, including pump stations and rising mains, to help reduce the overall costs. It is to be incorporated into the planning scheme as a schedule to clause 45.06 – Development Contributions Plan Overlay.

The DCP must set out:

- The extent of works;
- Services and facilities to be provided;
- Staging of works;
- Relate the need of the works, services or facilities to the proposed development of land area;
- Specify the estimated costs of each of the works, services and facilities;
- Specify the land in the area and the types of development in respect of which a levy is payable and the method for determining the levy payable in respect of any development of land; and
- Provide the procedures for the collection of a development infrastructure levy in respect to any development for which a permit is not required.

The DCP may:

- Exempt certain land or certain types of development from payment of a development infrastructure levy or community infrastructure levy or both, e.g. Council owned land may be exempt;
- Provide for different rates or amounts of levy to be payable in respect of different types of development of land or different parts of an area.

Council will be required to incorporate the DCP in the Planning Scheme and local and state levels in accordance with the Planning and Environment Act.

The estimated time to implement a DCP is around two years.

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An alternative to preparing a Developer Contributions Scheme is for the Planning Department to require Developers to create a Section 173 Agreement (S173) as a condition on the Developers Planning Permit to design and construct the retention basin, pump sets and associated works.

To help assess if a DCP or S173 is to be the preferred method for Developers to contribute to major infrastructure, the number of potential property owners impacted should be looked at. See Table 4 below.

Number Property Owners	Basin	S173 or DCP
1	2	S173
3	3	S173 or DCP
2	4	S173 or DCP

Table 4 Basin DCP or S173

As can be seen from Table 4 where the number of Property Owners is between 1 to 4 1 a S173 Agreement would be more suitable and timelier than a DCP.

7 RETENTION BASINS

The Yarrowonga West Drainage Catchment Master Plan which includes retention basins and pipe network is provided in Appendix 1. Due to the flat grades within Yarrowonga, a gravity system for overland flow will not work for a large storm event without the stormwater Retention Basins and associated works.

The works included in this study involve the construction of 4 No. retention basins (referred to as Basins) of varying size and 4 No. pump stations and rising mains. All of the pump stations will require a duty and standby pump as a backup and a provision for a diesel generator to operate the pumps when there is no power.

It is important to note that the basin capacity shown for Basin 1, 3 and 4 is the current capacity required for existing flows without any future development. No further large development can happen in the Yarrowonga West catchment until Basin 1 is constructed, providing an appropriate outfall for high intensity storm events.

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7.1 Southern Catchment

7.1.1 Basin 1

Basin 1 (shown as RB1 in Figure 8) is located on existing Crown land at the corner of South Road and Benalla Road, which is currently managed by council for sale yard purposes. The site is currently the old sale yards.

This basin will directly catch runoff from catchments D and E and part of catchment B. The storage required for this basin in a 1%AEP is 110,435m³ with an approximate TWL of 127.00m AHD. The TWL is set to be lower than the low-lying areas within the catchment to alleviate any surcharging through pits.

The basin will utilise a gravity fed stormwater network system for all runoff entering and a Telemetry Pump Station with 2 – 375mm dia rising mains and backup generator will also be required. This water will be held until the existing outfall at Node 7 has capacity. The telemetry pump will turn on and pump directly into the existing 900mm pipe (at the Murray Valley Highway) to the east of the railway.

Basin 1 will be large enough to hold water for 24hrs before releasing downstream and assumes the stormwater flows contributing to node 7 will be gone within this time frame before the pumps at Basin 1 commence. See Figure 8 below for concept.



Figure 8: Basin 1 Concept

The Crown land is for Public use (Municipal Purposes), therefore, Council may need to change the use from a saleyard purpose to a retarding basin as both functions for public use. In this event, The Department of Environmental, Land, Water and Planning (DELWP) should be notified for the public use change and approval for the proposed use should be obtained. Failure by Council or DELWP to allow this site for use as a retention basin will cause continual flood impacts on properties (approximately 180 residential properties and 25 industrial properties) in the area as there is no other alternative basin site available.

Furthermore, before any Concept Design commences following change of use approval a Site Contamination Assessment Report must be undertaken to ensure the removal of concrete and soil from this site complies with current regulations.

Sub Catchments, D and E (refer Appendix 1) will still present major flooding problems well into the future, triggering long term costs to Council in maintenance and prevent further development in the Yarrowonga West Catchment if the basin is not built.

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Figure 9: Basin 1 Crown Land Site

Without Basin 1, no future residential, commercial or industrial development can be unlocked within Yarrowonga West area and flooding in low lying areas will become more common.

As a result, this basin is the most critical piece of infrastructure for Yarrowonga West’s continual growth and should be included for deliberation in the Year 2 Council Works Budget and fully paid by Council to meet community expectations and reducing flood risk in Yarrowonga West.

Retention Basins 2,3 & 4 cannot be developed without Basin 1 as these basins have to discharge through Basin 1 to the Outfall.

7.1.2 Basin 2

Basin 2 is located at the future Yarrowonga West Precinct low point, Figure 10 below.

This basin will catch runoff from the existing catchment C farming land. The 24hr storage required for this undeveloped catchment in a 1%AEP is 28,037m³ and approximately 119,550m³ developed, with an approximate TWL of 127.00m AHD. The water will be pumped after a 24hr period via a 375mm dia rising main into the existing channel system near the railway crossing of Benalla-Yarrowonga Road.

The Telemetry Pump Station with duty, standby and generator will only release water into the existing outfall channel after a 24-hour storage period.

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Figure10 Basin 2 Location

It is intended that this basin is to be constructed when the land is developed by the Developers at no cost to Council.

The infrastructure required will include a pump station, backup generator, rising main, Telemetry, basin with ephemeral landscaping in the basin, fencing, access track around the basin for maintenance and perimeter landscape planting and maintenance for 24 months.

The land required for this basin is currently private ownership and would be transferred to Council as part of future development planning conditions.

In the interim, flooding will continue on the farm zoned land and outflows for this catchment are currently controlled by a 450mm dia culvert under Benalla-Yarrowonga Road.

7.1.3 Basin 3

Basin 3 is located at a low point to the east of the North East Water Sewerage Treatment Plant as shown in Figure 11 below.

This basin will catch runoff from the existing catchment F and G farming land. The 24hr storage required for this undeveloped catchment in a 1%AEP is 108,197m³, with an approximate TWL of 127.0m AHD. The water will be pumped after a 24hr period via a 375mm dia rising main into Basin 1.

The Telemetry Pump Station will only release water once the storage within Basin 1 has reduced to a satisfactory level.

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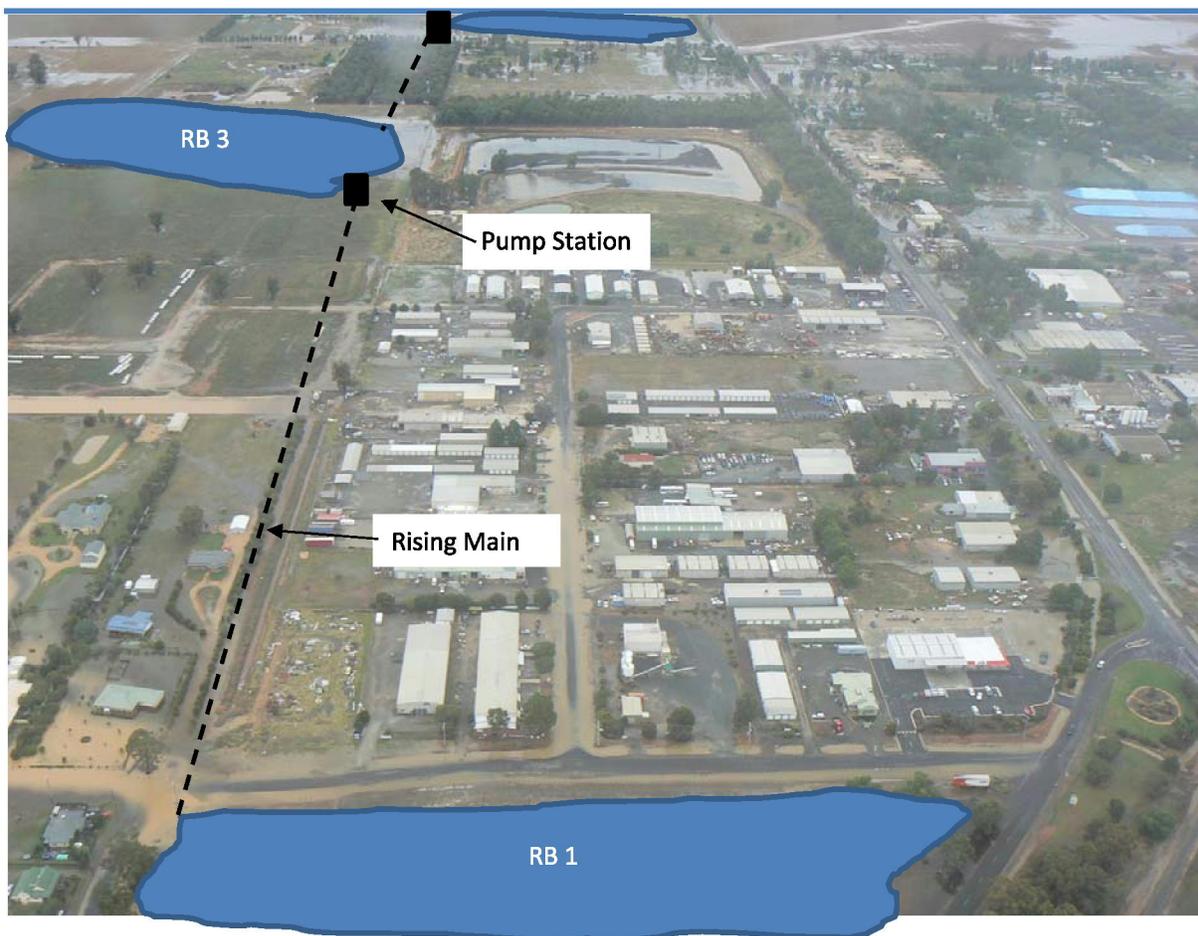


Figure 11: Basin 3 Location

The basin works should be included for deliberation in the Year 4 Capital Works Budget to be constructed to an undeveloped storage size.

The basins undeveloped works will eventually be partly paid for from contributions from Developers and they will also contribute to future extensions of the basin’s capacity.

Basin 3 cannot be developed until Basin 1 is operational. The infrastructure required will include a pump station, backup generator, rising main, Telemetry, basin earthworks with ephemeral landscaping in the basin, fencing, access track around the basin for maintenance and perimeter landscape planting and maintenance for 24 months.

The land for this Basin site is currently owned by Council and the value of the land should be included in the Developer Contribution Scheme or S173 Agreed Contribution. The basin size will need to increase once development occurs in this catchment to hold an approximate capacity of 263,556m³ and consume the total site area.

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7.1.4 Basin 4

Basin 4 is located at a low point to the south east corner of Channel Road as shown in Figure 12 below. This land is owned by Council and the entire site will be utilised for this basin, approximately 5.53 Ha.

Yarrowonga West Catchment Drainage Master Plan

This basin will catch runoff from the existing catchment H farming land and residential development. The 24hr storage required for this undeveloped catchment in a 1%AEP is 34,687m³ and will increase in storage capacity as future development occurs to approximately 114,577m³, with an approximate top water level (TWL) of 128.50m AHD.

The overland flow will run into the basin, with a 24hr stop capacity. After the 24hr period, the water by pumped via a 300mm dia rising main to Basin Number 3 via McNamara Walk as seen in Figures 11, 12 and 13.



Figure 12: Basin 4 Location

The pump will only run once Basin 3 commences pumping to Basin 1.

Basin 4 will merge with the existing retention channel to reduce the construction works. The cost to develop the Basin to hold the undeveloped storage should be included for deliberation in the Year 6 Capital Works Budget.

As development occurs in this catchment, Developer Contributions could be applied for part of the undeveloped works and all of the future basin enlargements. Basin 4 cannot be developed until Basin 3 is operational.

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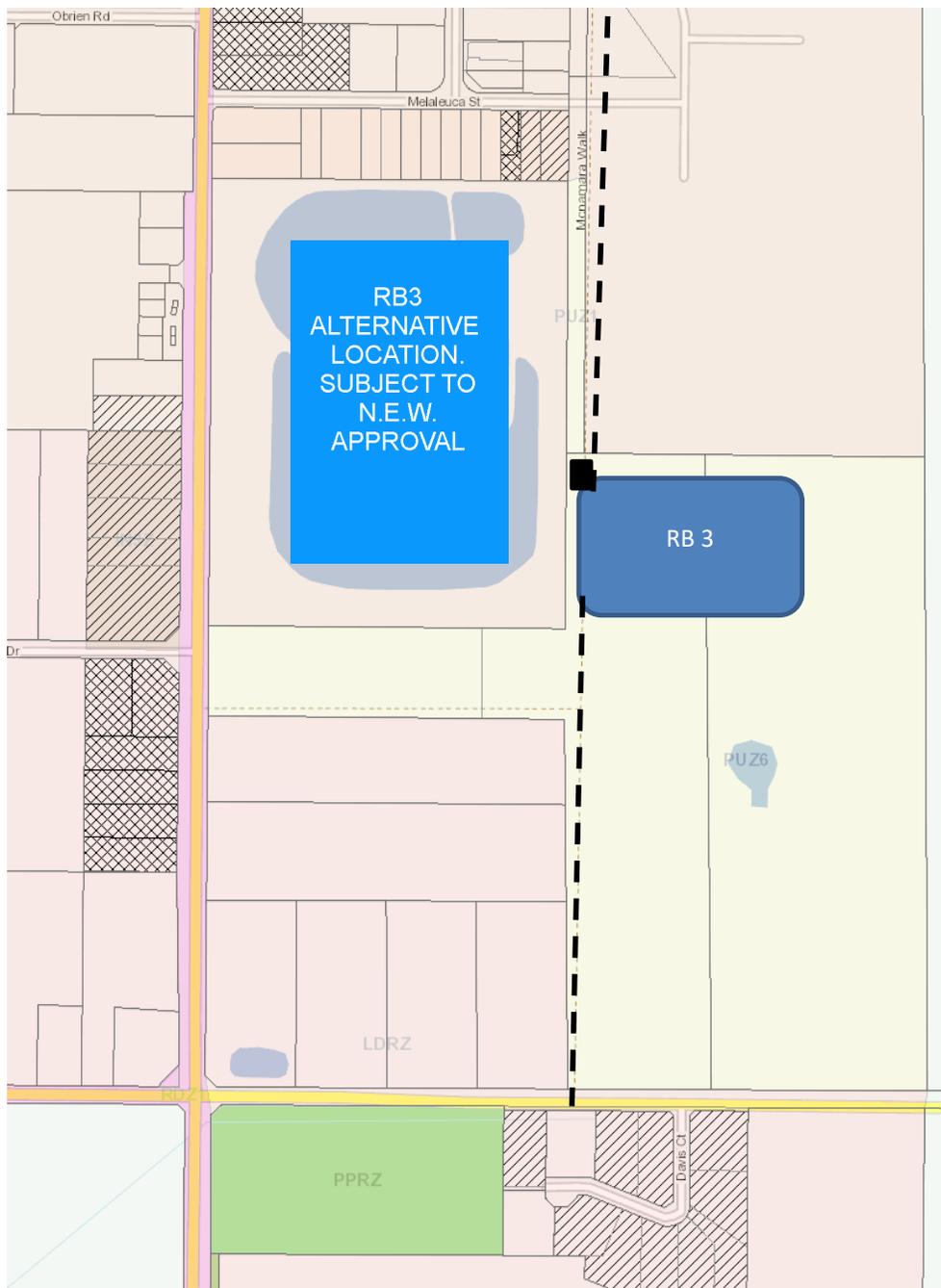


Figure 13: Basin 3 and 4 Zoning

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7.1.5 Cahills Road Upgrade Works

The Cahills Road drainage upgrade works consist of the existing table drains being regraded at 1 in 500 west to the 5-way intersection.

From here, the flows will be piped to the depression/farm basin in Old Wilby Road. The existing farm depression to the west of Old-Wilby road is to be lowered approximately 700mm to allow for overland flow from the farm depression to the proposed Basin 3. This depression will convey flows from the existing catchment from Cahills residential area and catchment F and G farming land.

There are to be negotiations with the existing Farm owner to create a 6 m wide drainage easement across this property in favour of Council. A low flow piped solution from the farm basin on Old-Wilby Road to the proposed Basin 3 may need to be considered with an open catch drain. This will enable the Cahills Road catchment to successfully drain via gravity.

This solution cannot be developed until Basin 3 has been constructed and an easement acquired across the farmland.

This should be included for deliberation in the Year 5 Capital Works Budget and fully paid by Council to instantly meet community expectations and lowering the risk of flooding.

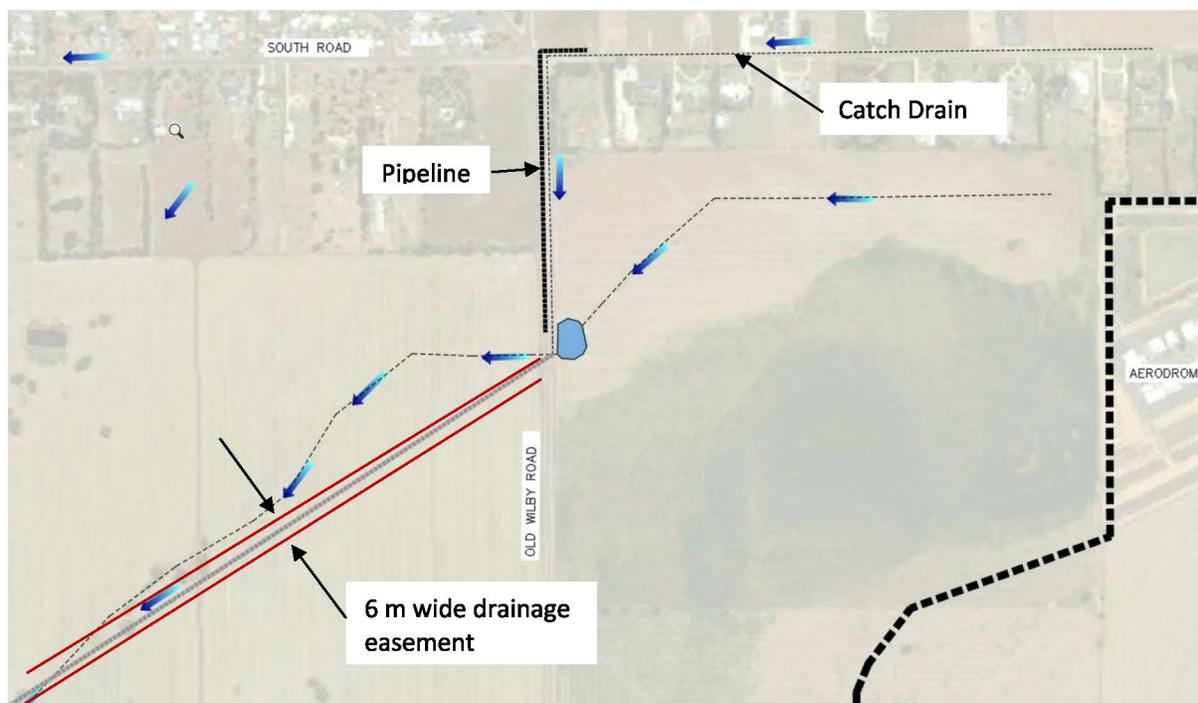


Figure 14: Cahills Road Drainage Upgrade

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7.2 Northern Catchment Works

The last location of concern within the Yarrowonga West Drainage Catchment is the intersection of Belmore Street and the Murray Valley Highway.

Yarrowonga West Catchment Drainage Master Plan

This flood prone area catches runoff from the existing catchments J and K and fails to drain away quickly in a large storm event inundating surrounding properties, as shown in Figure 15 below. This is most likely due to inadequate downstream pipe capacities, runoff backflow and pipe blockages.

A full detailed analysis needs to be completed to better understand the existing pipe network downstream, including, pipe sizes, direction of flow, low lying areas etc. The analysis will also need to present potential upgrades to the system that will assist in draining the area. This may include, upgrading the roundabout drainage and sending flows into the southern catchment, providing a new outfall under the Yarrowonga main channel or just doing some upgrade works within the catchment.

The works should be held off until the Basin to the east of Woods Rd (Glanmire Park) has been constructed. With the construction of Basins 1,3, 4 and Glanmire Park development within foreseeable future, the flood risk around this area may be tolerable and may only require some minor diversion works.

The Catchments will need to be reviewed once Basins 1, 3 and 4 have been constructed to determine the need for the upgrade works in the Northern Catchment.

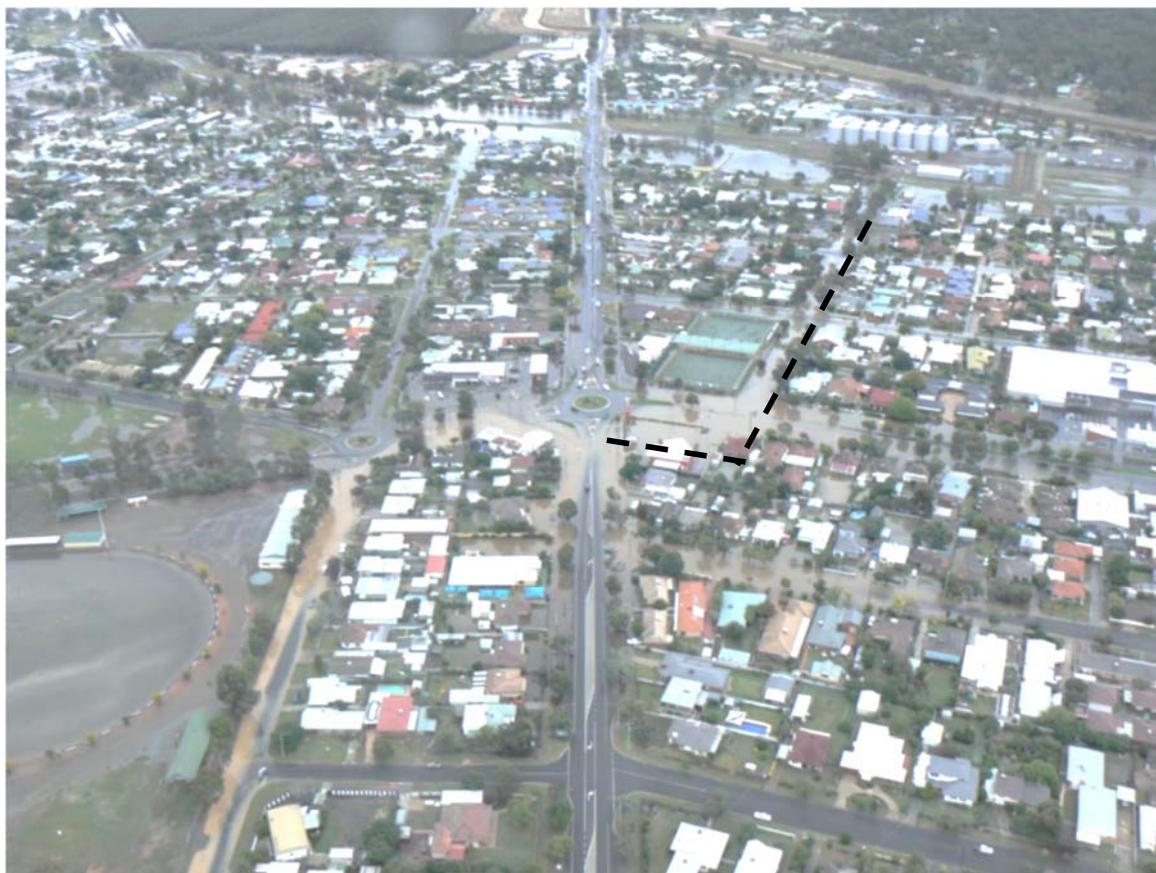


Figure 15: Northern Catchment Drainage Issues

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7.3 Summary of Retention Basin Capacities:

Table 5 is a summary of Stormwater storage volumes for undeveloped and fully developed conditions.

The approximate Total Basin Capacity undeveloped and fully developed gives an indication of the flooding problem in this catchment and the need to implement a drainage strategy.

Basin	Catchment	Area (ha)	C100 (weighted)		24hr 100 year Storage		Area (assume 3.5m Deep)	
			Existing	Developed	Undeveloped Size (m ³)	Developed Size (m ³)	Undeveloped Area (ha)	Developed Area (ha)
1	D, E, 0.5B	206.6	0.92	0.92	110,435	110,435	3.1552	3.1552
2	C	142	0.197	0.84	28,037	119,550	0.8011	3.4157
3	F, G	346	0.312	0.76	108,197	263,556	3.0913	7.5302
4	H	156.6	0.221	0.73	34,687	114,577	0.9911	3.2737
Total Capacity Required:					281,356	608,118	8.039	17.3748

Table 5: Yarrowonga West Catchment Retention Basins-Undeveloped Vs Developed

Note: Basin Area in Table 5 is approximate only and should be determined at Functional Design Stage

8 SUMMARY

In summary what needs to be done as best practice for Council is to relieve the stress on the existing outfall system and reduce flooding in the Yarrowonga West Drainage Catchment as follows:

Southern Outfall

- Overland flow from catchments A&I will enter the existing 900mm dia pipe at the corner of Oaten Street and the Murray Valley Highway and exit through the 1050mm dia pipe under the Yarrowonga main channel.
- Catchment B northern streets will flow into the natural low point in the railway reserve. This will then enter the 900mm dia pipe system and release. The southern streets of catchment B will now be directed by gravity into Basin 1 within the sale yards. This basin will have enough capacity to hold flows for a Q100 for 24hrs. The telemetry pump will release water once the 900mm dia pipe has capacity.
- All overland flow from catchments E and D will enter Basin 1 via gravity.

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- Catchment C will flow via gravity into Basin 2 and be held for 24hr or until there is capacity in the 900mm dia outfall pipe at the Murray Valley Highway. Once there is capacity, the telemetry pump station will release water at a pre-developed rates into the large channel running along Oaten Street, the flows will then enter Node 7 grated pit and travel north towards the Yarrowonga Main Channel outfall. Both Basins 1 and 2 will be discharging into the 900mm dia outfall at the same time.
- Catchments F and G will make their way to Basin 3 via gravity with the Cahills road drainage upgrade strategy. This Basin will hold the overland flow for 24hrs and start pumping once Basin 1 has proceeded to pump, it is recommended that the discharge rate is less than the discharge rate from Basin 1.
- Catchment H will flow via gravity into Basin 4. Using a telemetry pump, the water will be pumped to Basin 3 via McNamara Walk at pre development rates, the water will then be pumped out of Basin 3, then to basin 1. It is recommended that the discharge rate from Basin 4 is less than the discharge rate from Basin 3.
- That Basin 1 release water at a rate of 250L/s via a rising main to ensure the Basin is not overtopped after 24 hours, and to allow any downstream flows to discharge prior. Basin 1 will continually release water until all basins are empty.

Northern Outfall

Further Analysis needs to be completed to identify the network issues in the area once Basin 1 and 3 are constructed.

9 COST ANALYSIS

The Summary of the overall costs for each Basin and associated works excluding future land development is detailed in Table 6 below.

Basin 1 is within an existing developed area and no developer contributions will apply. Basin 1 requires DELWP approval to use this land as a retention basin.

Basin 3 and 4 cost estimations is for an undeveloped drainage system and will be further upgraded with developer contributions or S173 Agreements when future development starts. The two Basins will be developed on Council owned land.

Basin 2 will be developed at full cost by Developers.

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Preliminary Estimate of Costs Summary Yarrowonga West Catchment Drainage Feasibility

Item No.	Description	Qty	Unit	Rate \$	Amount \$
	Basin 1 - Saleyards Site				
	Crown land approval required to use site for Stormwater retention basin and Site Soil Contamination Assessment Report.				
	Sub Total				\$4,272,200.00
	Consultancy Fees 15% - Design, Survey, Geotech, Project Management				\$ 640,830.00
	Contingency 15%				\$ 640,830.00
	Total Preliminary Estimate exc GST				\$5,553,860.00
	Basin 2- Undeveloped				
	Private Property: To be developed by Developers in Future at no cost to Council				
	Sub Total				\$ 1,303,944.00
	Consultancy Fees 15% - Design, Survey, Geotech, Project Management				\$ 195,591.60
	Contingency 15%				\$ 195,591.60
	Total Preliminary Estimate exc GST				1,695,127.20
	Basin 3- Undeveloped				
	To be extended by Developers in Future at no cost to Council to cater for developed flows				
	Sub Total				\$ 3,221,440.00
	Consultancy Fees 15% - Design, Survey, Geotech, Project Management				\$ 483,216.00
	Contingency 15%				\$ 483,216.00
	Total Preliminary Estimate exc GST				4,187,872.00
	Basin 4- Undeveloped				
	To be extended by Developers in Future at no cost to Council to cater for developed flows				
	Sub Total				\$ 1,455,740.00
	Consultancy Fees 15% - Design, Survey, Geotech, Project Management				\$ 218,361.00
	Contingency 15%				\$ 218,361.00
	Total Preliminary Estimate exc GST				1,892,462.00
	Northern Catchment Analysis				
	To provide further analysis on the drainage network and provide recommendations				
	Sub Total				\$ 50,000.00
	Contingency 15%				\$ 7,500.00
	Total Preliminary Estimate exc GST				57,500.00
	Cahills Road Upgrade				
	To upgrade the existing Cahills Road drainage network to reduce flooding				
	Sub Total				\$ 395,000.00
	Consultancy Fees 15% - Design, Survey, Geotech, Project Management				\$ 59,250.00
	Contingency 15%				\$ 59,250.00
	Total Preliminary Estimate exc GST				\$513,500.00
	Total Overall Preliminary Estimate exc GST				\$13,900,321.20
	Total Overall Preliminary Estimate for Basin 1, 3, 4 and Cahills Upgrade exc GST				\$12,147,694.00

NOTE: Costs are high end preliminary estimates only. Final cost subject to detailed design and tendering.

Table 6: Preliminary Estimate of Costs Summary

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10 RECOMMENDATIONS

The current drainage outfall can only convey a one-year rainfall event before surcharging and causing major flooding within the Yarrowonga West Catchment area.

This is a real concern for Council in the absence of adequate drainage infrastructure and overland flow paths to convey stormwater as it will preclude any future development occurring in the Yarrowonga West Drainage Catchment until the drainage strategy is implemented.

The Yarrowonga West Drainage Catchment Master Plan recommendations are as follows:

1. Council adopts this Master Plan as the preferred approach to deliver the best long term stormwater infrastructure outcomes for Council, community and future development within the Yarrowonga West Drainage Catchment.
2. The project delivery program and preliminary infrastructure cost estimates be included onto Councils forward budget estimates for deliberation and adoption. It is very important that Basin 1 is delivered as soon as possible as no other development can happen within the Yarrowonga West Catchment until this occurs. This also applies to Industrial land in Acacia Street and Melaleuca Street where road and drainage upgrade works are currently being considered. .

Financial Year	Total	Deliverable
Y1	\$160,000	Development of Yarrowonga West Drainage Masterplan
Y2	\$550,000	Stage 1 design Stage 2 design Stage 3 design
Y3	\$4,700,000	Stage 1 Construction
Y4	\$4,285,000	Stage 2 Construction Stage 3 – Construction
Y5	\$250,000	Stage 5 – Design
Y6	\$1,600,000	Stage 4 Construction
Y7	\$800,000	Stage 5 Construction
Total	\$12,045,000	

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NOTE: Proposed roll out schedule is for discussion purposes only. Refer to Council budget documents for scheduled roll out.

Table 7: Summary of Work

3. Council to apply for Federal/State funding for each of the proposed projects above.
4. The existing storm water drainage system to be re-modelled using current design criteria both with the original sub-catchments and the proposed revised sub-catchments resulting from this report.
5. Council agrees to the current Saleyards site being used for Basin 1 to reduce flooding effects of large rainfall events in the Yarrowonga West Drainage Catchment. In particular -
 - a. An application needs to be made to DELWP for approval to change the Crown Land status from Saleyards to Retention Basis use by Council. DELWP approval to use the saleyards site is paramount to ensuring the proposed Yarrowonga West Catchment Drainage Master Plan goes ahead and doesn't restrict any future development in the catchment.
 - b. A site Soil Contamination Report for the Saleyards needs to be prepared as soon as possible.
 - c. Detailed design begins straight away.
6. Council engage a suitably qualified and experienced consultant to undertake the functional design, RORB modelling, cost estimates and prepare either a Developer Contribution Scheme for Basins 2,3 & 4 or for Council to negotiate with land owners/developers an agreed drainage cost per hectare secured via a Section 173 Agreement.
7. That Basin 2 be fully developed by Developers, so is not required until a land development application for subdivision of this sub-catchment is received by Council.
8. Upgrade works within the Northern Catchment around the Belmore and Murray Valley Highway intersection cannot occur until more analysis has been undertaken on the drainage network to find the best solution. With the construction of Basins 1,3, 4 and Glanmire Park development within foreseeable future cutting off flood waters from crossing the Murray Valley Highway the flood risk around the showgrounds may be tolerable with some minor diversion works.
9. If any developer is requiring soil for fill in the future, they can dig Basins 3 and 4 on Councils behalf to an approved design which will have some significant cost savings.

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APPENDIX 1- Preliminary Concept Plans

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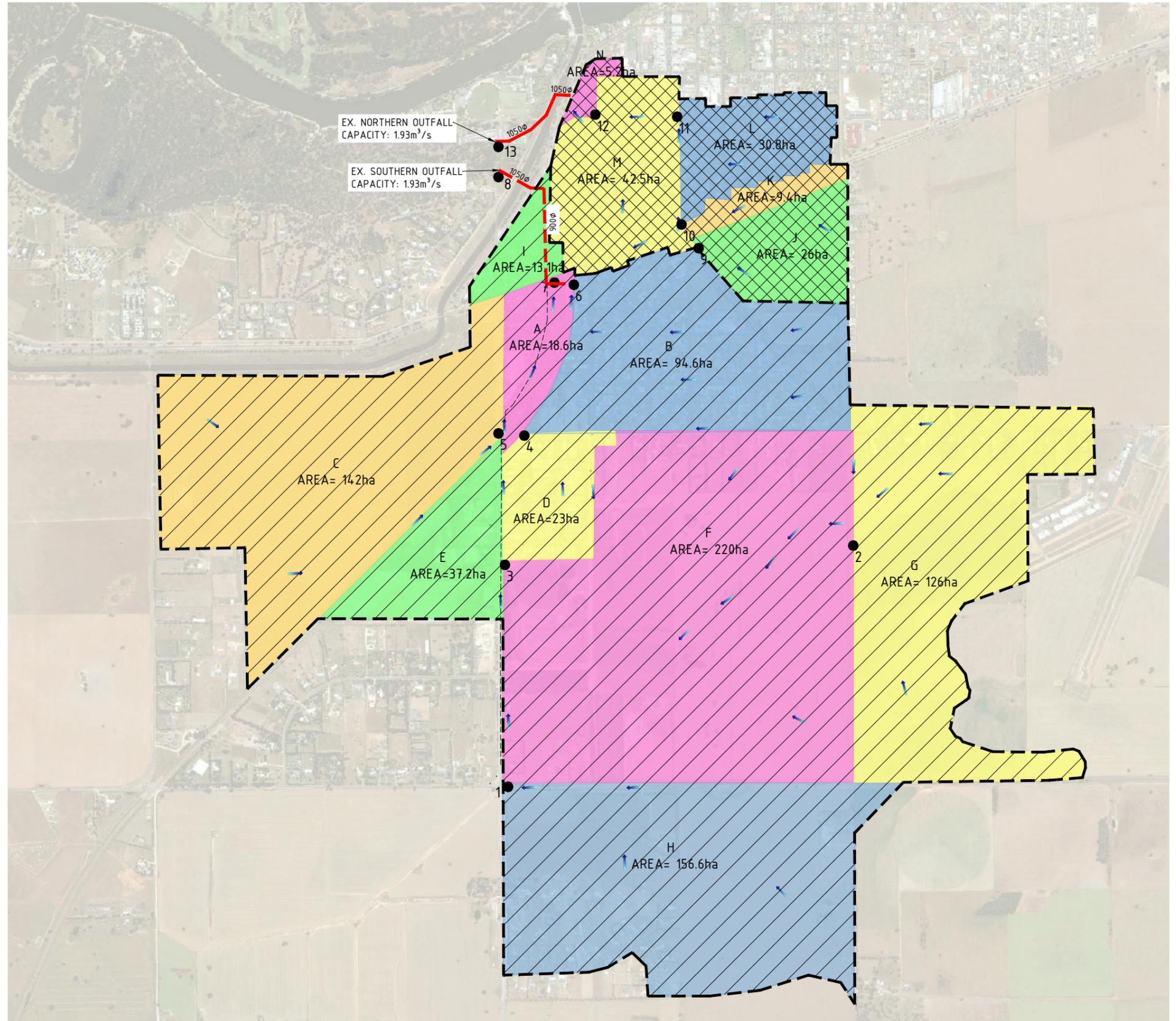
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LEGEND

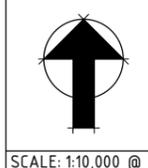
- CATCHMENT NODE
-  SOUTHERN CATCHMENT
-  NORTHERN CATCHMENT
- - - CATCHMENT BOUNDARY
-  FLOW ARROW

Rainfall Event Capacity	Southern Outfall (m3/s)	Northern Outfall (m3/s)
Q _{3month}	1.48	0.83
Q ₁	3.56	1.98
Q ₂	4.96	2.76
Q ₅	7.38	4.16
Q ₁₀	8.99	5.10
Q ₂₀	11.12	6.34
Q ₅₀	14.69	8.44
Q ₁₀₀	17.41	10.04
Q _{CAP-1050mm dia outfall}	1.93	1.93

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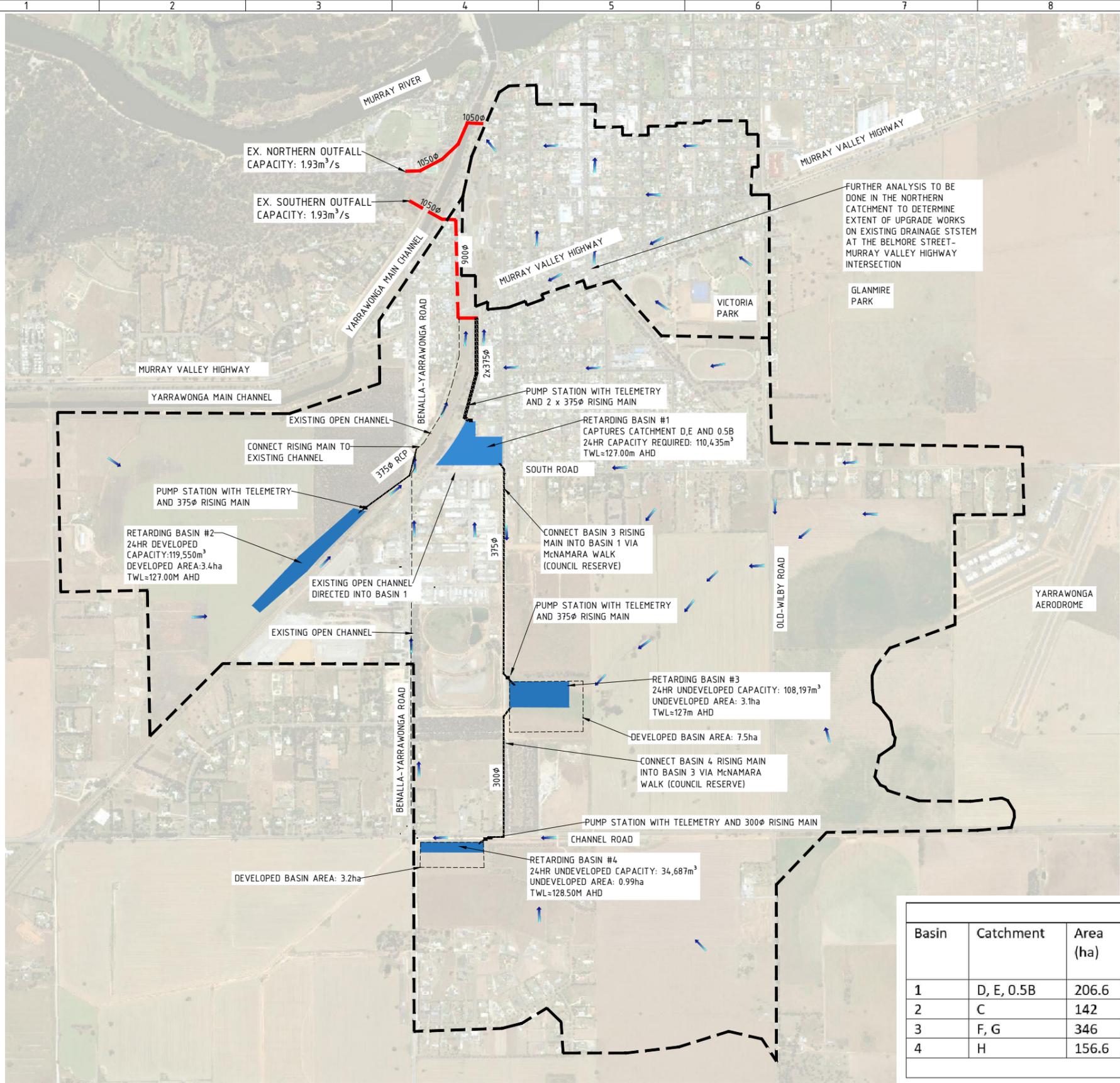


MOIRA SHIRE COUNCIL
YARRAWONGA WEST DRAINAGE STRATEGY
CATCHMENT PLAN

DRAWING NO.:1
PROJECT NO.:

Revision: A
Sheet No.:1 of 6

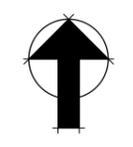
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Basin	Catchment	Area (ha)	C100 (weighted) Existing	C100 (weighted) Developed	24hr 100 year Storage		Area (assume 3.5m Deep)	
					Undeveloped Size (m ³)	Developed Size (m ³)	Undeveloped Area (ha)	Developed Area (ha)
1	D, E, 0.5B	206.6	0.92	0.92	110,435	110,435	3.1552	3.1552
2	C	142	0.197	0.84	28,037	119,550	0.8011	3.4157
3	F, G	346	0.312	0.76	108,197	263,556	3.0913	7.5302
4	H	156.6	0.221	0.73	34,687	114,577	0.9911	3.2737
Total Capacity Required:					281,356	608,118	8.039	17.3748

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MOIRA SHIRE COUNCIL
YARRAWONGA WEST DRAINAGE STRATEGY
OVERALL BASIN CONCEPT PLAN

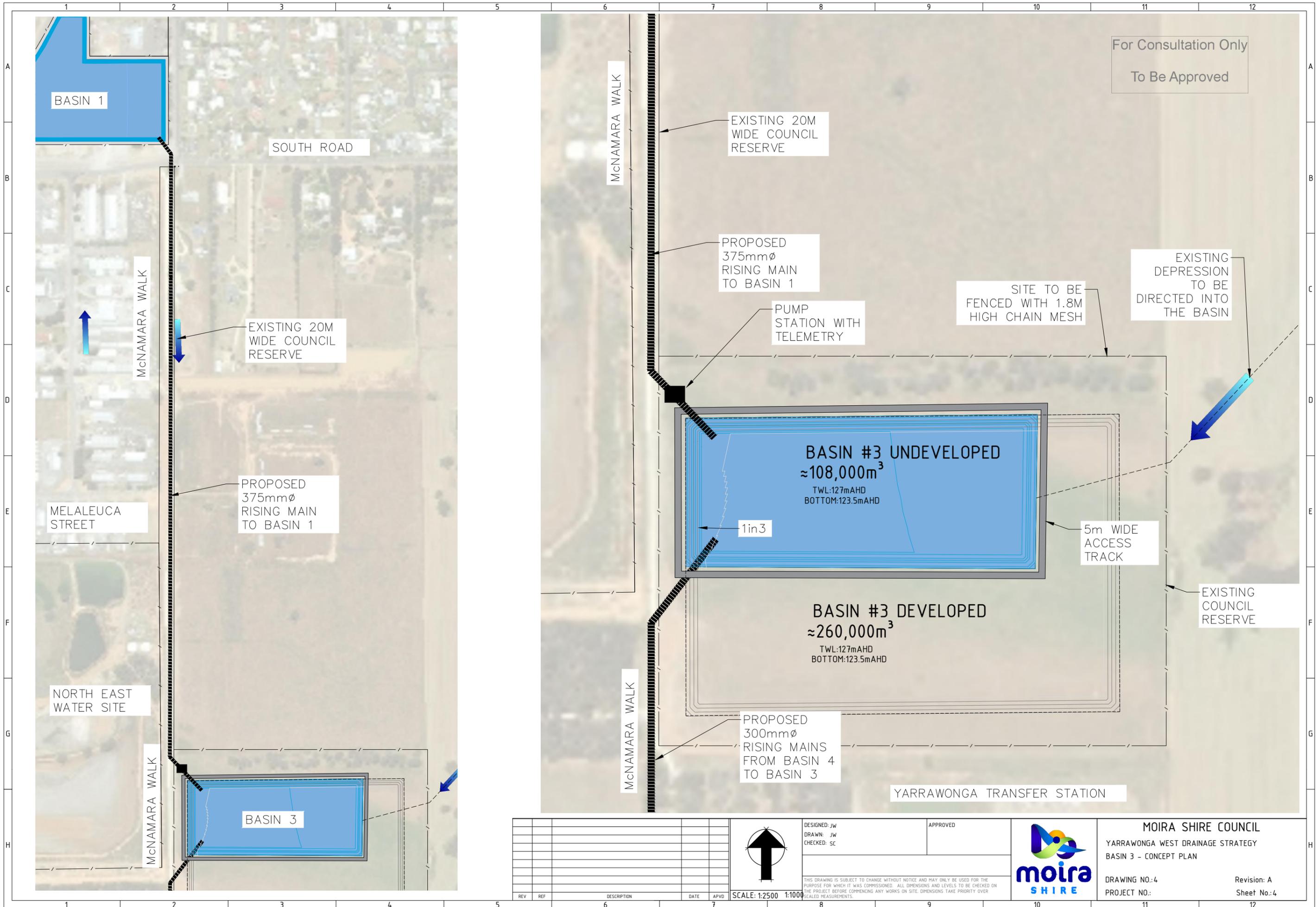
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Revision: A
Sheet No.: 2

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To Be Approved



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BASIN 1

SOUTH ROAD

McNAMARA WALK

EXISTING 20M WIDE COUNCIL RESERVE

MELALEUCA STREET

PROPOSED 375mm ϕ RISING MAIN TO BASIN 1

NORTH EAST WATER SITE

McNAMARA WALK

BASIN 3

McNAMARA WALK

EXISTING 20M WIDE COUNCIL RESERVE

PROPOSED 375mm ϕ RISING MAIN TO BASIN 1

PUMP STATION WITH TELEMETRY

SITE TO BE FENCED WITH 1.8M HIGH CHAIN MESH

EXISTING DEPRESSION TO BE DIRECTED INTO THE BASIN

BASIN #3 UNDEVELOPED
 $\approx 108,000\text{m}^3$
TWL: 127mAHD
BOTTOM: 123.5mAHD

1 in 3

5m WIDE ACCESS TRACK

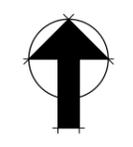
EXISTING COUNCIL RESERVE

BASIN #3 DEVELOPED
 $\approx 260,000\text{m}^3$
TWL: 127mAHD
BOTTOM: 123.5mAHD

PROPOSED 300mm ϕ RISING MAINS FROM BASIN 4 TO BASIN 3

YARRAWONGA TRANSFER STATION

REV	REF	DESCRIPTION	DATE	APVD



SCALE: 1:2500 1:1000

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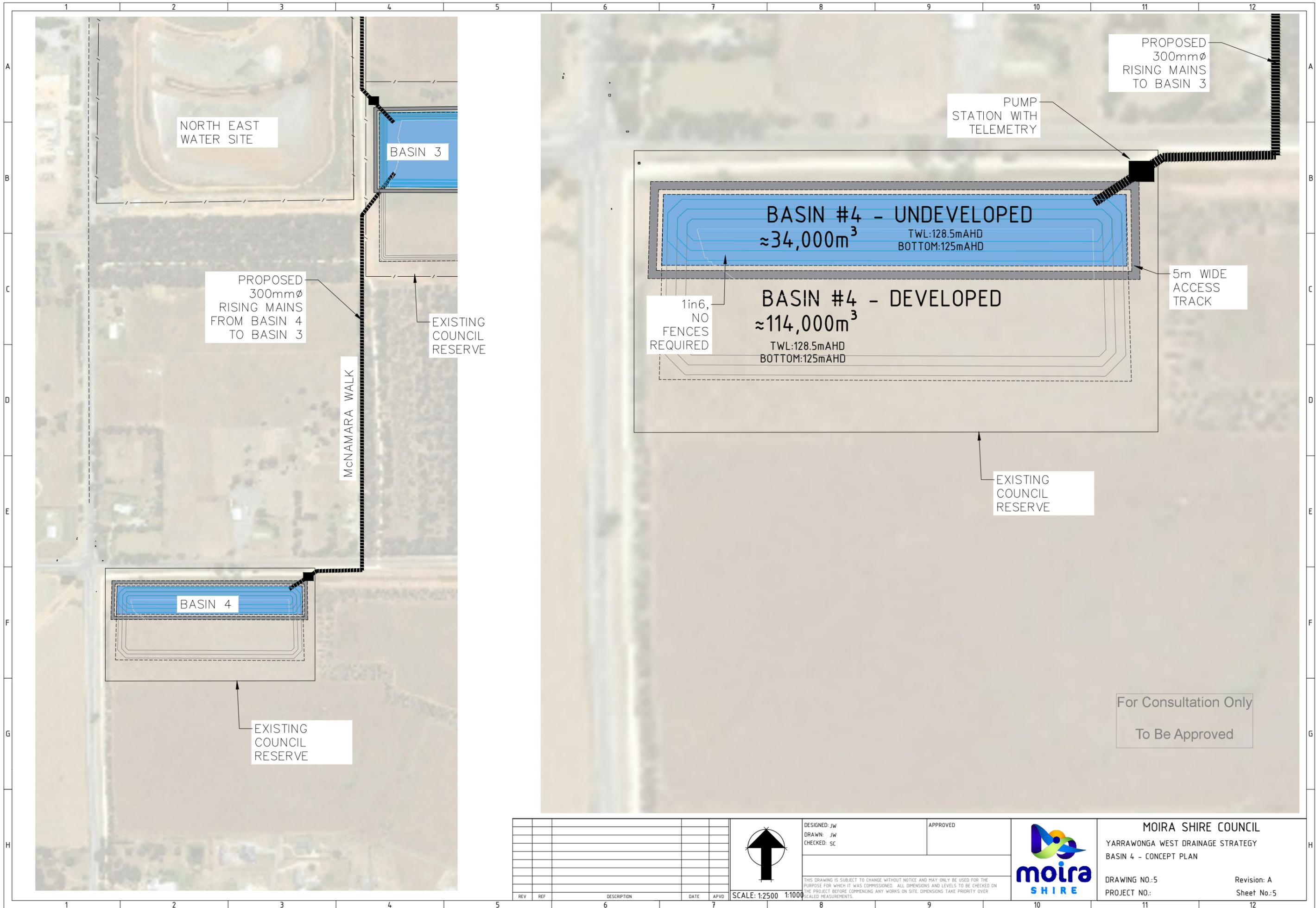
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YARRAWONGA WEST DRAINAGE STRATEGY
BASIN 3 - CONCEPT PLAN

DRAWING NO.: 4
PROJECT NO.:

Revision: A
Sheet No.: 4

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NORTH EAST WATER SITE

BASIN 3

PROPOSED 300mmØ RISING MAINS FROM BASIN 4 TO BASIN 3

EXISTING COUNCIL RESERVE

McNAMARA WALK

BASIN 4

EXISTING COUNCIL RESERVE

PROPOSED 300mmØ RISING MAINS TO BASIN 3

PUMP STATION WITH TELEMETRY

BASIN #4 - UNDEVELOPED

≈34,000m³

TWL:128.5mAHD
BOTTOM:125mAHD

5m WIDE ACCESS TRACK

BASIN #4 - DEVELOPED

≈114,000m³

TWL:128.5mAHD
BOTTOM:125mAHD

1in6, NO FENCES REQUIRED

EXISTING COUNCIL RESERVE

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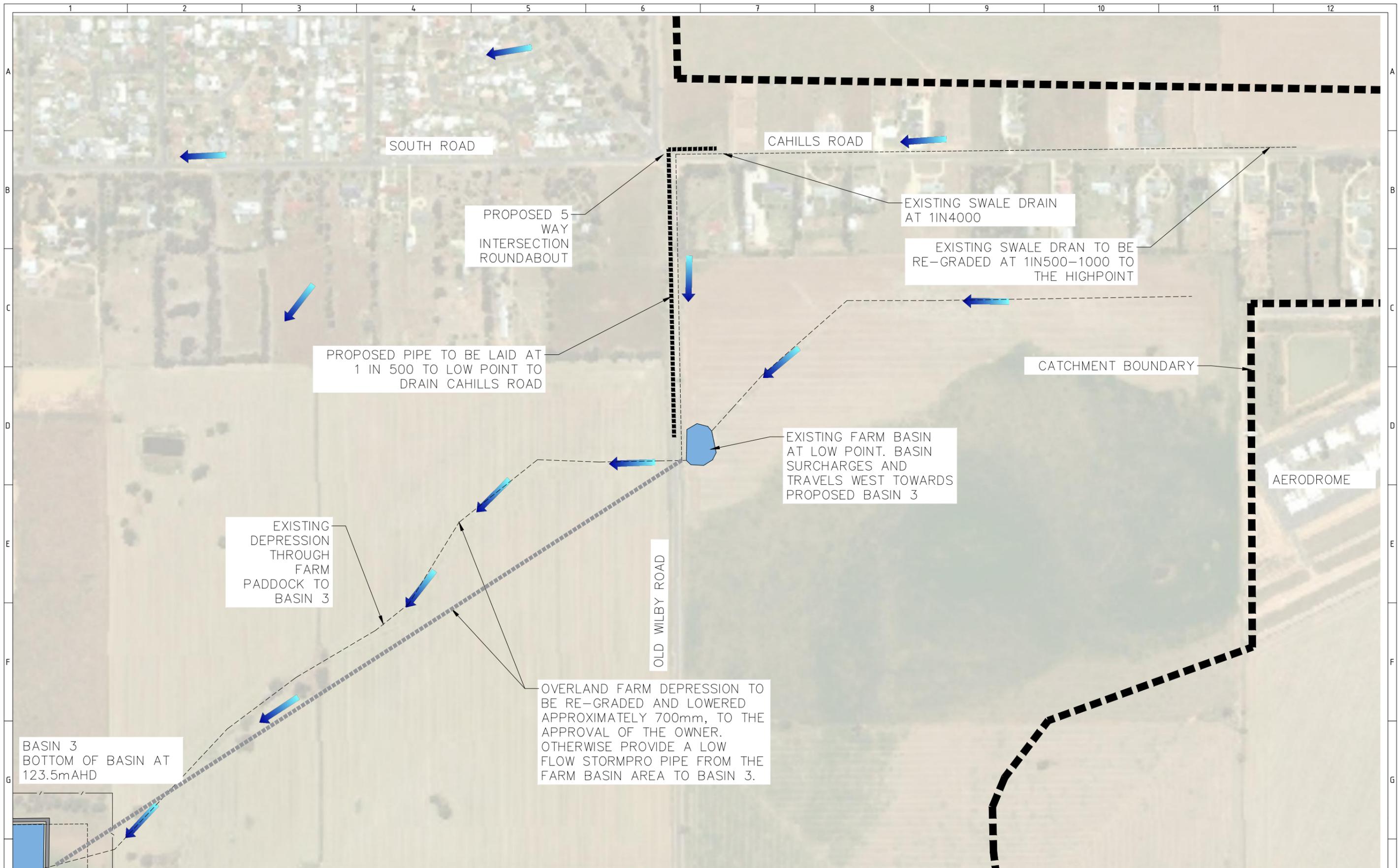
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YARRAWONGA WEST DRAINAGE STRATEGY
BASIN 4 - CONCEPT PLAN

DRAWING NO.:5
PROJECT NO.:

Revision: A
Sheet No.:5

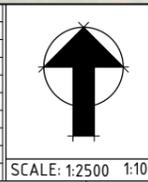
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YARRAWONGA WEST DRAINAGE STRATEGY
CAHILLS ROAD UPGRADE CONCEPT PLAN

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Sheet No.: 6

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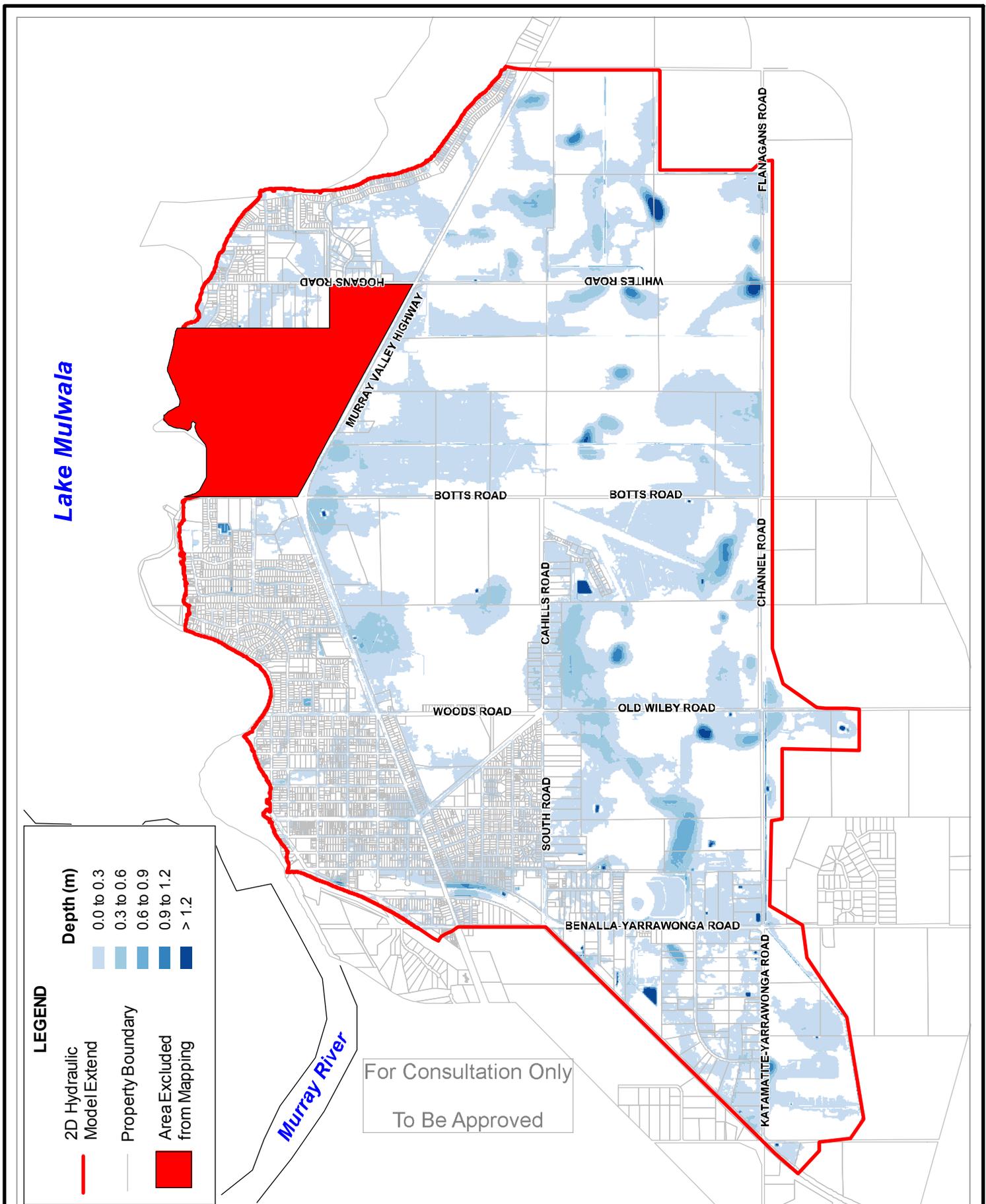
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APPENDIX 2- BMT WBM Report- Flood Effected Properties in the 5 and 100 year Events

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To Be Approved



Title:
Peak 100 Year ARI Flood Depth

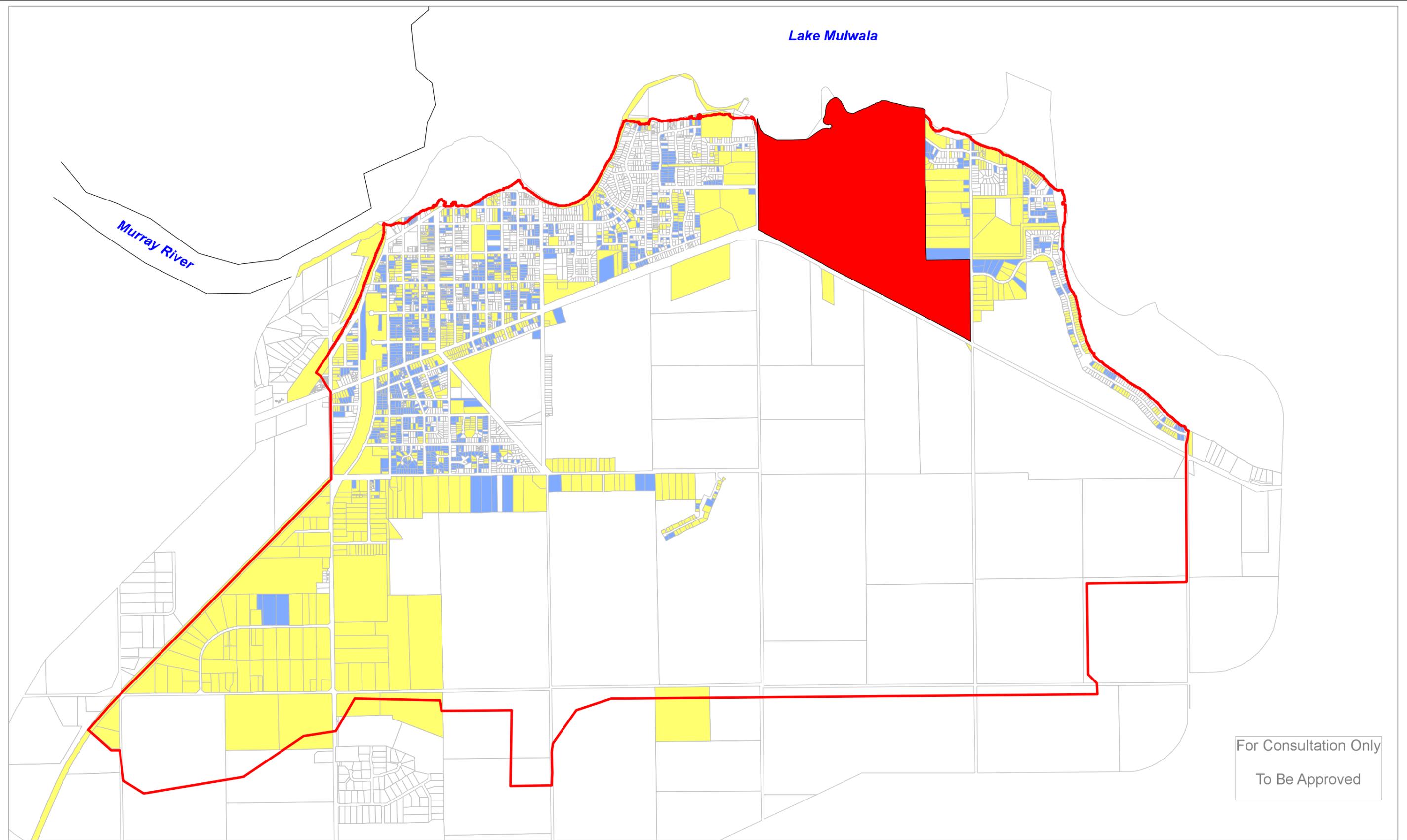
Figure:
7-5

Rev:
A

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LEGEND

	2D Hydraulic Model Extend
	Property Boundary
	Area Excluded from Mapping
	5 Year ARI Inundation Greater than 10mm (395 Properties)
	100 Year ARI Inundation Greater than 10mm (1030 Properties)

*Note: The number of properties identified and mapped to be affected by flooding is based on the cadastral layer supplied by Moira Shire Council. A proportion of the properties identified to be flood affected may be for zoned for public use.

Title:
**Yarrowonga
 Flood Affected Properties**

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Figure: 7-6	Rev: A
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APPENDIX 3 PRELIMINARY ESTIMATE OF COSTS

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To Be Approved

Preliminary Estimate of Costs

Yarrowonga West Catchment Drainage Master Plan

Basin 1 - Saleyards Site					
Item No.	Description	Qty	Unit	Rate \$	Amount \$
1	Pre Work				
	Crown land approval required to use site for Stormwater retention and Site Soil Contaminations Report Prepared				\$25,000.00
2	Site Establishment				
	Site Establishment - include demolition of sale yards and crushing of concrete and other associated works.	1	Item	100,000.00	\$ 100,000.00
3	Pump Station				
	Pump Station, duty and standby pump, switchboard, telemetry, electricity supply, installation and generator standby.	1.0	No.	800,000.00	\$ 800,000.00
4	Bulk Earthworks				
	(i) Cut from retardation basin - Place cut at Council Stockpile Offsite	110,485.0	m ³ (solid)	20.00	\$ 2,209,700.00
5	Drainage				
	(i) Connect existing drainage network from McLean Streen South into Basin 1. Includes adding additional Pipework, blocking existing drainage pipes, redirecting flows, trenching, backfill, breaking into existing pits.	1.0	No.	200,000.00	\$ 200,000.00
	(ii) Supply of all materials, excavate, trench and backfill for pipeline inclusive of all compaction, sand bedding, laying, connection to existing pits and pipe, backfilling, including Class 1 FCR under roads, dispose of surplus spoil from site and clean up: 2 x 375mm dia rising main.	500.0	lin.m	540.00	\$ 270,000.00
6	Fencing				
	Supply all materials and erect a 2.1m high mesh security fence, posts, wires and single 4m gate at each site as specified.	900.0	lin.m	75.00	\$ 67,500.00
7	Ephemeral Planting - Supply and Planting		Item	100,000.00	\$ 100,000.00
8	Soil				
	Soil remediation/removal of possible contaminated soil.		Item		\$ 500,000.00
				Sub Total	\$4,272,200.00
				Consultancy Fees 15% - Design, Survey, Geotech, Project Management	\$ 640,830.00
				Contingency 15%	\$ 640,830.00
				BASIN 1 Saleyards Site - Total Preliminary Estimate exc GST	\$5,553,860.00
Basin 2- Undeveloped					
	Private Property: To be developed by Developers in future at no cost to Council				
Item No.	Description	Qty	Unit	Rate \$	Amount \$
1	Site Establishment	1	Item	10,000.00	\$ 10,000.00
2	Pump Station				
	Pump Station, duty standby pump, switchboard, telemetry, electricity and installation and generator standby.	1.0	No.	800,000.00	\$ 800,000.00

Preliminary Estimate of Costs

Yarrowonga West Catchment Drainage Master Plan

3	Bulk Earthworks				
	(i) Cut from retardation basin - Place cut onsite	28,037.0	m ³ (solid)	12.00	\$ 336,444.00
4	Drainage				
	Supply of all materials, excavate, trench and backfill for pipeline inclusive of all compaction, sand bedding, laying, connection to existing pits and pipe, backfilling, including Class 1 FCR under roads, dispose of surplus spoil from site and clean up: 375mm dia rising main	170.0	m	250.00	\$ 42,500.00
5	Fencing				
	Supply all materials and erect a 2.1m high mesh security fence, posts, wires and single 4m gate at each site as specified.	200.0	lin.m	75.00	\$ 15,000.00
6	Ephemeral Planting - Supply and Planting		Item	100,000.00	\$ 100,000.00
				Sub Total	\$ 1,303,944.00
				Consultancy Fees 15% - Design, Survey, Geotech, Project Management	\$ 195,591.60
				Contingency 15%	\$ 195,591.60
				Basin 2 - Total Preliminary Estimate exc GST	1,695,127.20
	Basin 3- Undeveloped				
	To be extended by Developers in Future at no cost to Council to cater for developed flows				
Item No.	Description	Qty	Unit	Rate \$	Amount \$
1	Site Establishment	1	Item	10,000.00	\$ 10,000.00
2	Pump Station				
	Pump Station, duty standby pump, switchboard, telemetry, electricity and installation.	1.0	No.	600,000.00	\$ 600,000.00
3	Bulk Earthworks				
	(i) Cut from retardation basin - Place cut at Council Stockpile Offsite	108,197.0	m ³ (solid)	20.00	\$ 2,163,940.00
4	Drainage				
	Supply of all materials, excavate, trench and backfill for pipeline inclusive of all compaction, sand bedding, laying, connection to existing pits and pipe, backfilling, including Class 1 FCR under roads, dispose of surplus spoil from site and clean up: 375mm dia rising main.	1,000.0	m	250.00	\$ 250,000.00
5	Fencing				
5	Supply all materials and erect a 2.1m high mesh security fence, posts, wires and single 4m gate at each site as specified.	1,300.0	lin.m	75.00	\$ 97,500.00
6	Ephemeral Planting - Supply and Planting		Item	100,000.00	\$ 100,000.00
				Sub Total	\$ 3,221,440.00
				Consultancy Fees 15% - Design, Survey, Geotech, Project Management	\$ 483,216.00
				Contingency 15%	\$ 483,216.00
				Basin 3 - Total Preliminary Estimate exc GST	4,187,872.00

Preliminary Estimate of Costs

Yarrowonga West Catchment Drainage Master Plan

Item No.	Description	Qty	Unit	Rate \$	Amount \$
Basin 4- Undeveloped					
To be extended by Developers in Future at no cost to Council to cater for developed flows					
1	Site Establishment	1	Item	10,000.00	\$ 10,000.00
2	Pump Station, duty standby pump, switchboard, telemetry, electricity and installation.	1.0	No.	500,000.00	\$ 500,000.00
3	Bulk Earthworks				
	(i) Cut from retardation basin - Place cut at Council Stockpile Offsite	34,687.0	m ³ (solid)	20.00	\$ 693,740.00
4	Drainage				
	Supply of all materials, excavate, trench and backfill for pipeline inclusive of all compaction, sand bedding, laying, connection to existing pits and pipe, backfilling, including Class 1 FCR under roads, dispose of surplus spoil from site and clean up: 300mm dia rising main.	760.0	m	200.00	\$ 152,000.00
5	Fence				
	Supply all materials and erect a 2.1m high mesh security fence, posts, wires and single 4m gate at each site as specified.	0.0	lin.m	75.00	\$ -
6	Ephemeral Planting - Supply and Planting	1.0	Item	100,000.00	\$ 100,000.00
				Sub Total	\$ 1,455,740.00
				Consultancy Fees 15% - Design, Survey, Geotech, Project Management	\$ 218,361.00
				Contingency 15%	\$ 218,361.00
				Basin 4 - Total Preliminary Estimate exc GST	1,892,462.00
Northern Catchment Analysis					
Item No.	Description	Qty	Unit	Rate \$	Amount \$
1	A full detailed drainage analysis to understand the existing pipe network downstream, including, pipe sizes, direction of flow, low lying areas and problems. The analysis to present potential upgrades to the system that will assist in draining the area. Includes survey and concept design for the drainage upgrade.	1	Item	50,000.00	\$ 50,000.00
				Sub Total	\$ 50,000.00
				Contingency 15%	\$ 7,500.00
				Total Preliminary Estimate exc GST	57,500.00

Preliminary Estimate of Costs

Yarrowonga West Catchment Drainage Master Plan

Cahills Road Upgrade					
Item No.	Description	Qty	Unit	Rate \$	Amount \$
1	Site Establishment	1	Item	10,000.00	\$ 10,000.00
2	Bulk Earthworks				
	Re-grading existing overland flow path through farmers paddock approximately 700mm deeper with 1 in 6 batters	3,500.0	m ³ (solid)	18.00	\$ 63,000.00
	Re-grading existing table drain to the existing farm basin and reconstruct 18 vehicle crossings on the north side of Cahills Road	1.0	Item	150,000.00	\$ 150,000.00
3	Easement Creation and Lodge at Titles				
	Include property negotiations, survey, and Solicitors fees.	1.0	Item	80,000.00	\$ 80,000.00
4	Drainage				
	Supply of all materials, excavate, trench and backfill for pipeline inclusive of all compaction, sand bedding, laying, connection to existing pits and pipe, backfilling, including Class 1 FCR under roads, dispose of surplus spoil from site and clean up: 450mm dia Pipe	200.0	m	300.00	\$ 60,000.00
	Culvert Crossings with Endwalls	2.0	Item	16,000.00	\$ 32,000.00
				Sub Total	\$ 395,000.00
				Consultancy Fees 15% - Design, Survey, Geotech, Project Management	\$ 59,250.00
				Contingency 15%	\$ 59,250.00
				Total Preliminary Estimate exc GST	\$513,500.00
				Total Overall Preliminary Estimate exc GST	\$13,900,321.20
				Total Overall Preliminary Estimate exc GST for Basin 1,3,4 and Cahills Upgrade	\$12,147,694.00