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Report

To Michael MacDonagh
From Michael Lewis & James Espagne
Project Name North East Growth Corridor
Subject Desktop Drainage Strategy Review

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1 Introduction

This report has been prepared for Greater Shepparton City Council (GSCC) to provide a desktop drainage assessment report of the North East Growth Corridor (NEGC) in Shepparton.

The report examines the drainage strategy report carried out by Reeds Consulting for the NEGC. In particular this report analyses the proposed drainage catchments, basin locations, basin depths and basin cost estimates by Reeds Consulting. In addition to this report Spiire has undertaken its own assessment of the existing drainage catchment and has provided alternative drainage solutions for the NEGC.

The information contained in this report is based on Spiire's local knowledge of work in Shepparton's flat terrain and a long working relationship with Greater Shepparton City Council (GSCC), Goulburn-Murray Water (G-MW) and Goulburn Broken Catchment Management Authority (GBCMA).

2 Catchment Review

The NEGC catchment is approximately 172Ha in size and bounded north by Ford Road, east by Grahamvale Road, west by Verney Road and south by G-MW's Drain 3. Reeds Consulting has proposed to spilt the NEGC into five (5) catchments each with a corresponding basin as shown below in Figure 1.

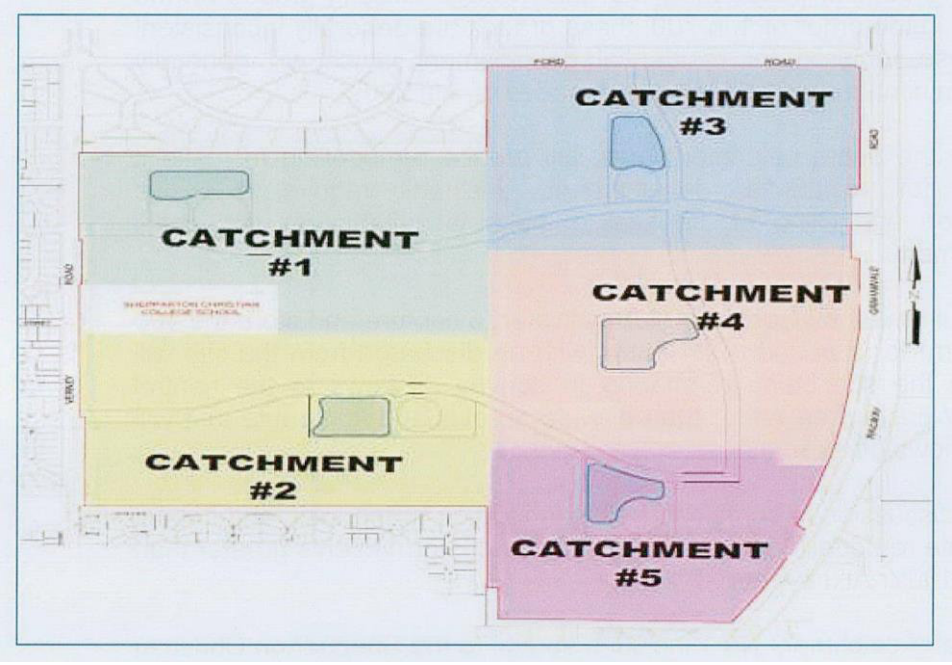


Figure 1 Reeds Consulting NEGC Drainage Catchment Plan.

A review of the existing survey information supplied by GSCC shows the natural fall of the land is grading east to west across the site. After analysing the catchment Spiire proposes to split the NEGC into 4 catchments. Refer to the drainage catchment plan in Appendix A showing the proposed catchment boundaries.

As shown in Appendix A catchments 1 and 2 are located on the west side of the corridor and catchments 3 and 4 are located on the eastern side to utilise the available grades.

The natural grade on catchments 1 and 2 is approximately 1 in 620 towards Verney Road from the eastern catchment boundary. Due to the significant grade over the land the basin location is critical in reducing the earthwork volumes across the development. Therefore basins 1 and 2 have been located in the North West corners of their catchments to maximise the grade of the land and to allow the 100 year overland flows to enter the basin. By locating the basins in the lowest area of the catchment it also reduces the final depth of the basin as the underground drainage and the land are grading in the same direction.

Catchments 3 and 4 continue to grade west; however, it is not as significant as catchments 1 and 2. The grade across the catchments is approximately 1 in 2400 from the eastern and southern catchment boundaries. Due to these catchment being quite flat the basin location is not as critical as discussed catchments 1 and 2. Therefore the basins have been located in the centre of each catchment to reduce the pipe lengths and overall depth of basins.

By reducing the catchments from 5 to 4 it has increased the overall size of catchments 3 and 4 by consolidating catchments 3, 4 and 5 from Figure 1. These catchments were merged because of the relatively flat ground when compared to catchments 1 and 2.

The catchment boundaries discussed above have been based off feature survey information supplied by GSCC and may be subject to change during detail design of drainage basins.

3 Basin/Drainage Details

A review of Reeds Consulting basin for catchment 1 and the associated documentation provided for water sensitive urban design (WSUD) treatment of the catchment conforms to industry standards. Spiire agrees with the catchment 1 analysis undertaken by Reeds Consulting, agreeing with their approach to drain the catchment to the North West corner.

Independent of the work undertaken by Reeds Consulting, Spiire has undertaken a high level investigation on the drainage requirements for each of the 4 catchments discussed in Section 2. In determining the basin characteristics Spiire has followed the assumptions listed in Table 1 below.

Initial Time of Concentration (t_c)	6mins
Max length of reach to basin	800m
Assumed pipe grade:	1 in 400
Initial Pipe Cover	1.1m
Basin discharge limit (5Yr)	1.2L/s/ha
Basin discharge limit (100Yr)	0
100Yr Storage period with no discharge	24hours
Assumed C of R	0.75
Max depth of basin floor	4.3m*
Max depth of sedimentation basin	5.3m
Max basin slope	1 in 6
No access track along perimeter r of basin, Access track provided to Sedimentation Basin.	

Table 1 Basin Design Assumptions.

*Predominant basin floor level minus sedimentation basin.

By applying these assumptions to the 4 drainage catchments it has resulted in the following basins in Table 2 below.

Catchment/ Basin No.	Catchment Size (ha)	Sub-Catchments	Catchment Size (ha)	5 Yr Discharge Rate (L/s/ha)	100 Yr Discharge Rate (L/s/ha)	100Yr Storage Volume (m^3)	Basin Area (ha)	Approximate Pipe Reach (m)	Total t_c (mins)	Outfall Pipe Diameter (mm)	Approx. Basin Depth (m)	Approx. Sedimentation Basin Depth (m)
1	37.1	1A	18.5	1.2	0	32,100	1.47	650	17	1200	4.3*	5.3
		1B	18.6					800	19	1200		
2	37.1	2A	18.6	1.2	0	32,100	1.64	650	17	1200	4.3*	5.3
		2B	18.5					800	19	1200		
3	52	3A	12.3	1.2	0	45,000	1.88	600	16	1050	4.2*	5.2
		3B	12.3					700	18	1050		
		3C	13.7					650	17	1200		
		3D	13.7					750	19	1200		
4	50.8	4A	10.2	1.2	0	44,000	1.88	650	17	1050	4.3*	5.3
		4B	13.8					700	18	1200		
		4C	13.3					800	19	1050		
		4D	13.5					700	18	1200		

Table 2 Basin Details.

*Predominant basin floor level minus sedimentation basin.

The total sedimentation basin range from 5.2 to 5.3 metres in depth with the predominant basin floor level being 1 metre higher ranging from 4.2 to 4.3 metres in depth. Each basin includes a sedimentation basin at the pipe outfalls to remove sediments from incoming drainage flows.

The basins will discharge via pumps into the existing G-MW Drain 3 and the discharge rates for each basin have been set at 1.2 L/s/ha as shown in Table 2 as advised by G-MW. The stormwater rising mains from each basin will be via pressurised pipe mains from each basin. Where possible the stormwater rising mains have been linked to reduce pipe infrastructure and reduce the number of outfall structures into the drain. The proposed locations of the stormwater rising mains have been shown in Appendix A. The outfall structures for the stormwater rising mains into the G-MW Drain 3 will require control devices that cut off pumping from the basins when the water level within the drain reaches a predetermined top of water level as per G-MW requirements.

The drainage catchments have been split into sub-catchments to determine the size and number of outfalls into each basin. Also, the basin sizing in Table 2 has been designed on the most efficient layout to service each catchment and it is expected the basins will increase once landscaping features are incorporated into the design to interface with adjacent open spaces. To determine the effect of this, functional designs on both basins and open spaces are recommended to be undertaken. However, using the work undertaken on the South East Growth Corridor (SEGC) as a guide a percentage increase to basin and open space areas can be applied to determine the price increase of works as shown in Section 4 Basin Costing Table 3.

The reduction from 5 to 4 basins has resulted in larger basins being required for catchments 3 and 4. However, the drainage infrastructure required for the NEGC has been reduced for construction costs and future maintenance costs with the reduction of pump stations, rising mains, WSUD treatment systems, etc. With these reductions it will have a significant impact on the overall costings for the growth corridor drainage. Refer to Appendix A showing the basin locations and catchment boundaries.

Please note the basin locations for the new catchments proposed by Spiire are subject to geotechnical assessments to determine suitability in relation to groundwater and may be subject to change during detailed design.

4 Basin Costings

A review of Reeds Consulting basin costings for Catchment 1 has uncovered a significant excavation cost of $12.50 per cubic metre. Spiire believes this rate is excessive when compared to local contractor rates, and also given the fact the excavated soil will be retained on site to assist in earthworks for overland flows. Based on similar projects completed within Shepparton region Spiire believes the excavation rate can be reduced to $5 per cubic metre of soil.

Examples of where similar works have been undertaken include the basin construction for the Lifestyle Village in Shepparton where the average tendered excavation rate was $4.22 per cubic metre in 2011 for approximately 10,000 cubic metres of soil and the average

tendered excavation rate for the basin works at Kensington Gardens in Shepparton was $4.52 per cubic metre in 2008 for approximately 20,000 cubic metres of soil. Given excavation volumes in the NEGC are approximately 50,000 to 60,000 cubic metres the rate of $5 per cubic metre has been adopted as a conservative figure to make allowance for any price increase in excavation cost to detail landscape and WSUD features in the basin.

Applying this rate to the existing excavation costings completed by Reeds Consulting for catchment 1 results in a $465,000 saving.

Spiire has undertaken basin cost estimates for the 4 drainage catchments listed in Sections 2 and 3. The basin estimates undertaken by Spiire make allowance for the additional costs that will be incurred with basin embellishments and interfacing with open space areas. As discussed in Section 3 of the report the additional costs have been based off the works completed on the SEGC basin and landscape estimates by applying a percentage increase to the basin and open space areas. To increase the accuracy of these costs it is recommended functional designs on both basins and open spaces are to be undertaken. Refer to table 3 below for cost estimates.

Below in Table 3 is the “ball park” estimates associated with each basin catchment including landscape and excluding professional fees.

Basin No.	**Basin Estimate**	**Landscape Estimate**	**Total Cost**
1	$1,040,000*	$875,000**	$1,915,000
2	$960,000*	$650,000*	$1,610,000
3	$1,170,000*	$725,000*	$1,895,000
4	$1,120,000*	$725,000*	$1,845,000
Sub Total	*$4,290,000*	*$2,975,000*	*$7,265,000*
Contingency (20%)	$858,000	$595,000	$1,453,000
Total	**$5,148,000**	**$3,570,000**	**$8,718,000**

Table 3 Basin Estimates.

* Based off SEGC landscape costings and basin embellishments.
** Price excludes building works, Sports Facilities, Car Parking. Further design required to determine cost.

The basin costings above are estimates only and are subject to variation during detail design and geotechnical assessments.

5 Conclusion

In conclusion to the assessment completed, Spiire believes the number of catchments can be reduced from 5 to 4 given the natural fall of the ground and its effects on the drainage systems. This reduction in catchments has resulted in a basin being removed from the growth corridor. The new positioning of the basins in the catchment low points proposed by Spiire will require a rework of the internal road networks, however the cost saving provided by reducing the infrastructure required for a basin is significant.

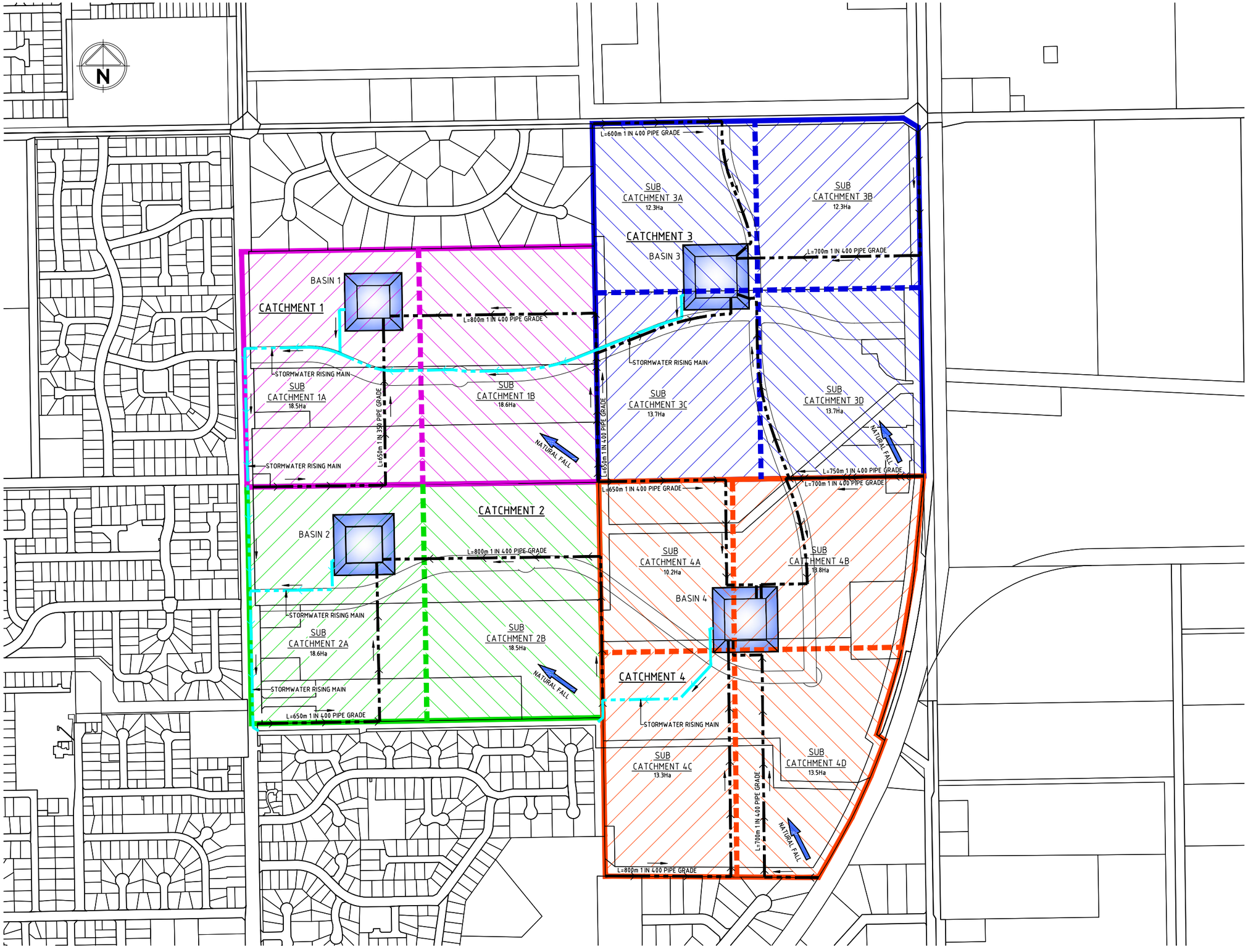
Reviewing the cost estimates prepared by Reeds Consulting identified the majority of the rates were higher than local civil contractor rates, most notably the high cost associated with the excavation of material for the basin. Spiire believes that this cost can be reduced due to the soil not being removed from the site and based on local contractor rates. Spiire agrees with Reeds Consulting's methodology for catchment 1 basin location and WSUD treatment systems, however Spiire believes that there can be improvements in the design of each basin to reduce costs.

The costings provided by Spiire are only indicative and include allowance for additional costs that may be incurred with basin embellishments and interfacing with the adjacent open spaces. These cost increases have been based off the work undertaken in the SEGC.

Spiire believes that it would be beneficial for further work to be undertaken on the NEGC drainage to provide new basin designs based on the information provided in this report due to the significant cost savings.

Please note this report has been prepared as a desktop assessment of the NEGC drainage and is based off Spiire's local knowledge of Shepparton's flat terrain and long working relationships with GSCC, G-MW and GBCMA.

Appendix A – Drainage Catchment Plan



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NORTH EAST GROWTH CORRIDOR SHEPPARTON

DRAINAGE CATCHMENT PLAN

CITY OF GREATER SHEPPARTON

Rev B
Drg No 302389D01