

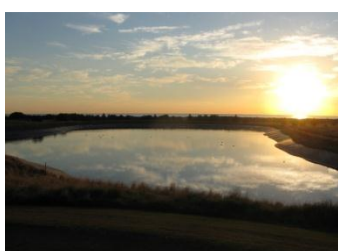


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STORMWATER MANAGEMENT STRATEGY

ST. GERMAIN DEVELOPMENT, THOMPSONS ROAD, CLYDE NORTH

21 AUGUST 2013

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Date	Revision	Distribution
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APPENDICES

- APPENDIX A. NEIL M CRAIGIE PTY LTD (2012) REPORT; STORMY WATER SOLUTIONS, NEIL CRAIGIE PTY LTD, AND PAT CONDINA & ASSOC (2012) REPORT.**
- APPENDIX B. SITE CATCHMENT PLAN**
- APPENDIX C. SITE TOPOGRAPHY PLAN & SITE ANALYSIS PLAN**
- APPENDIX D. INDICATIVE DEVELOPMENT PLAN AND MASTERPLAN**
- APPENDIX E. OVERLAND FLOOD PATHS**
- APPENDIX F. WETLAND LAYOUT PLANS**

Glossary of terms

Alphabetical list of terms and abbreviations used in report

ARI	Average Recurrence Interval - <i>The average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration.</i> ¹
Authorities	Organisations responsible for supply and management of sewer, water, gas, electricity and telecommunications, roads and transport
Client	St. Germain Developments
CMA	Melbourne Water
Council	City of Casey
GAA	Growth Areas Authority
WSUD	Water Sensitive Urban Design

1 STORMWATER MANAGEMENT STRATEGY

1.1 Introduction

Beveridge Williams has been commissioned by St. Germain Developments (the Developer) to prepare a Stormwater Management Plan (SWMP) for a proposed Commercial and Residential Estate located at 1425 Pound Road and 2100 Thompsons Road, Clyde North.

This SWMP is intended to provide sufficient evidence that the proposed Commercial and Residential Development can meet Stormwater Best Practice Environmental Management Guidelines (BPEMG) and provide supporting evidence that the stormwater discharges from the proposed subdivision shall be to the satisfaction of Melbourne Water Corporation (MWC).

The site, 1425 Pound Road and 2100 Thompsons Road, Clyde North, is bounded by Smiths Lane (east), Thompsons Road (north), Pound Road (west) and farm land to the south (currently proposed for further development into residential housing). The site has a road frontage of approximately 2400m on Thompsons Road, 800m on Smiths Lane and 1600m on Pound Road. The site is irregularly shaped, and occupies an area of approximately 171.2 ha. The location of the site is shown on Figure 1 below.

1.2 Site constraints

The site lies within the proposed 1053 Precinct Structure Plan area, and at the time of writing this report, the land is designated for future residential development (Zoned UGZ – Urban Growth Zone).

The Ti-Tree Creek catchment area is not subject to an inundation overlay but areas along Thompsons Road are subject to localised inundation. The eastern catchment discharging to the Cardinia Creek is subject to an inundation overlay as shown in Figure 2 overleaf.

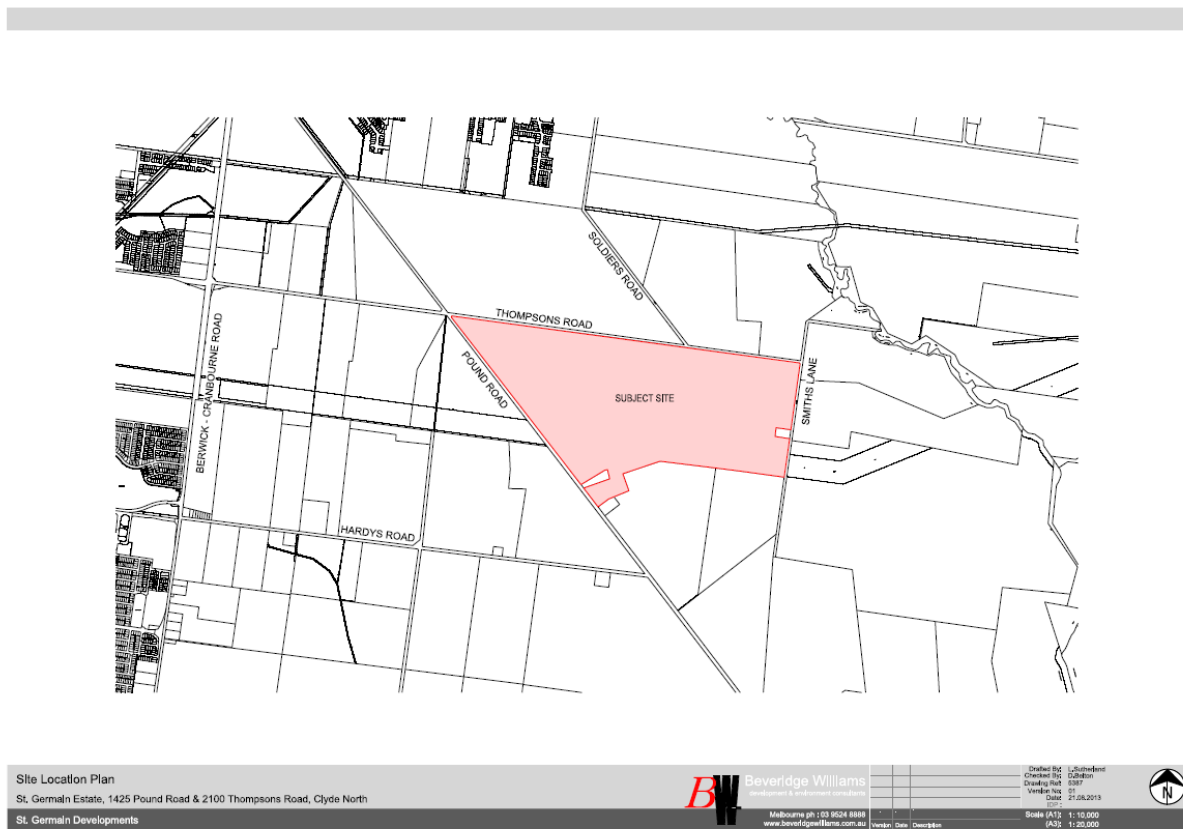


Figure 1: Location Plan
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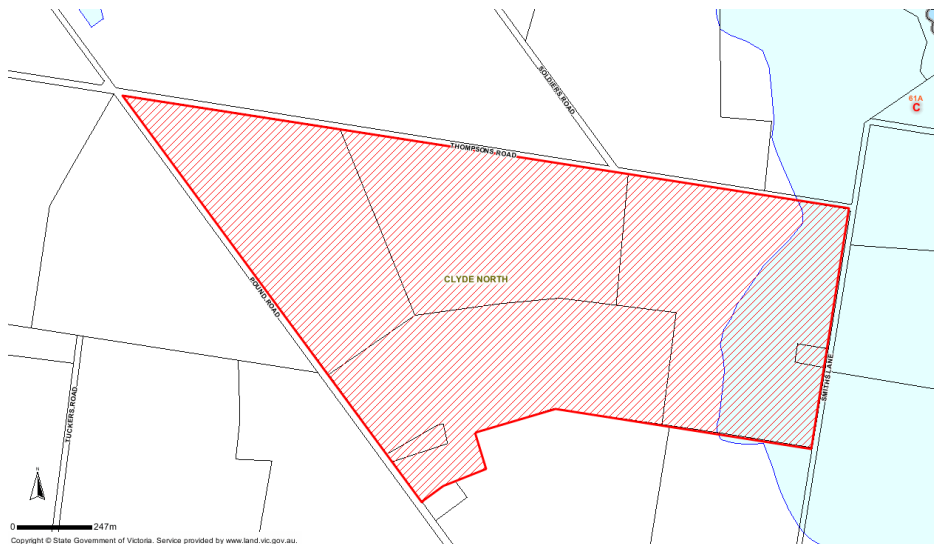


Figure 2: Inundation Overlay

It is proposed to subdivide the land into both residential and commercial areas. The development breakdown can be seen in Appendix D – Indicative Development Plan and The Masterplan, which shows the various commercial, residential and mixed use areas, as well as the medical and retail precincts and the proposed retirement village.

The land is currently occupied by a number of farm sheds that are located towards the south western end of the site. An Electricity Transmission Easement approx. 150m wide, and associated power lines traverse the site from east to west at the southern end of the site. Baillieu Creek starts in the south east corner of the site and heads southeast towards Smiths Lane. The land is almost entirely cleared of large trees, although there are a few scattered trees and rows of trees on the property. The desalination pipeline runs along the frontage of Pound Road within a pipeline easement 20m wide.

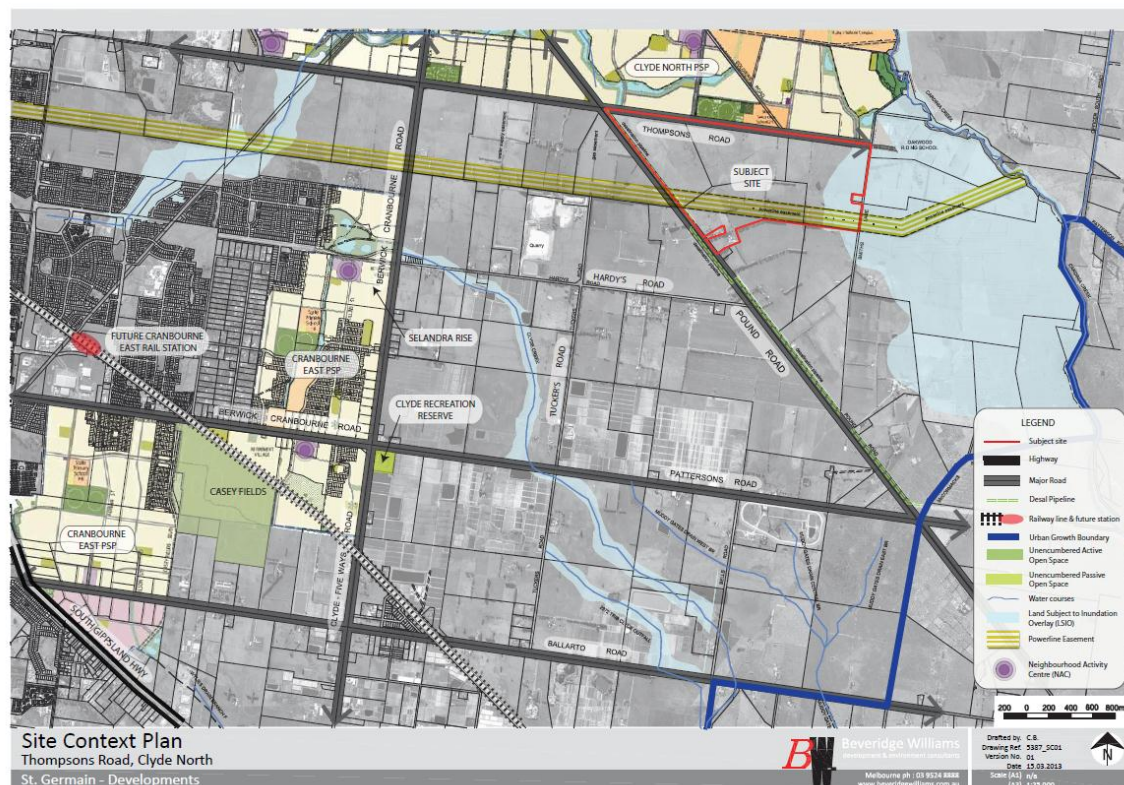


Figure 3: Site Context
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1.3 Design Intent

It is proposed to base the Site Stormwater Management Strategy on the Regional Stormwater Management Strategy (SWMS) prepared by Neil Craigie for the Casey Growth Areas known as PSP 1053 and PSP 1054 – refer to Appendix A.

The strategy being prepared by Neil Craigie proposes a series of Sediment Basins (SB) and Wetland/Retarding Basins (WLRB) located in the north of the site discharging to Ti-Tree Creek near Grices Road to the north. The WLRB proposed in the Neil Craigie SWMS is within the subject site, and also caters for external catchments to the west of Pound Road. A second catchment exists within the site discharging to the east towards Baillieu Creek. A Sediment Basin and Wetland/Retarding Basin will be built to cater for the needs of the eastern part of the site.

It will be a requirement for the development to provide stormwater quality mitigation measures for the overall site, as well as provide retardation back to pre-developed flow rates.

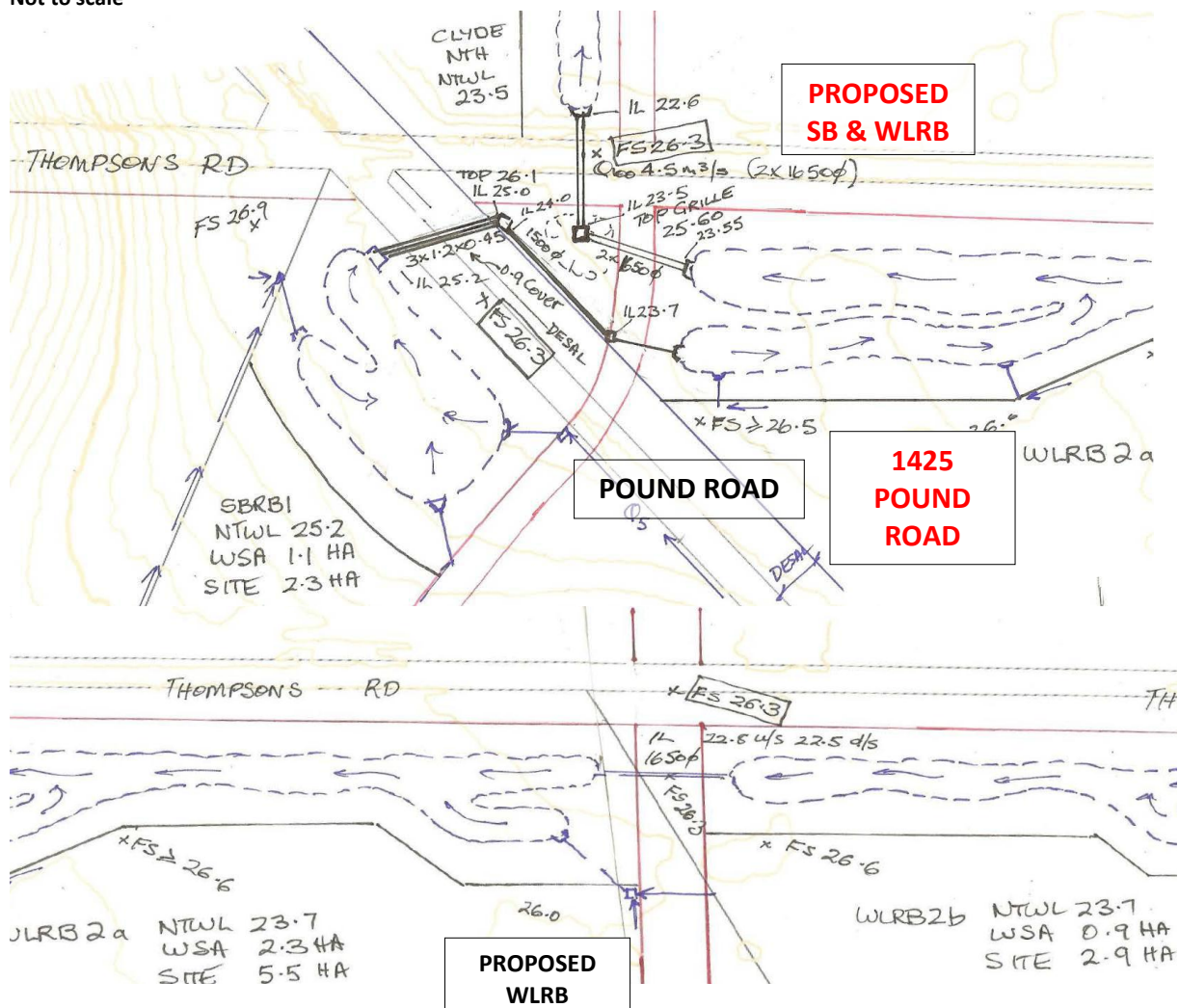
This WLRB is proposed to maintain peak discharges to existing rural conditions in the 100 year ARI event.

The plan below (Figure 4) identifies the proposed WLRBs as indicated in Neil Craigie's report.

Figure 4: Sediment Basins & Wetland/Retarding Basins for western catchment

Source: Neil M Craigie Pty Ltd (Report)

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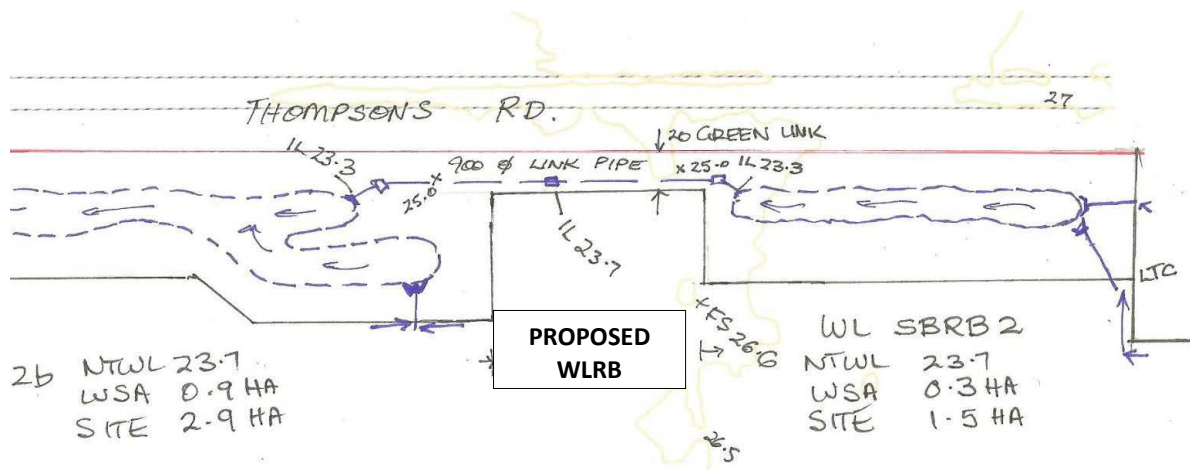
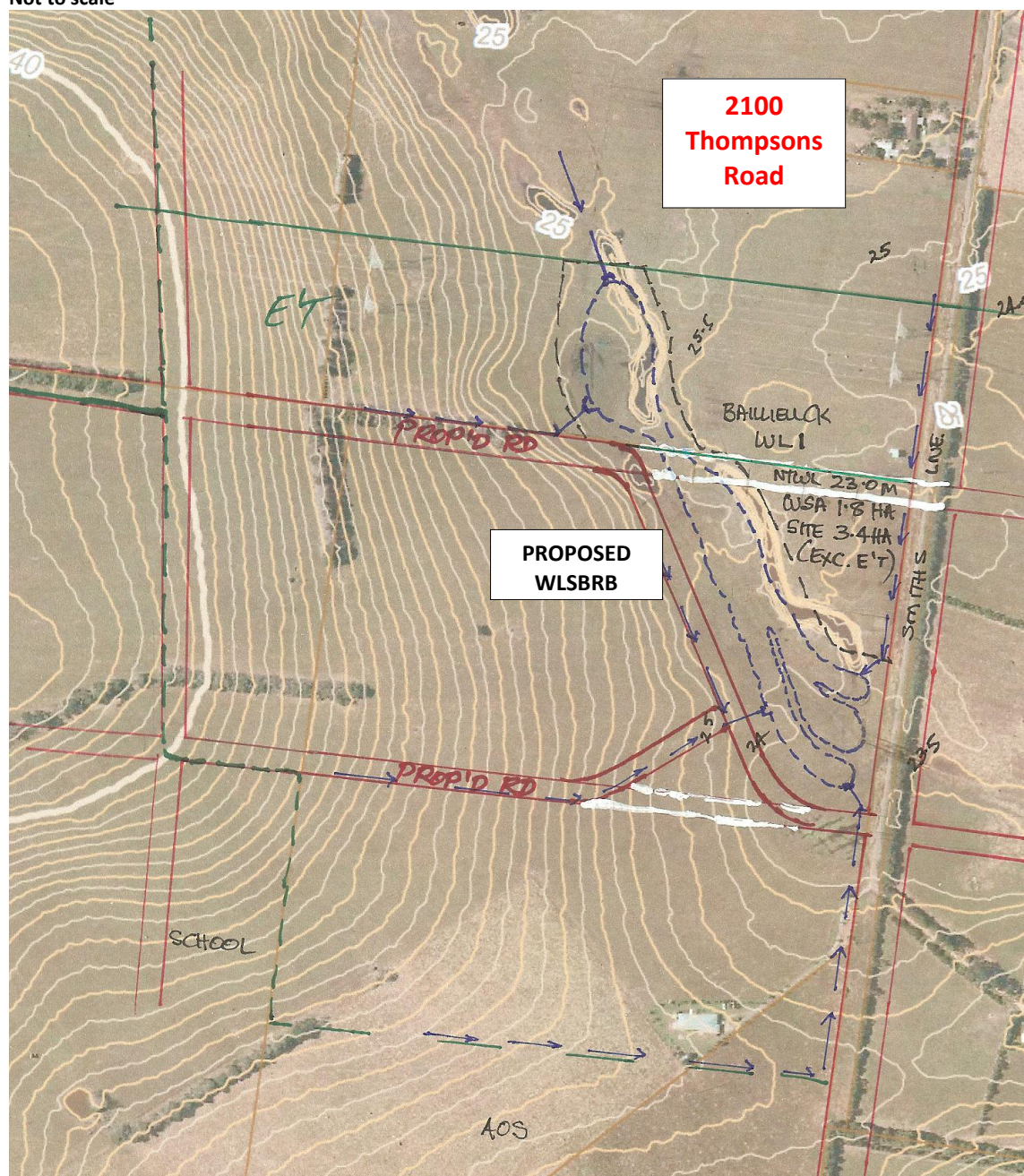


Figure 5: Sediment Basins & Wetland/Retarding Basins for eastern catchment

Source: Neil M Craigie Pty Ltd (Report)

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It is a requirement of the City of Casey Planning Scheme that both the Quantity and Quality of stormwater runoff from the proposed development meet the Urban Stormwater Best Practice Environmental Management Guidelines (BPEMG) and these objectives will be met as per the Neil Craigie SWMS and by the developer in providing the required water quantity and water quality treatment facilities within the site.

Melbourne Water has declared this area to be a drainage scheme (interim) - Cardinia Creek Drainage Scheme 1310X for the eastern end of the site and the western end will contribute to the Ti-Tree Creek Drainage Scheme 0619.

1.4 Catchment Plan

The site of 171.2 Ha is within the PSP 1053. It has two sub-catchments, the first of 118 Ha discharges into the Ti-Tree Creek Drainage Scheme 0619 and is part of a larger catchment as shown over the page (Figure 6) on the Catchment Plan. The second catchment of 53.2 Hectares discharges into the Cardinia Creek catchment via Baillieu Creek sub catchment 1310X. Preliminary catchment areas were shown in the report prepared by Neil M Craigie Pty Ltd dated 3 November 2012 (Draft).

Figure 6: St. Germain and external Drainage Catchment Areas
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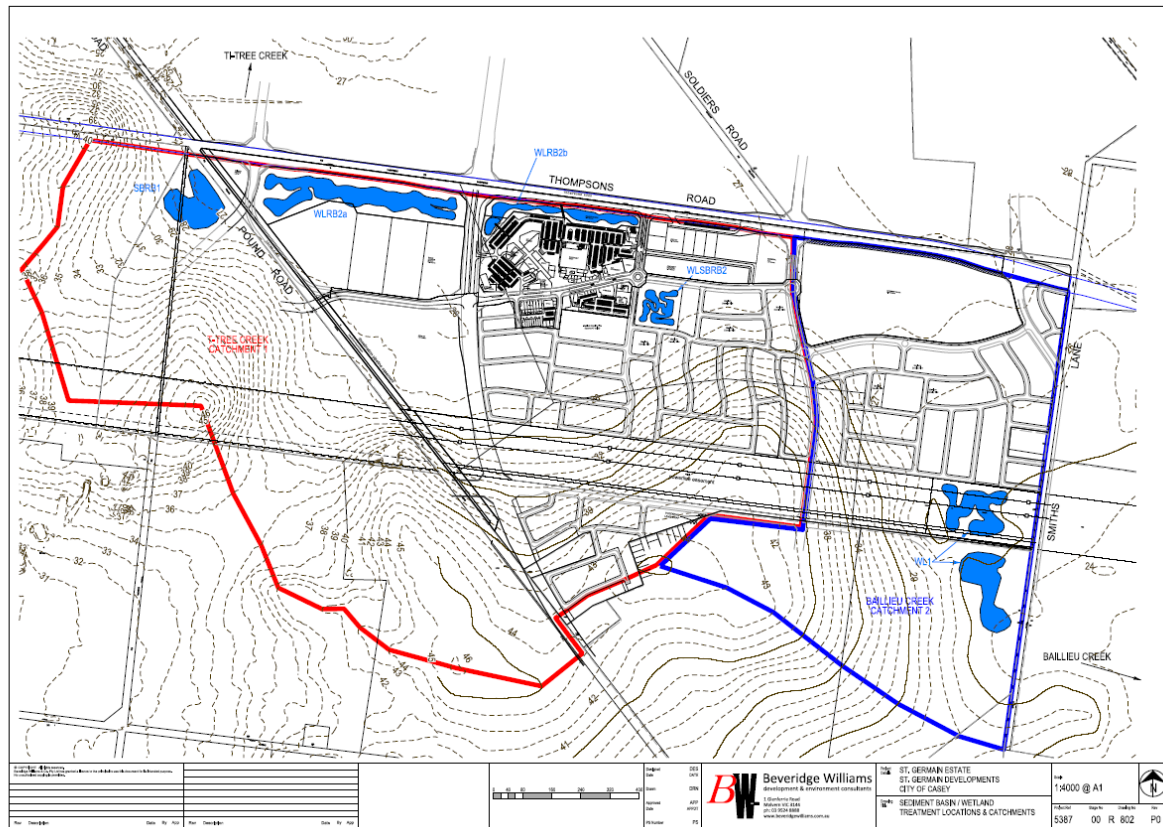




Figure 8: Site Analysis Plan

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2.2 Surface Water and Drainage

The closest surface water feature for the western catchment is Ti-Tree Creek to the north of the site, located about 1.2km away. Currently, surface water runoff discharges along existing open drains through private property at 1275 Pound Road. In the event of storms, water sheet flows across the paddocks in a north-west direction through 1275 Pound Road and to the wetland built at Berwick Waters Estate near Grices Road.

The closest surface water feature for the eastern catchment is Cardinia Creek located about 600m to the north east of the site. However, due to the fall of the land from the north-west to the south east, overland flows merge with Cardinia Creek approx. 2.5 km to the south east. Surface water discharge is via shallow open drains winding its way through several properties before merging with Cardinia Creek.

There is some external catchment entering the site from the west from 1350 Pound Road.

2.3 Development Proposal

The site is proposed to be developed as standard to medium density residential with areas of open space including two 0.6ha Reserves in the centre and a 1.01ha Reserve to the east. An electrical transmission easement 150m wide traverses the site from east to west along part of the southern boundary.

The proposed subdivision as shown in the Indicative Development Plan (Figure 9 overleaf) together with the Masterplan shows the breakdown for the site which includes a proposed Drainage Reserve, small Recreation Reserves, Community Facilities, Medical Centre, Hospital, Neighbourhood Activity Centre and a Mixed Use-Commercial area, a retirement village as well as conventional and medium density residential allotments.

The indicative development plan shows that the residential site development will comprise the following:

- 44.50 ha allocated to Residential Allotments;
- 23.54 ha to Non Arterial Roads
- 20.47 ha to Powerline Easement;
- 3.73 ha to Drainage Reserves;
- 0.64 ha to Tree Reserve;
- 2.28 ha of Unencumbered Passive Open Space.

95.15 ha Total Area.

The Indicative Development Plan and The Masterplan are provided in Appendix D.

3 HYDROLOGY

3.1 Catchment Assessment

There is currently a report being carried out for the 1054 and 1053 PSP areas by Neil M Craigie Pty Ltd, for the GAA and City of Casey. Although the report has not been finalised or adopted the draft report has been used as the basis for the preparation of stormwater infrastructure layouts, locations and sizing throughout the 1053 PSP.

For the catchment assessment relating to 1425 Pound Road and 2100 Thompsons Road, Clyde North, we refer to the draft report prepared by Neil M Craigie Pty Ltd for the 1053 PSP, and also the report carried out by Stormy Water Solutions, Neil Craigie and Pat Condina titled "Assessment of Drainage Strategy for PSP 53 and the Overall Cardinia Creek Catchment" dated 24 Sept 2012. A copy of the reports can be found in Appendix A.

The first report proposes a Sediment Basin (SB) and a series of Wetland / Retarding Basins (WLRB) be constructed. As part of the Ti-Tree Creek Drainage scheme and for the western catchment of the site, the WLRB's are to be located along the northern boundary fronting Thompsons Road within a combination of drainage reserves totalling 9.86 ha. The WLRB will also service some land to the west of the subject site. As part of the Cardinia Creek Drainage Scheme, the eastern catchment of the site will form part of the Baillieu Creek sub-catchment and will be serviced by a WLRB located in the power line easement in the south east part of the site fronting Smiths Lane.

The Peak flow estimates for Existing Conditions were provided in Table 2 of the Neil Craigie report and are shown below:

Table 1: (Taken from Neil M Craigie Report) "TABLE 2: Peak Discharges for 100 years ARI (m³/s) (Critical durations in parentheses)"

Location	Peak 100 Year ARI discharge
Thompsons Road (east outfall)	6.1 (9 hr)

Water Surface Area and Site area, taken from Neil Craigie's report, were calculated based on a MUSIC model. Normal Top Water Levels (NTWL) were selected from LIDAR data having regard to various constraints such as planning layout, protection of habitat areas, likely pipe gradings and sizes, and desirable open waterway grades. They are summarised below:

Table 2: (Taken from Neil M Craigie Report) "TABLE 4: Proposed Main SWMS Assets in the CGA"

Waterway / Location	Water Surface Area (ha)	NTWL (m)	Approximate Site Area (ha)
Ti Tree Creek at Thompsons Road SBRB1 (external to subject site)	1.85	25.00	3.30
Ti Tree Creek at Thompsons Road WLRB2 (incl SBRB2)	2.80	23.50	5.00
Baillieu Creek at Smiths Lane WL1	1.80	23.00	3.40

The Neil Craigie report includes the RORB hydrologic model developed for the 1054 PSP. The results of RORB modeling for the 1, 10 and 100 year ARI events were shown in Table 5 of the report, an extract is shown below for this site:

Table 3: (Taken from Neil M Craigie Report) “TABLE 5: RORB Model Results for fully developed conditions Waterway and storage layout as shown on Figure 4 (Critical Durations in parentheses)”

ARI (years)	Asset	Peak Inflow (m ³ /s)	Peak Outflow (m ³ /s)	Water Level (m)	Storage Volume (m ³)
1	Ti Tree Creek WLRB2	6.4 (2)	1.2 (48)	24.72	39,300
10	Ti Tree Creek WLRB2	12.5 (2)	2.3 (12)	25.11	56,900
100	Ti Tree Creek WLRB2	23.9 (15)	4.7 (12)	25.66	83,200

- The Peak flows for the 100 Year ARI are significantly reduced compared with pre-developed conditions, 6.1 m³/s down to 4.7 m³/s;
- Storage volumes can be retained within the drainage reserve area;
- Based on Existing surface levels for the site, freeboard above the 100 year flood level can be achieved.

The proposed SB and WLRB will therefore provide all required retardation for the designated catchment including 1425 Pound Road, Clyde North, and no additional detention capacity will be required within the western part of the development.

The internal catchments and proposed fraction impervious adopted will be as per the Neil Craigie Report.

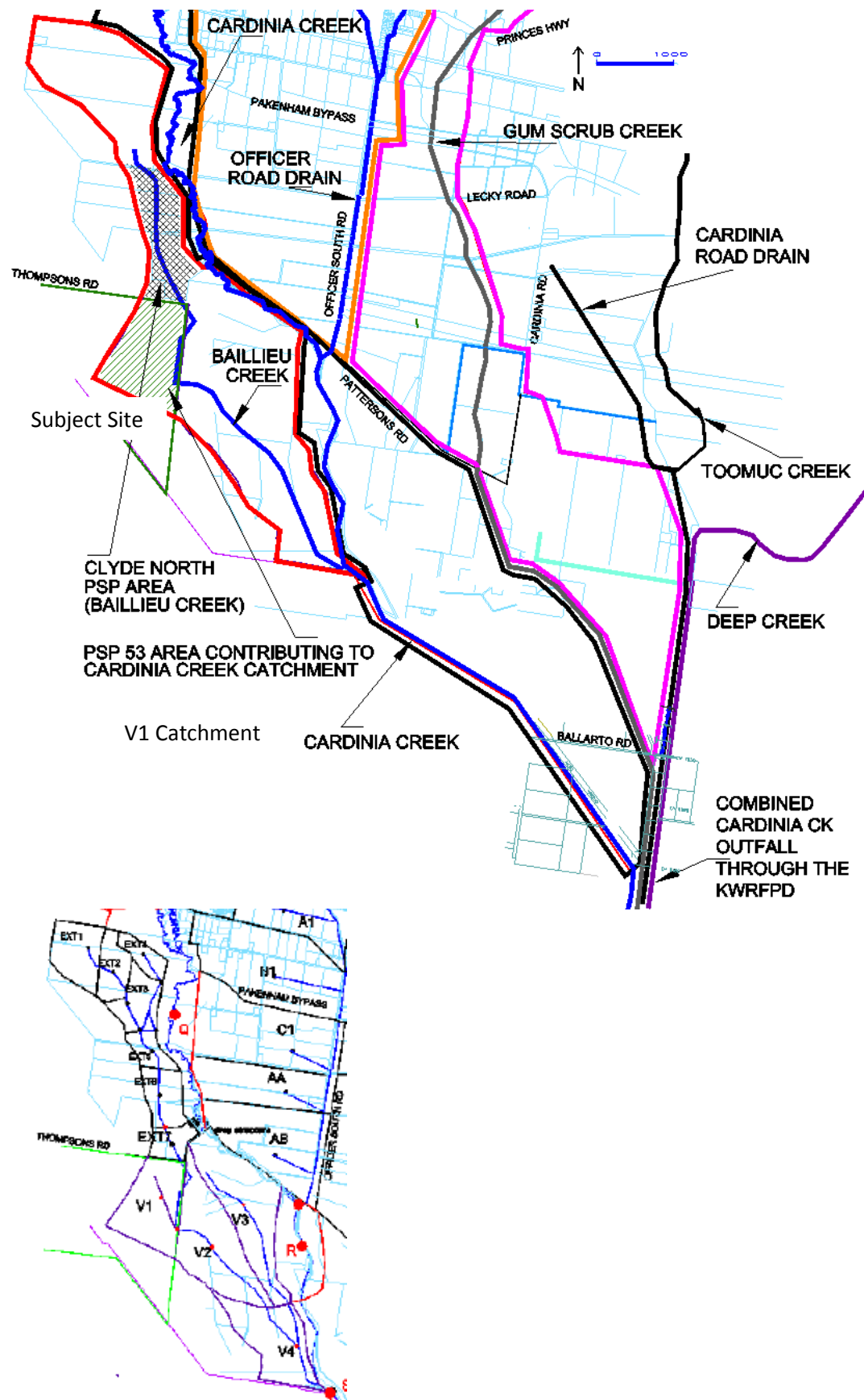
In regards to the eastern catchment draining to Cardinia Creek, the catchment forms part of the network discharging to Cardinia Creek via the Ballieu Creek tributary, the subject catchment is labelled V1 on the plan in Figure 10 overleaf.

As per figure 5 and Table 2, we are only looking to treat the V1 catchment, a total of 117 Ha, of which 9.8 Ha is powerline transmission easement and can not be developed. According to Neil Craigie’s report, a water surface area of 1.80 Ha will be required to treat the contributing catchment in a wetland. As the proposed wetland spans the adjoining property to the south and the subject site contributes approx. half the area of the catchment, the wetland will be constructed in two components. The first part will consist of a wetland in the transmission easement to service the northern part of the catchment and the linked second part will service the southern part of the catchment belonging to the adjoining owners (see Figure 16).

Figure 10: PSP 53 Catchment Area contributing to Baillieu Creek

Source: Stormy Water Solutions, Neil Craigie and Pat Condina titled "Assessment of Drainage Strategy for PSP 53 and the Overall Cardinia Creek Catchment" dated 24 Sept 2012. (Report)

Not to scale



4 STORMWATER MANAGEMENT AND TREATMENT

The subject site is located within the 1053 PSP. It will be necessary for the development to provide stormwater quality mitigation measures within the overall site, as well as provide infrastructure with capacity up to a 1 in 100 year ARI within and through the site.

It is a Victorian Government requirement that both the Quantity and Quality of stormwater runoff from the proposed development meet the Urban Stormwater Best Practice Environmental Management Guidelines (BPEMG). These objectives will be met in accordance with the Neil M Craigie Pty Ltd report.

4.1 Sub-surface Drainage

There will be two Legal Points of Discharge for the subject site: the western catchment area will discharge to Ti Tree Creek wetlands near Grices Road using a temporary pipe system to convey flows through private property at 1275 Pound Road. For storm events up to the 100 ARI year events, storage will be required on-site within the constructed wetlands. As the free flowing outlet pipe will have limited capacity of 0.6m³/s, temporary storage for excess volumes will also be stored on-site until the downstream wetland/waterway is constructed within the property at 1275 Pound Road.

The eastern catchment area will discharge via pipes to a constructed Wetland in the south east corner of the site before discharging via open drains to Baillieu Creek and thence to Cardinia Creek. This wetland will also be used as a storage facility during storm events to maintain off-site discharge to pre-developed conditions.

The subsurface drainage network for the development will convey all pipe flows to the above mentioned waterways, via the water quality treatment facilities located in the drainage reserves and powerline easement for the treatment of flows.

The Pipe network will be adequately sized to convey the 5 year flows through the network for Residential development and 10 year flows for the Business development area.

The overall SB & WLRB works proposed in the Neil Craigie report are located wholly within the site, although there will be a WL located in the neighbouring development on the southern side of the site at Smiths Lane, this will cater for external catchments to the south. This will enable 1425 Pound Road and 2100 Thompsons Road to proceed independently of any other surrounding developments, as water quality and quantity requirements are able to be met within the subject site.

Pipeline flows will follow the routes of overland flows as shown in Figure 13. Major pipeline systems will generally follow the major overland floodpaths as well as arterial and connector roads wherever possible to discharge into the wetland systems.

Clyde North PSP (excerpt shown in Figure 11) shows that a waterway / wetland system is to be constructed through 1275 Pound Road from the inlet point at Thompsons Road (the subject site outlet point) to the constructed Wetland on the north side of the proposed Connector Road as shown at the top left hand corner of Figure 11. As this property is not being developed at this time, and an open drainage system would constrain the development of the land, the alternative is to provide a temporary subsurface pipe system along the Pound Road frontage. As the western catchment area ultimately requires a fully developed discharge limited to 1.2 m³/s in the one-year ARI event, a 900mm dia pipe can cater for flows of 0.6 m³/s. Once onsite storage detention is exceeded by the development discharge, further downstream works will have to be carried out which could include the construction of the proposed waterway/wetland within the 1275 Pound Road property. The cost of the outfall pipe will have to be covered by the developer as it is temporary work but is considered necessary to provide a free draining outlet from the subject site. No reimbursements will be made by Melbourne Water for this pipeline.



Figure 11: Excerpt from Clyde North PSP
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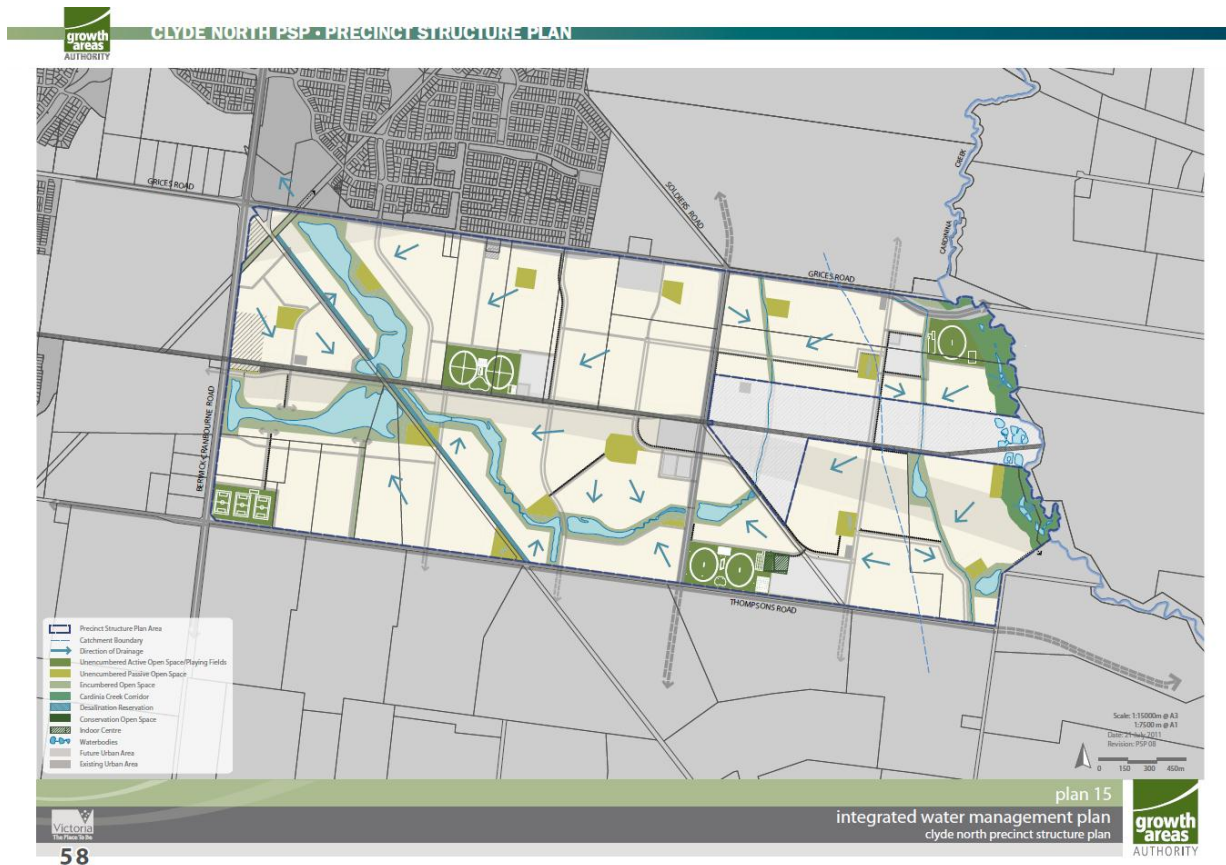


Figure 12: Clyde North PSP
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4.2 Subject Site Overland Flow

Overland flows from the site will be directed via the road network as shown in figure 13, full size plan is in Appendix E. Major floodpaths are shown in red, minor floodpaths are in blue.

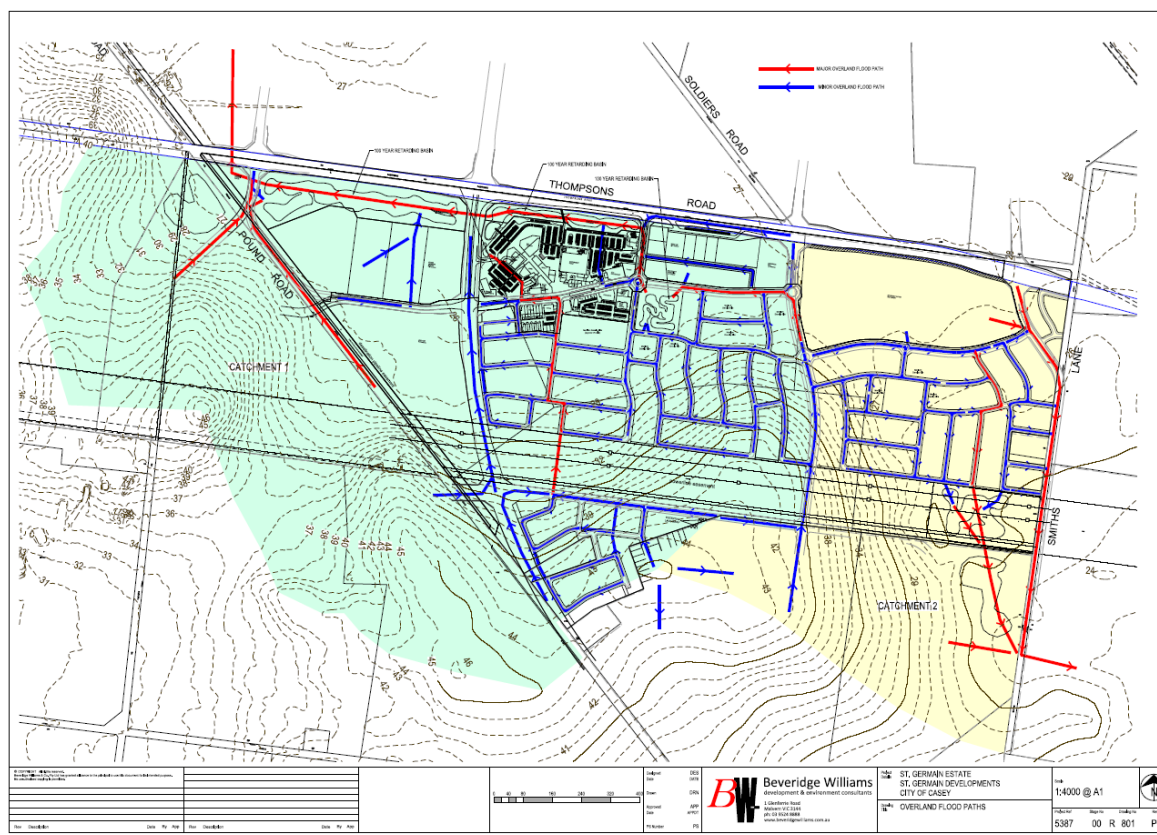


Figure 13: St. Germain overland floodpaths
Not to scale

Figures 14, 15 & 16 overleaf show the preliminary arrangement of the wetland areas and connecting pipe infrastructure required to service the requirements of best practice treatment of the developed flows and retard flows as per Neil Craigie's report.

Total Water Surface areas of the proposed wetlands for the western catchment (WLRB2a,b & c) is 3.93Ha which exceeds the required 3.50 Ha in Neil Craigie's report. The total detention volume available up to RL.26.00 with 600mm freeboard is 132,420 m³ and up to the expected 100 year ARI flood level of 25.66m as per table 3 is 110,090 m³ which exceeds the required storage volume of 83,200 m³. No additional detention capacity is required within this part of the development. It should be noted that these volumes apply to the situation where the downstream waterway is constructed. Further detention volumes may be required depending upon development rates of the site.

The wetlands and connecting pipe infrastructure will be invested as a Melbourne Water asset. Melbourne Water will be required to maintain the wetlands up to the 10 year ARI flood level and pipe infrastructure, with City of Casey to enter a maintenance agreement to maintain the remaining drainage reserve areas.

Figure 14: St. Germain Wetland WLRB2a
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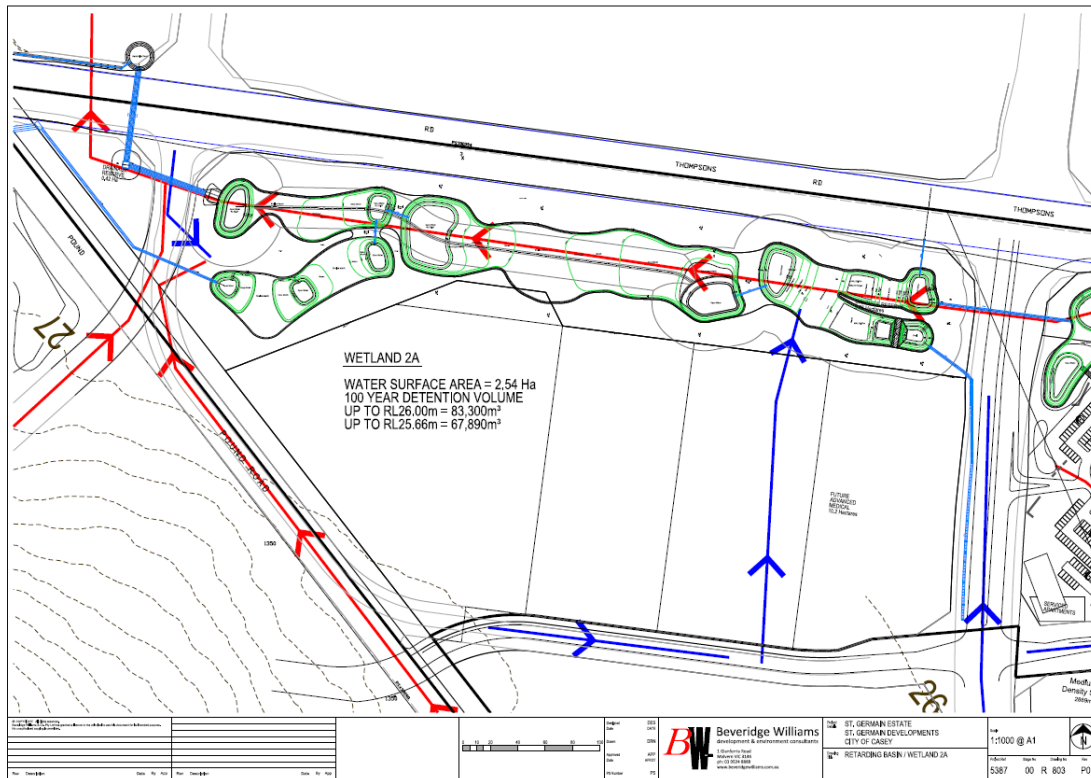


Figure 15: St. Germain Wetland WLRB2b & 2c
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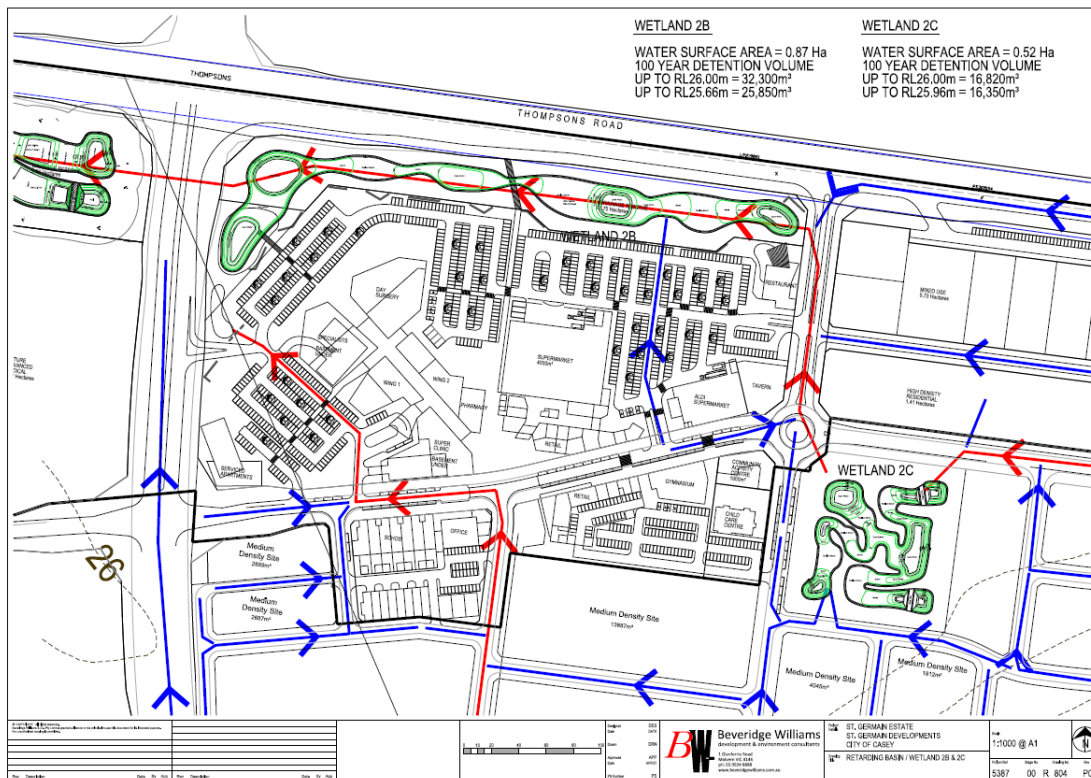
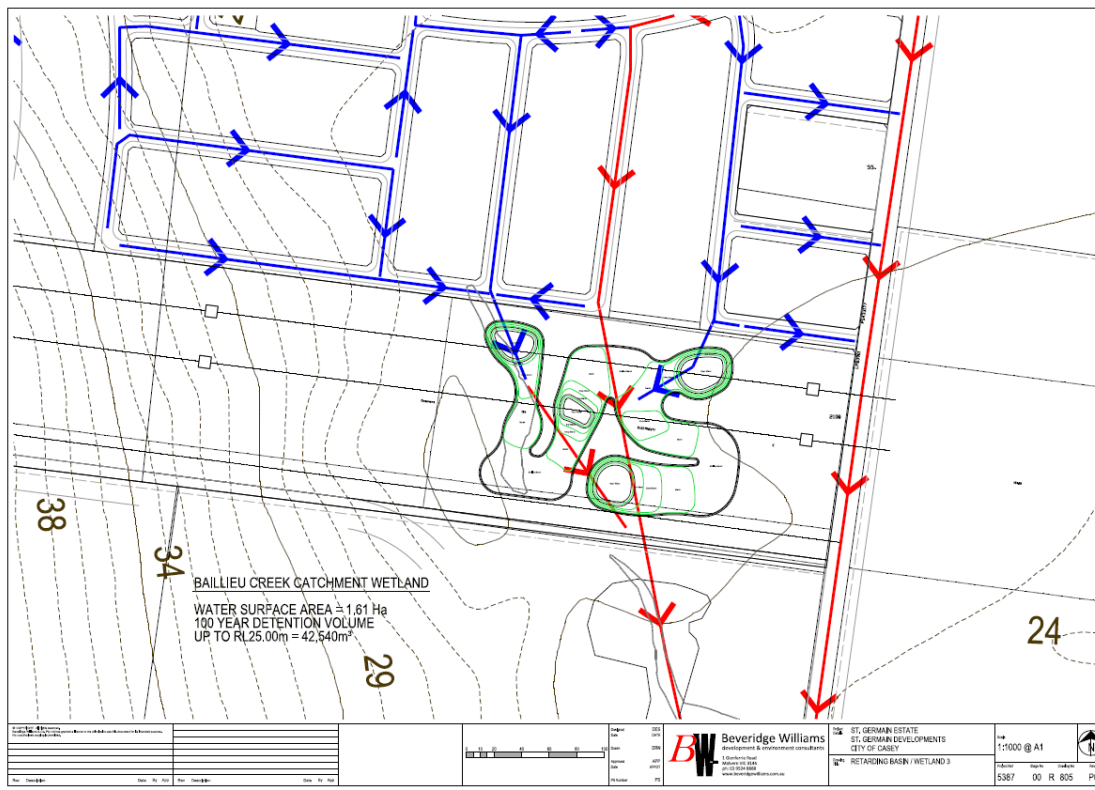


Figure 16: St. Germain Wetland WL – Baillieu Creek catchment
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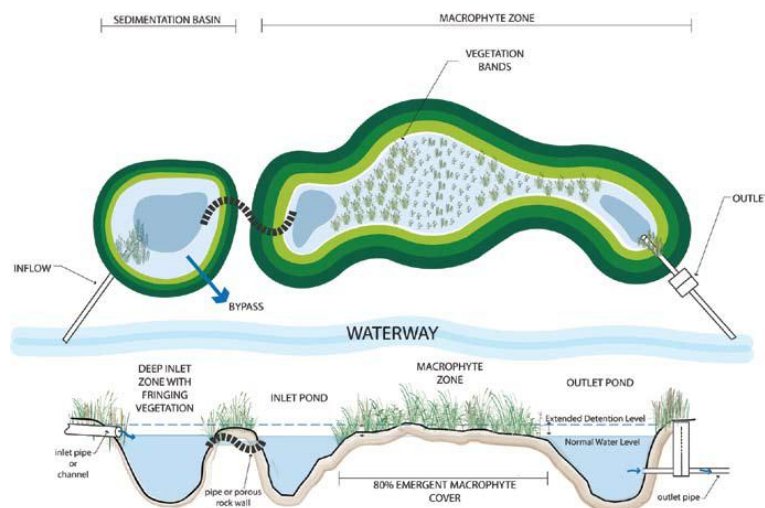
The internal roads for St. Germain, and associated lot finished surface levels, will be designed to ensure that the 1 in 100 year ARI overland flows through the site are within the safe hydraulic capacity of road floodways. Overland flows from external catchments will be directed through the subject site.

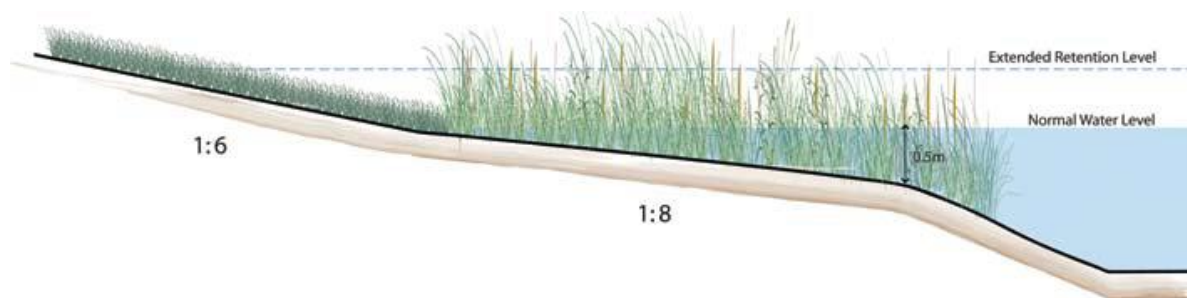
Design of the wetlands within the subject site will be in accordance with the Neil Craigie Report and the Melbourne Water constructed waterways guidelines, which are on their web site at : [http://ldm.melbournewater.com.au/content/drainage design and construction guidelines and requirements/constructed waterways in urban developments guidelines.asp](http://ldm.melbournewater.com.au/content/drainage%20design%20and%20construction%20guidelines%20and%20requirements/constructed%20waterways%20in%20urban%20developments%20guidelines.asp)

Some examples are shown below (Figure 17).

Figure 17: Waterway Examples

Source: Constructed Wetlands Guidelines by Melbourne Water
Not to scale





4.3 Detention and treatment

It is expected that Melbourne Water will require all developments to provide as a minimum best-practice water quality treatment via 'at source' methods.

This means that it will be necessary for the development to provide stormwater quality mitigation measures, as well as provide a 1 in 100 year capacity waterway through the site.

The WSUD options to be utilised for this development will include a number of Sediment Basins incorporated with the Wetland / Retarding Basins.

These options will be located in the south east corner of the site along Smiths Lane for the Baillieu Creek catchment and along Thompsons Road frontage for the Ti-Tree Creek catchment area. Within Neil Craigie's report and the draft PSP the SBRB2 & WLRB2 are wholly within St Germain site, SBRB1 is located on private property at 1350 Pound Road and is subject to the drainage strategy for that site. Wetland flows will be treated within the St. Germain site though. The designs will be in accordance with the specific technical details contained in the design and construction [WSUD Technical Manual](#).

A MUSIC model of the overall catchment (including other treatments) has been prepared in Neil Craigie's report (Figure 10 of the report). The summary of this model is shown below in Table 4. A summary of the MUSIC model results for Individual Assets is shown in Table 5. A total of 4.65ha of Water Surface area for the Ti-Tree Creek catchment is required, of which 1.1 ha for the SBRB1 is located within the property at 1350 Pound Road. A total of 1.8ha WSA for the Baillieu Creek catchment is required to service contributing sub-catchments from three separate properties. As half the area is within the St Germain property an initial wetland with a minimum surface area of 0.9 ha will be constructed in the south east corner of the subject site. The Normal Top Water Level (NTWL) will be 25.0m and the 100 Year flood level is 26.28m for SBRB1, 23.7m and 25.66m respectively for WLRB2a & b, 24.0m and 25.66m respectively for WLRB2c, 23.0m and 25.5m respectively for Baillieu Creek WL1.

Table 4: (Taken from Neil M Craigie Report "TABLE 7: MUSIC Model Results for the whole system performance.")

Location / Asset / Parameter	Catchment Source Loads	Residual Loads	% Load Removal in System to Asset Outlet
<u>SBRB1 (external to site)</u>			
Flow (ML/yr)	485	477	2
Suspended Solids (Kg/yr)	96,800	18,600	81
Total Phosphorus (Kg/yr)	199	80	60
Total Nitrogen (Kg/yr)	1,380	928	33
Gross Pollutants (Kg/yr)	17,000	0	100

<u>WLRB2 (includes SBRB1 and SBRB2)</u>			
Flow (ML/yr)	1,230	1,180	4
Suspended Solids (Kg/yr)	248,000	38,300	85
Total Phosphorus (Kg/yr)	506	146	71
Total Nitrogen (Kg/yr)	3,480	1,900	46
Gross Pollutants (Kg/yr)	43,400	0	100
<u>Baillieu Creek @ PSP 53 boundary</u>			
Flow (ML/yr)	400	382	4
Suspended Solids (Kg/yr)	75,400	11,500	85
Total Phosphorus (Kg/yr)	157	44	72
Total Nitrogen (Kg/yr)	1,130	581	48
Gross Pollutants (Kg/yr)	13,200	0	100

Table 5: (Taken from Neil M Craigie Report) "TABLE 8: MUSIC Model Results for Individual Assets.

Location / Asset / Parameter	Input Loads	Residual Loads	Load Removal in Asset
WLRB2 (includes SBRB2)			
Flow (ML/yr)	1,220	1,180	40
Suspended Solids (Kg/yr)	166,000	38,300	127,700
Total Phosphorus (Kg/yr)	382	146	236
Total Nitrogen (Kg/yr)	3,080	1,900	1180
Gross Pollutants (Kg/yr)	26,400	0	26,400

Location / Asset / Parameter	Input Loads	Residual Loads	Load Removal in Asset
WL1 (Baillieu Creek)			
Flow (ML/yr)	400	382	18
Suspended Solids (Kg/yr)	77,000	12,500	64,500
Total Phosphorus (Kg/yr)	160	45	115
Total Nitrogen (Kg/yr)	1,140	578	562
Gross Pollutants (Kg/yr)	13,200	0	13,200

The detailed design of the Sediment Basin and Wetland / Retarding Basin has not yet been completed, but this will be submitted to Melbourne Water during the detailed design phase.

5 STAGING AND SEQUENCING

As the provision for Melbourne Water to reimburse the construction of the wetlands will be limited, it is proposed to develop the wetlands in stages along Thompsons Road. The contributions due for the development of the land will be used to construct the wetland in an offset payment strategy.

The full development of the site relies on downstream works to be carried out for the ultimate construction of the Melbourne Water waterway through 1275 Pound Road property as per the Clyde North PSP. Permission will be required from the property owner to construct the temporary pipeline and provide an easement, in favour of City of Casey 3m wide, for maintenance purposes. To create a free flowing outlet in the interim, a min. 900mm dia pipe culvert is proposed to be installed along the frontage of 1275 Pound Road and into the existing Wetlands constructed as part of the Berwick Waters development 1.2 km to the north west. This pipe will carry approx. half the ultimate developed flows for Ti-Tree Creek catchment south of Thompsons Road for the 1 year storm event. In the event that the waterway is delayed downstream, the excess detention required on-site for up to the 100 year ARI event will be increased to compensate.

Sediment Basin and Wetland / Retarding Basins are proposed to be fully contained within 1425 Pound Road site.

Stage 1 works are proposed to construct a Medical Centre with some retail and residential lots with access off Thompsons Road by the proposed arterial road. Part of the wetland will be built as shown in Figure 18 with a grassed channel to convey the overland flows to the outlet pipes at Thompsons Road. The channel will act as a retarding basin in the event of storms. As further stages are developed, the wetlands will be expanded to cater for the expected flows and minimise costs to Melbourne Water and the client. The Baillieu Creek wetland will be required once the Retirement village or residential development reaches the eastern catchment area.

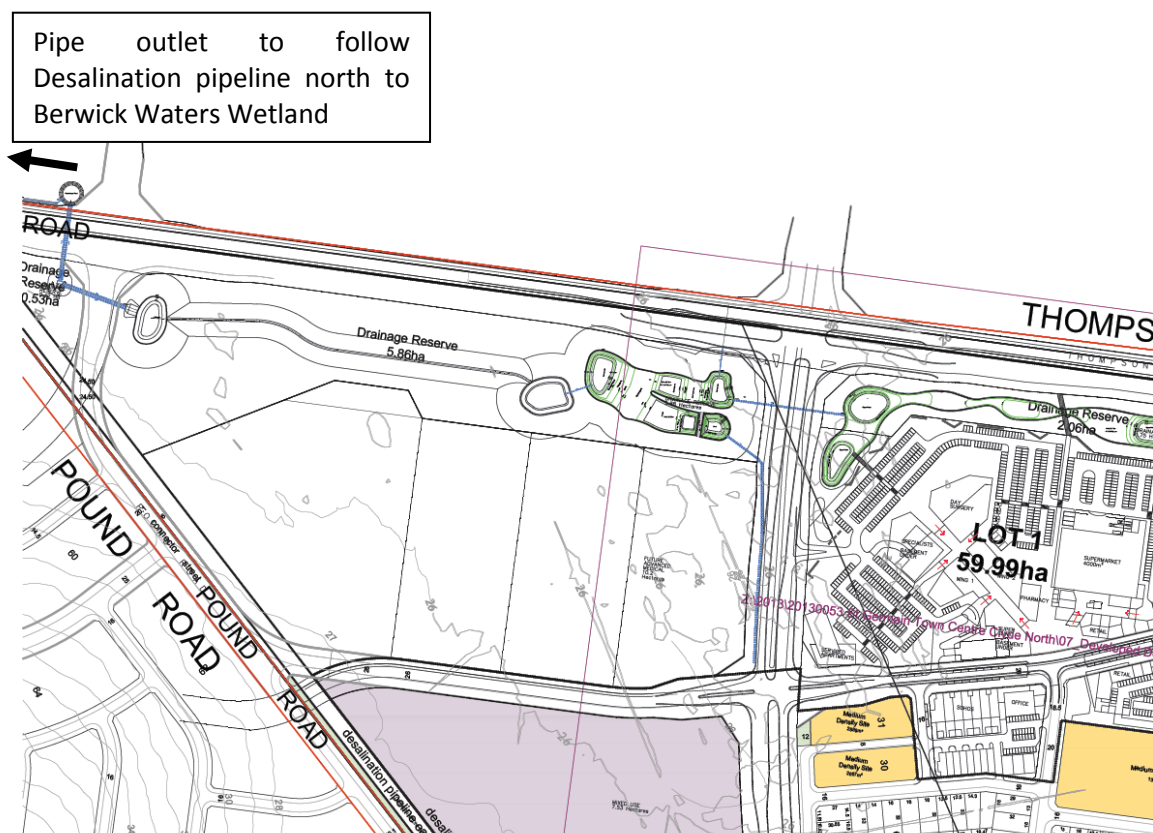


Figure 18: Stage 1 wetland and channel extents

6 CONCLUSION

This report has identified a drainage management strategy for the proposed residential development located at 1425 Pound Road and 2010 Thompsons Road (known as the Gill property), Clyde North, based on the SWMS prepared by Neil M Craigie.

The strategy provides a methodology for the management of stormwater on the subject site which would result in:

- Conveyance of external catchment flows through the site in accordance with the Melbourne Water Land Development Manual Safe Floodway Criteria;
- Construction of drainage to meet the likely requirements of Melbourne Water and Council, including a 1 in 100 year ARI capacity waterway and underground drainage for the 1 in 10 year ARI storm event for the Commercial area and 1 in 5 year ARI storm event for the Residential areas as needed;
- Construction of Wetlands / Retarding Basins to meet the retardation and water quality treatment requirements.

The above strategy can be implemented and all of Melbourne Water and Council's development requirements can be achieved, in accordance with the Proposed Draft Precinct Structure Plan and with no net effect on the downstream properties.

7 REFERENCES

Stormy Water Solutions , Neil Craigie Pty Ltd and Pat Condina & Associates (2012) *Assessment of Drainage Strategy for PSP 53 and the Overall Cardinia Creek Catchment*, 24th September 2012.

Neil M Craigie Pty Ltd (2012) *Casey Growth Area, Thompsons Road PSP 53 and Clyde Creek PSP 54, Stormwater Management Strategy (SWMS). Draft Version 2*, 3rd November 2012.

http://ldm.melbournewater.com.au/content/drainage_design_and_construction_guidelines_and_requirements/constructed_waterways_in_urban_developments_guidelines.asp

BEVERIDGE WILLIAMS & CO PTY LTD

Prepared by

Approved for issue by

Darren Belton

Robert Strong

Senior Engineer

Project Manager



**APPENDIX A.
Neil M Craigie Pty Ltd (2012)
Report; Stormy Water
Solutions, Neil Craigie Pty Ltd,
and Pat Condina & Assoc
(2012) Report.**

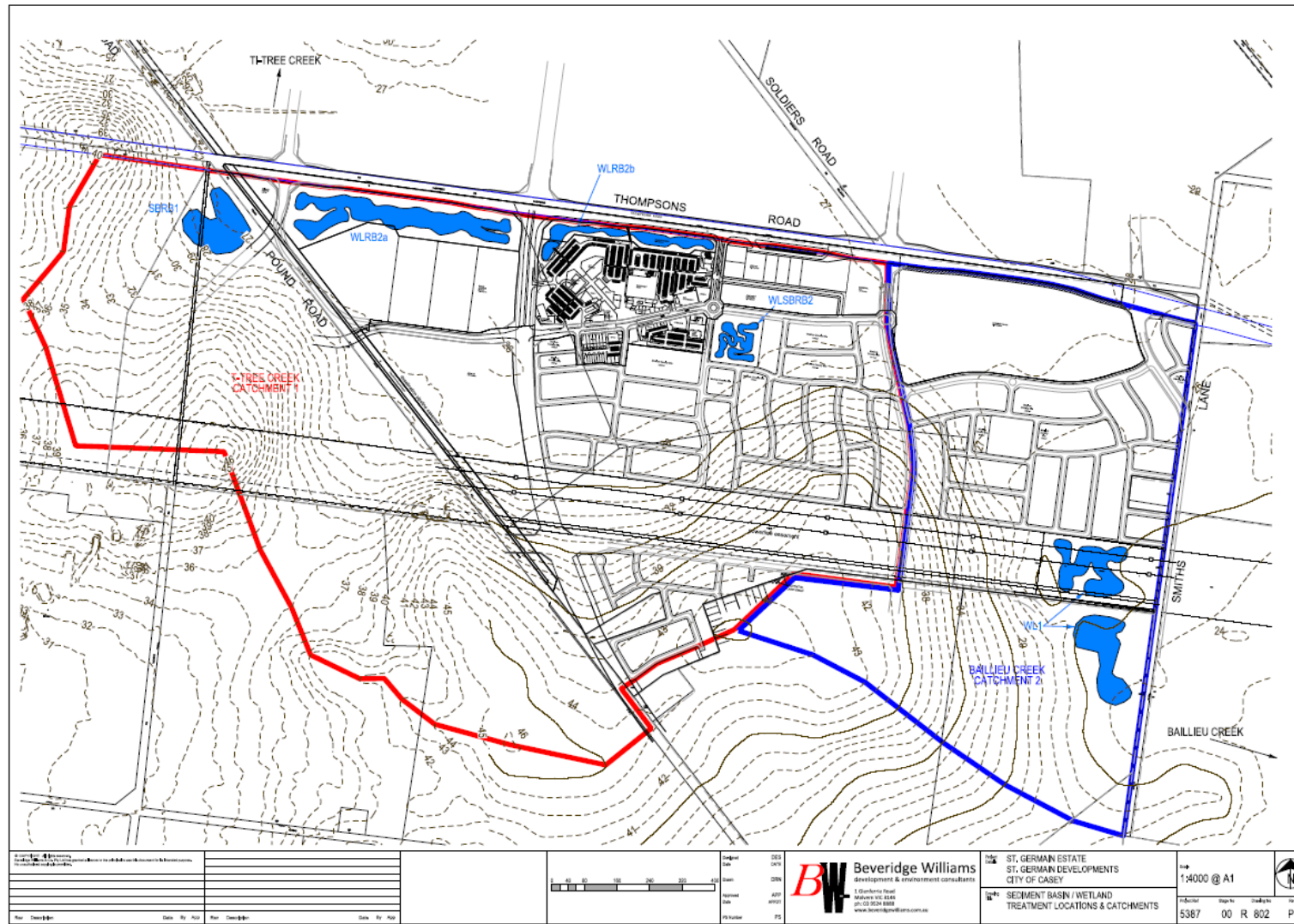




APPENDIX B. Site Catchment Plan



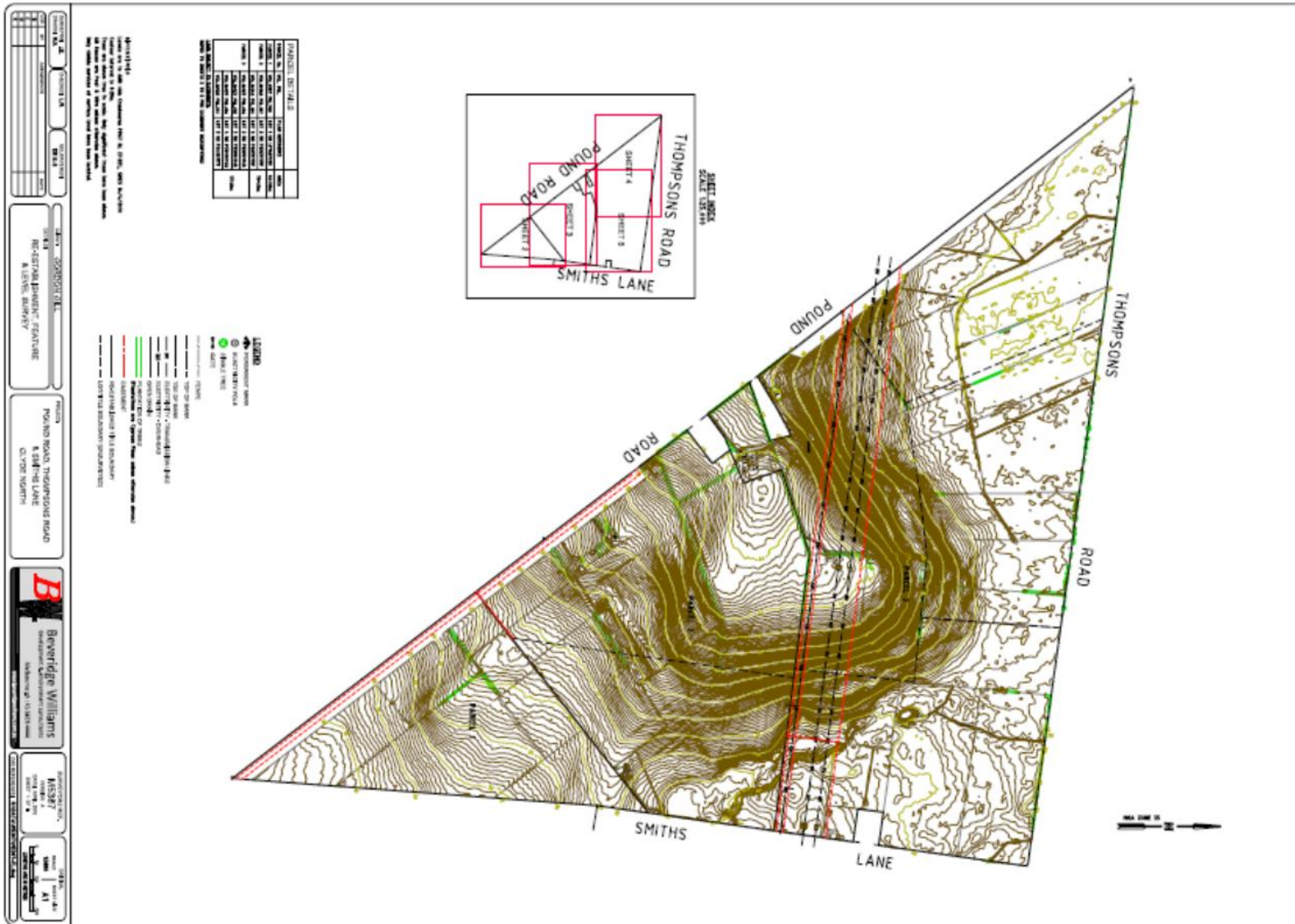
PROPOSED WETLAND RETARDING BASIN LAYOUT



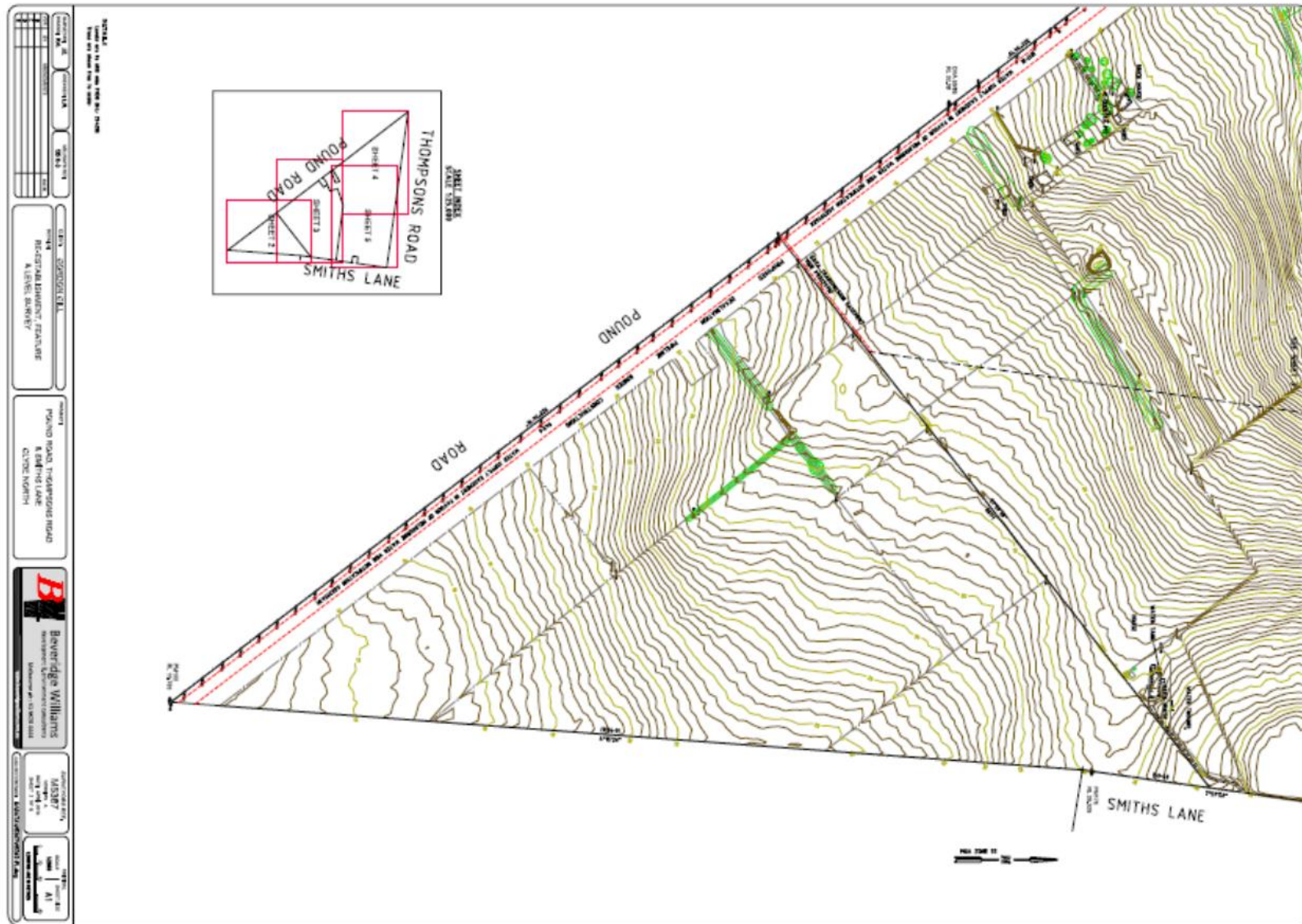


APPENDIX C.
Site Topography Plan & Site Analysis
Plan

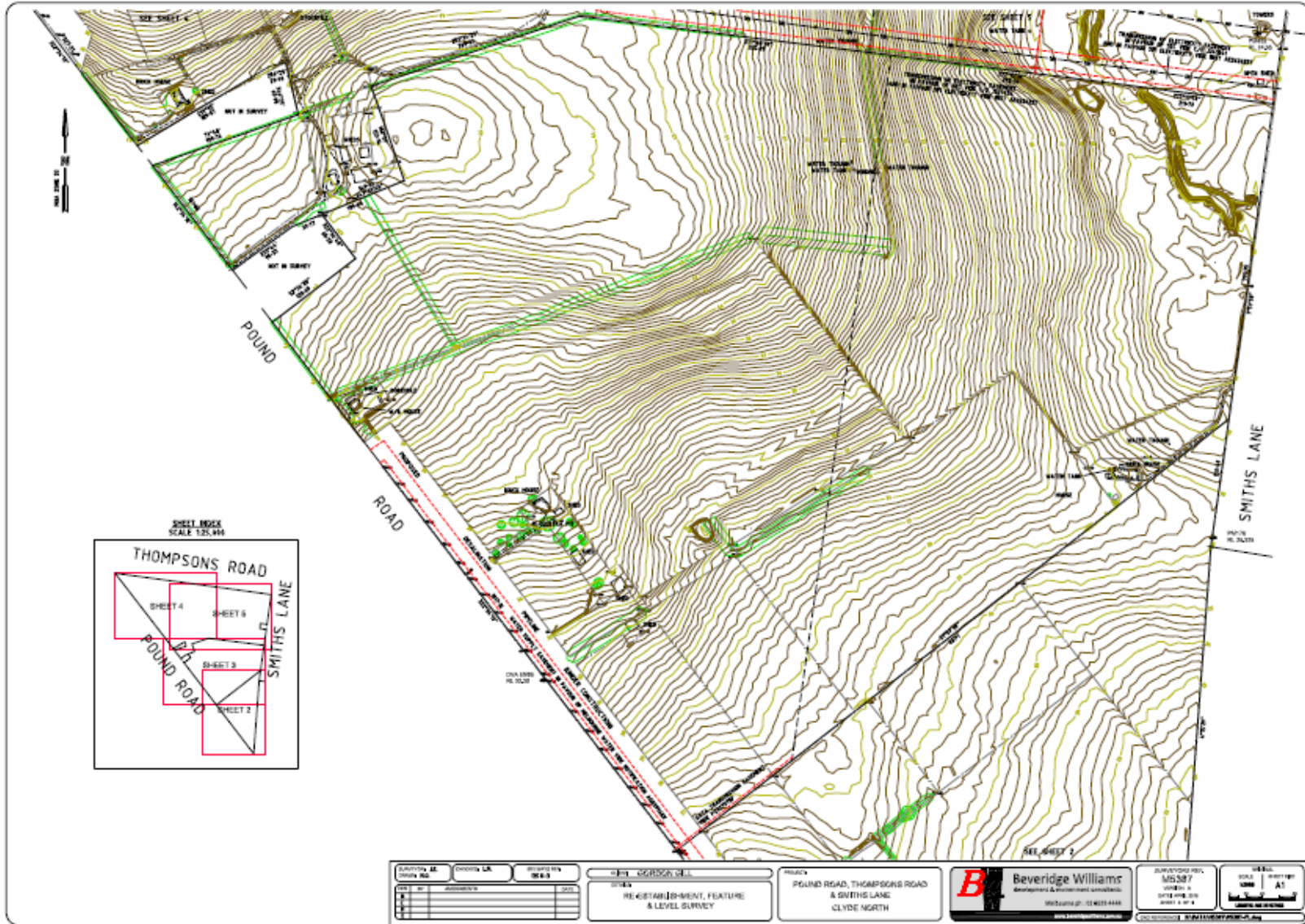
SITE TOPOGRAPHY PLAN 1



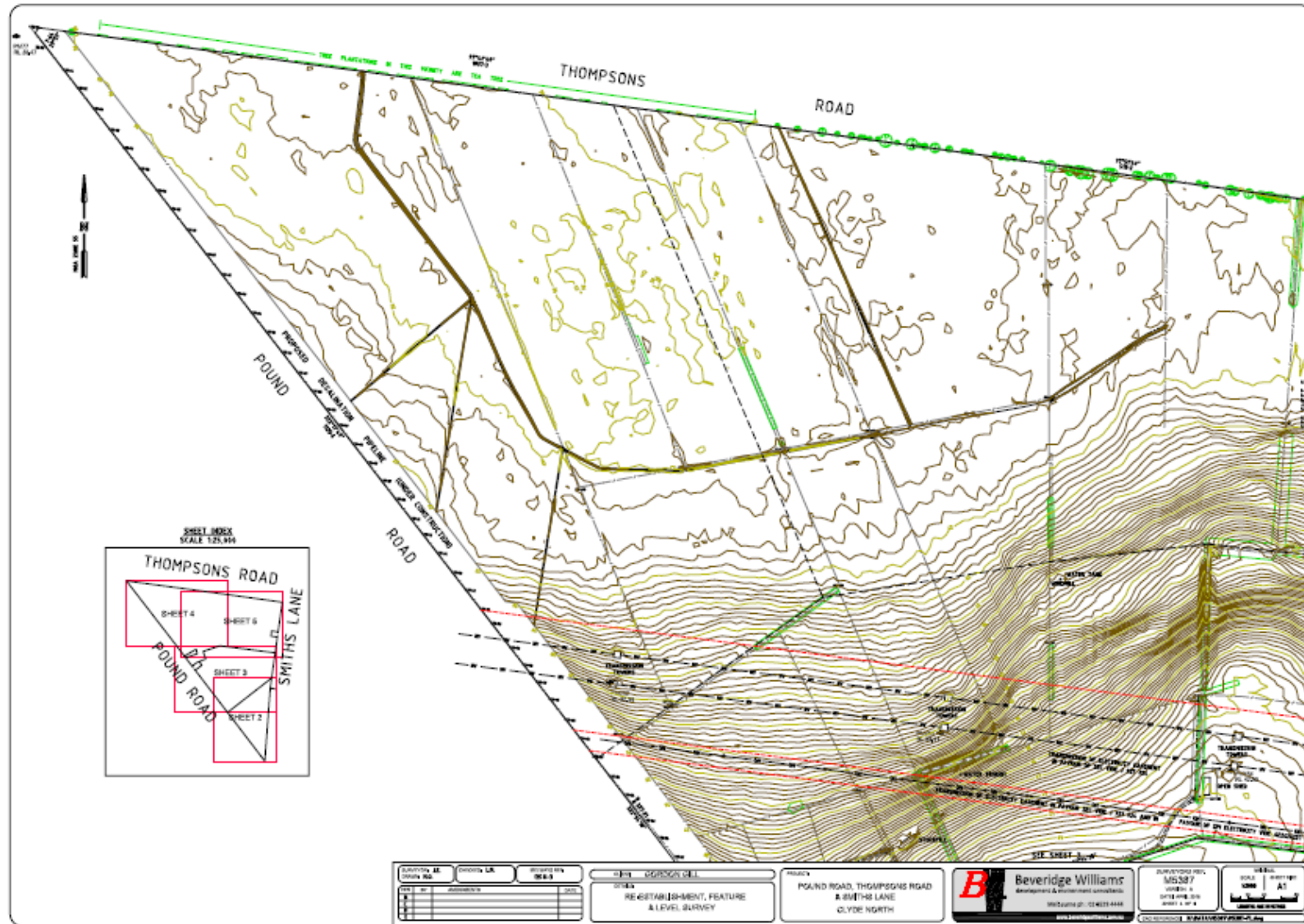
SITE TOPOGRAPHY PLAN 2



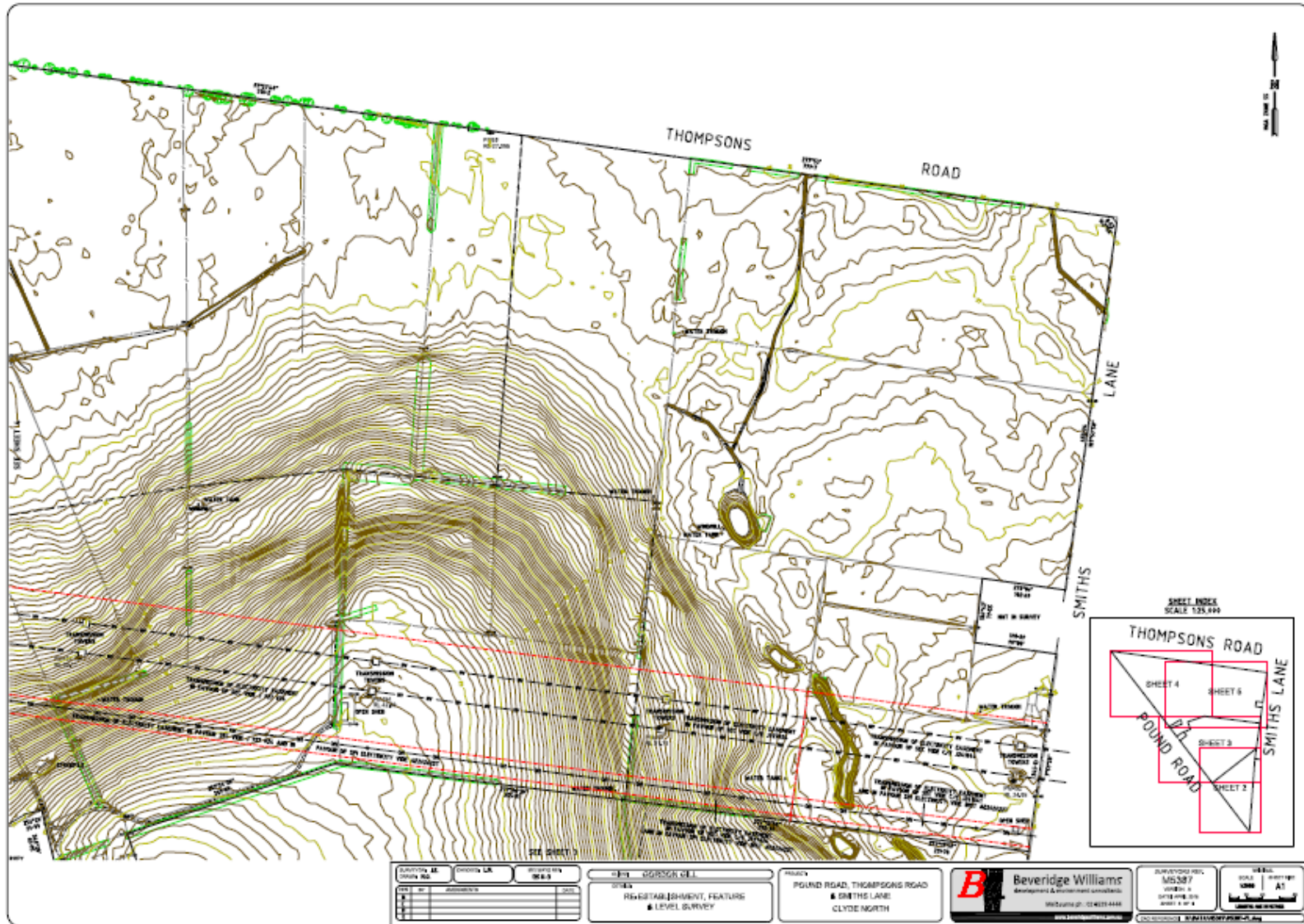
SITE TOPOGRAPHY PLAN 3



SITE TOPOGRAPHY PLAN 4



SITE TOPOGRAPHY PLAN 5



SITE ANALYSIS PLAN



Site Analysis Plan
 1425 Pound Road & 2100 Thompsons Road, Clyde North
 Campbell Park Property Developments Pty Ltd



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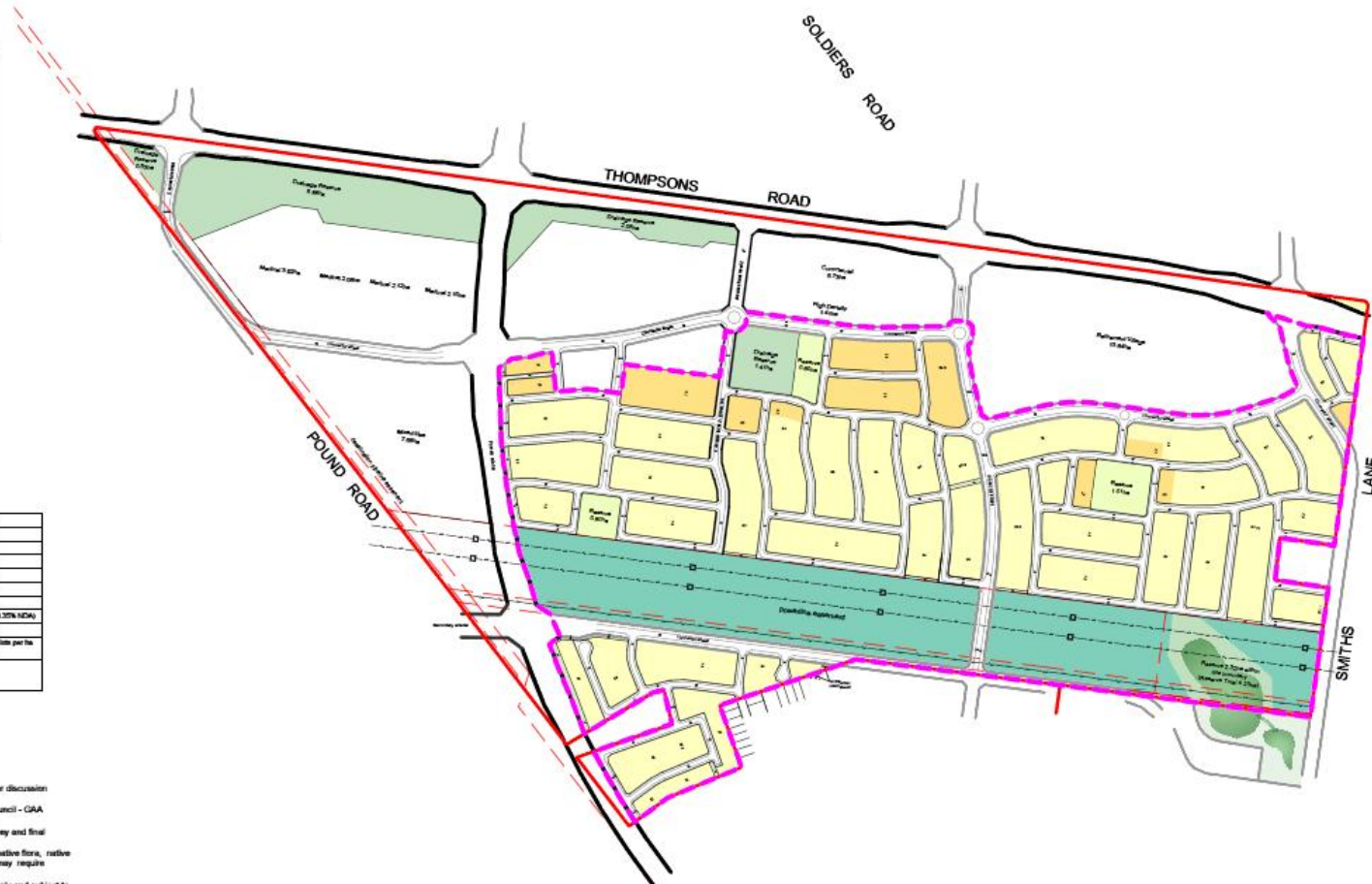


APPENDIX D. Indicative Development Plan and Masterplan

LEGEND	
	Site boundary
	Section 96a Application boundary
	Residential lots
	Medium density separate
	Unencumbered passive open space
	Encumbered passive open space
	Drainage reserve
	Tree reserve
	Primary arterial road
	Secondary arterial road
	Connector street
	Access street level 2

RESIDENTIAL ESTATE	85.15ha
Residential lots	36.126ha
Medium Density Separate (12)	6.37ha
Inter Arterial Roads	23.54ha
Drainage Reserve	3.75ha
Provisional Reserve	26.46ha
Tree Reserve	0.6ha
Unencumbered Passive Open Space	2.27ha (3.02% NDA)
Net Developable Area (NDA) for application area	85.04ha
Estimated Lot Yield (Residential lots)	approx 884 lots @ 10.3 lots per ha x 100m ² average lot size
Estimated Total Number of Residential Lots (includes 12 Medium Density Separates)	806 lots

- Notes
- This plan is indicative only and is intended for discussion purposes only
 - This plan is subject to change during the Council - CAA precinct structure plan preparation process
 - All dimensions and areas are subject to survey and final computations
 - This plan has yet to take into consideration native flora, native fauna or Aboriginal cultural heritage, which may require further investigation
 - Wetland / Drainage areas are approximate only and subject to detailed engineering design and may be subject to change during the precinct structure plan preparation process
 - Access/egress to the site is subject to Council / Vicroads approval
 - Road pavement is indicative only and subject to engineering design
 - All public open space areas are conceptual only and subject to change during the precinct structure plan preparation process

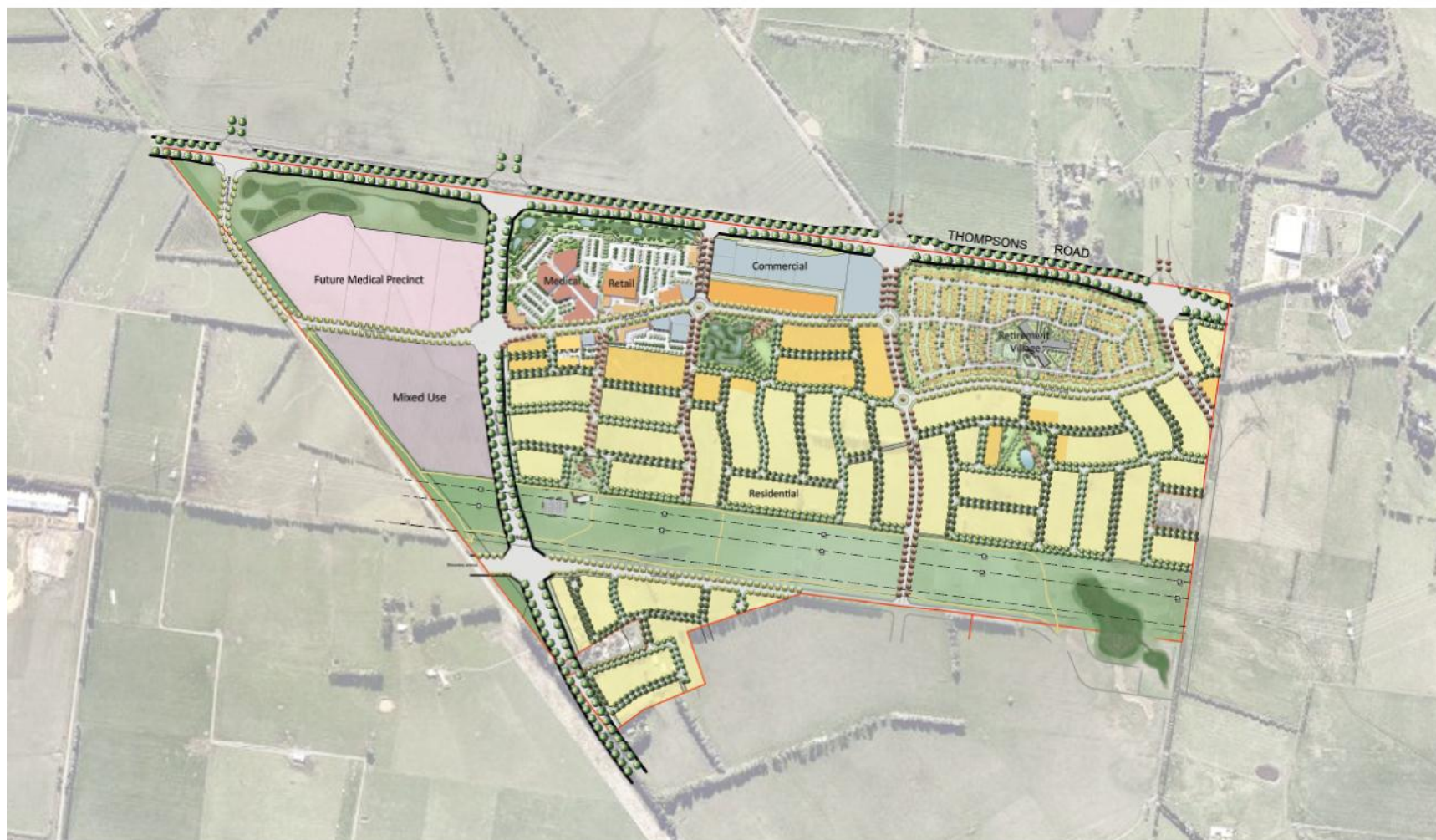


St. Germain Residential Estate Indicative Development Plan
Thompsons Road, Clyde North
St. Germain - Developments

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Drafted By:	T. GUY
Checked By:	N. FALLONER
Drawing Ref:	5387 IDP VSP Opt 1
Version No:	05F
Date:	05.09.2013
Scale (A1):	1:4000
(A3):	1:8000





50 0 50 100 150 200 250 300 350m

St. Germain Village Masterplan
Thompsons Road, Clyde North
St. Germain - Developments

Clarke
Hopkins
Clarke



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Version	Date	Description
1	30.08.2013	Initial Design

Drafted by: A.G. & C.B.
Checked by: N.F. & J.G.
Drawing Ref: 5387_MP01 01
Version No: 02
Date: 30.08.2013
Scale (A1): 1:4000
(A3): 1:8000





APPENDIX E. Overland Flood paths



APPENDIX F. Wetland Layout Plans

