Colliers

52 Golf Rd, Oakleigh South

Summerset

Stormwater Management Plan

REPORT REVISION: C

Report Date: December 2022

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Report Contact:

Name:	James Barker
Position	Manager – Water & Environment
Phone:	(03) 9562 7424

Document Control
REPORT REVISION

Version	Date	Details	Prepared	Checked	Approved	Signed
A	Dec 2022	Issued for Discussion	J. Barker	N. Matamala	J. Barker	J. Barker
B	Dec 2022	Issued for Discussion	J. Barker	N. Matamala	J. Barker	J. Barker
C	Dec 2022	Issued for Approval	J. Barker	N. Matamala	J. Barker	J. Barker

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1. Overview

Colliers Engineering & Design have been engaged by Summerset to prepare a Stormwater Management Plan (SMP) for the Site, located at 52 Golf Rd, Oakleigh South.

The plan outlines any stormwater quantity and quality measures required within the Site to comply with Council requirements.

The plan builds upon the previously accepted SMP prepared by the previous landowner with minor adjustments to reflect the proposed new land-use of an aged care facility and retirement village.

2. Existing Site

The Site is located in Oakleigh South, south-west of the Huntingdale Golf Club and north-east of the intersection between Centre Rd and Warrigal Rd, it has an area of 1.83 hectares (ha).

In existing conditions, the Site is substantially bare and is considered highly permeable. The Site falls towards the north-west corner. Natural topography data indicates approximately 2 m of fall across the Site to the north-west, from 58.2 m AHD at the south-east corner to 56.2 m AHD at the north-east corner, see Figure 1.

Figure 1. The Site

3. Proposed Development

Based on the current draft plan, the Site will be developed into a retirement village and will incorporate villas, an independent living apartment complex, and an aged care facility, see Figure 2.

Figure 2. Proposed Development Plan

This proposed development will increase the imperviousness of the Site resulting in higher (site derived) peak flow rates and stormwater pollutant loads.

4. Flooding

The site is not subject to any Special Building Overlays or Land Subject to Inundation, which indicates that the site should not be prone to stormwater overflow that would result in a 1% AEP storm event. Notwithstanding, Council engineers have indicated that the development site is subject to overland flows during storm events.

The runoff comes from the intersection of Bakers Road and Beryl Avenue and travels in a north/west direction where it has been captured in the existing channel along the northern boundary to avoid discharging into existing dwellings at Barholme Court. The existing channel along the northern boundary was constructed to divert the runoff away from these court bowl properties.

Figure 3. Existing Overland Flow Path - Previous SMP (FMG)

5. Stormwater Management

The stormwater management for the development will be based on water sensitive urban design (WSUD) principles and will be consistent with Urban Stormwater Best Practice Environmental Management Guidelines while also incorporating sustainable design features to deliver lower living costs for future residents of the proposed development. The following key items will be considered:

- Adequate drainage to ensure a free draining development.
- Pavement, road, and drainage levels are designed to ensure surrounding properties are not adversely affected.
- The discharge volumes of the development are stored to pre-developed levels.
- The pollutant discharge from the Site is minimized to meet Best Practices, ensuring the protection of downstream receiving waterways and environments.
- Rainwater Harvesting, promoting self-sufficiency and cost-effective water practices.
- All flows, including up to the 1% AEP to be conveyed below ground, ensuring a reduction in any slipping or tripping hazards to the vulnerable residents of the retirement village by the removal of kerbs from the road's design.
- All flows to discharge via the Legal Point of Discharge (LPD) to Council satisfaction.

The proposed development has a total catchment area of 1.83ha.

Table 1. Post-Developed Catchment Break-Up

Land Use	Fraction Impervious	Area (ha)
Road/Pavement	1.00	0.435
Grass/Open Space	0.05	0.614
Buildings [Villas]	1.00	0.449
Buildings [ALA/RAC]	1.00	0.328
Total	0.68	1.826

6. Stormwater Quality Treatment

The strategy for on-site stormwater quality treatment to achieve Best Practice Environmental Guidelines has been achieved by an integrated approach with a combination of rainwater harvesting and stormwater quality improvement devices.

Best Practice Environmental Management Guidelines (BPEMG), which are:

- 45% reduction in Total Nitrogen (TN)
- 45% reduction in Total Phosphorus (TP)
- 80% reduction in Total Suspended Solids (TSS)
- 70% reduction in Litter (GP)

Rainwater harvesting is utilised on the apartment complex and aged care facility to address ESD requirements. As all flows are directed underground, proprietary treatment is the only option to achieve the remaining water quality objectives. Surface flows receive primary treatment (TSS & GP) at source via decentralised SPEL Stormsacks in each roadside pit. Tertiary treatment (TN & TP) is achieved via a SPEL Hydrosystem end of line filter prior to discharge to the LPD.

MUSIC modelling of the proposed treatment train confirms that Best Practice objectives have been achieved with sufficient conservatism.

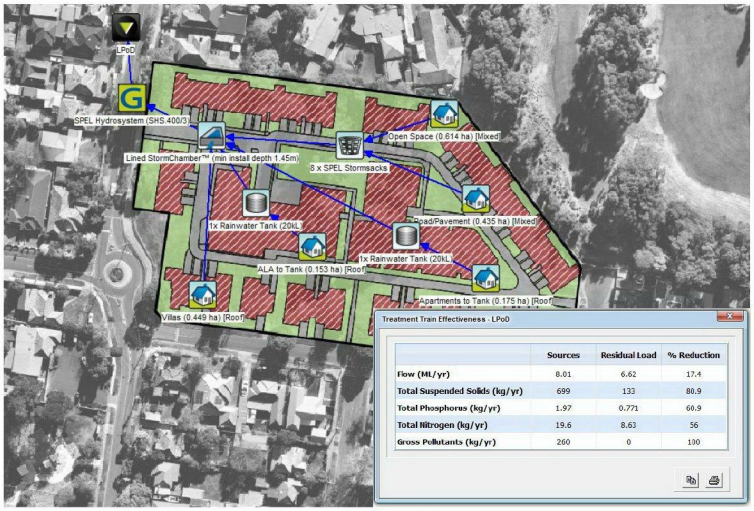

Figure 4. MUSIC Modelling

Stormwater quality improvement devices are to be owned and maintained by the body corporate.

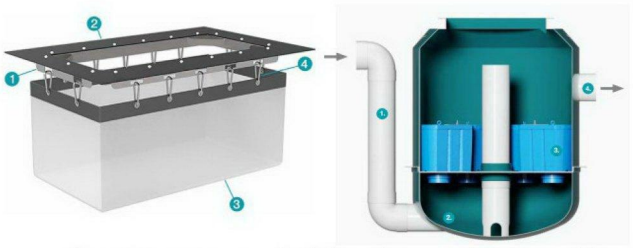

Figure 5. SPEL Stormsacks (left) and SPEL Hydrosystem (right)

7. On-Site Detention

An on-site detention (OSD) system will be constructed to protect the downstream receiving environment from increased (developed) flows. The OSD system has been sized using Boyd's Method where the 1% AEP developed flows developed within the Site were restricted to that of pre-developed conditions.

Storage is achieved via an underground detention tank (SPEL Storm Chamber). Table 2 highlights the storage requirements to detain flows to pre-developed conditions.

Table 2. On-Site Detention Parameters

Restricted Outflows	0.19 m³/s
Peak Inflows	0.65 m³/s
Storage Volume Required	250 m³

The outfall for the OSD system will discharge into the Council drainage network. As the OSD system is being proposed to be below ground, the location of the asset will be within the village road reserve close to the legal point of discharge at the north-west corner.

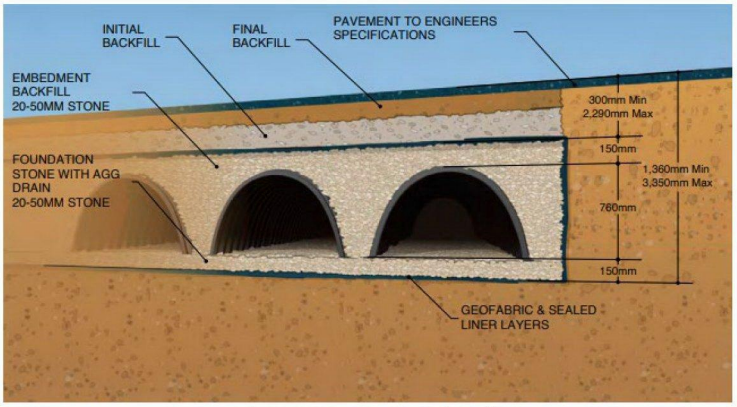

Figure 6. SPEL Storm Chamber

8. Flood Mitigation

The Site is subject to flooding from Bakers Rd and drainage network to the south with overland flows discharging through the Site and into existing residences within Barholm Ct and Golf Rd. The previously accepted proposal by the former landholder to mitigate this was achieved via directing these overland flows safely through the site via the internal road network.

As the new land-use is intended to contain aged care facilities for vulnerable residents, no tripping hazards (such as kerbs) are permitted within the site. As such, external flooding is to be mitigated by directing overland flows safely underground through the Site. Two-dimension flood modelling (TuFLOW) was undertaken to confirm this approach.

Hydrologic modelling (RORB) to ARR19 methodology was undertaken to determine the critical 1% AEP storm event flows within the area.

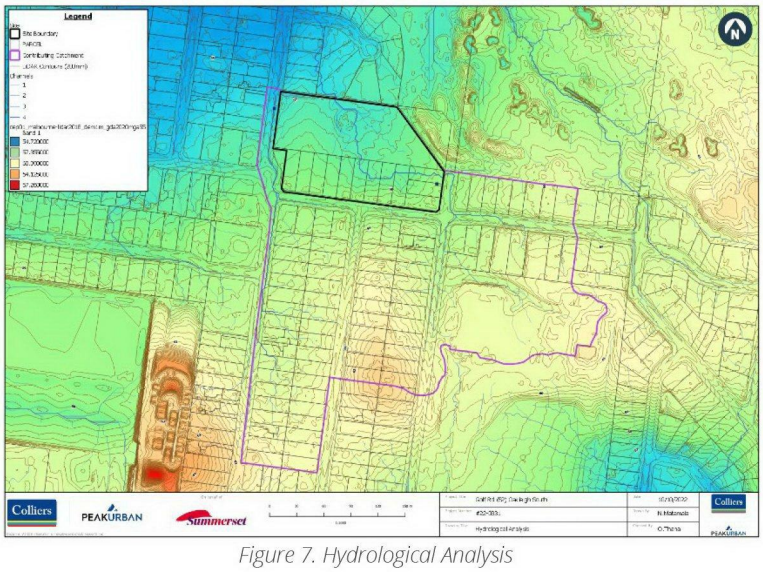

Figure 7. Hydrological Analysis

The 1% AEP existing conditions was run to determine the critical duration (20-min) and temporal pattern (27TPat) at

the Site Inlet at the eastern boundary of the Site. At this critical duration and temporal pattern, hydrographs have been developed, by extracting flows from the print nodes in the RORB model located at Beryl Avenue, Bakers Road, Joyce Avenue, and Cameron Avenue close to the Site, refer Figure 8.

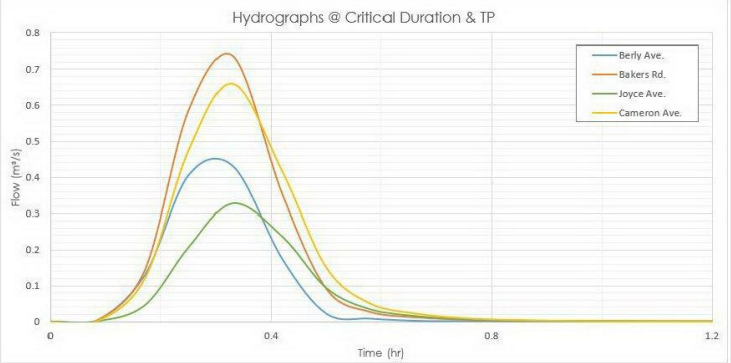

Figure 8. Critical Duration & Temporal Pattern Hydrographs

These hydrographs were used in the hydraulic analysis to inject flows into the TuFLOW model in order to determine the extent of flooding at the Site's outlet along Golf Rd and inform on the quantity of external flows entering the Site, while incorporating the surrounding drainage network.

Figure 9. Existing Conditions 1% AEP Flood Depths

Flood mitigation scenario modelling was undertaken utilising an iterative approach with the goal of achieving no overland flows within the site and no increase in flood risk to surrounding properties (both up-and-downstream) during the 1% AEP rainfall event as a result of the development.

Floodwaters from Bakers Rd are to be captured via a grated pit within the Site and directed towards the LPD via underground drainage.

Figure 10. Mitigated Conditions 1% AEP Flood Depths

An Afflux plot (flood depth comparison) between existing and developed conditions is highlighted below. There are significant reductions in flooding within the site and within the existing dwellings to the north (pink).

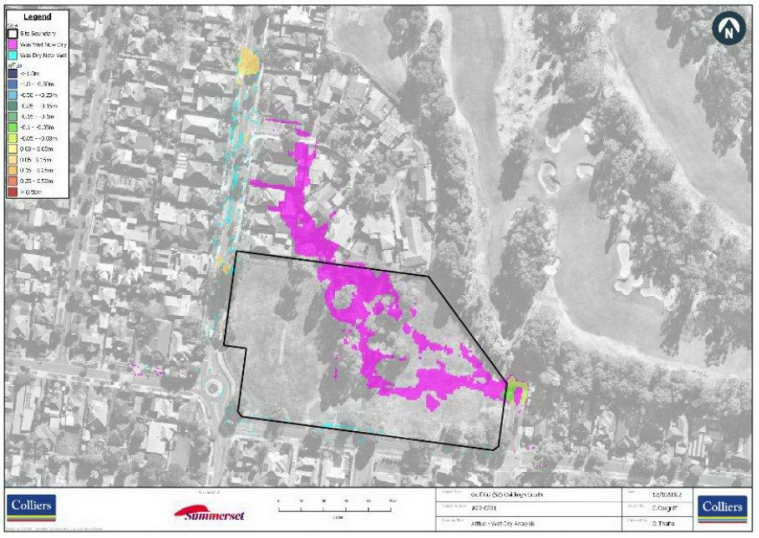

Figure 11. Existing Vs Developed Case Flood Afflux

A summary of the flood mitigation proposal includes:

- Residences of Golf Rd and Barholme Ct are no longer inundated in major storm events
- Reduced flood levels at the northern end of Bakers Rd
- A minor increase in flood depths down Golf Rd due to the diversion of flows preventing the flooding of households whilst maintaining adequate freeboard to lots adjacent to Golf Rd.

The proposed mitigation design is successful in the conveyance of overland flows through the development in a controlled manner with the major upshot of entirely removing the pre-existing flood risk to eight properties directly north of the subject site.

9. Summary

The proposed SMP achieves all Council requirements for stormwater management for the site. Including provision for flood mitigation, on-site detention and water quality treatment, while also incorporating rainwater harvesting.

Flood mitigation measures proposed not only provide flood protection via redirecting of flood waters underground for vulnerable residents within the site, but also improves existing flooding for surrounding properties.

On-site detention has been sized to restrict developed conditions flows to that of existing conditions via underground tank storage.

Water quality objectives have been achieved via a combination of rainwater harvesting, decentralised primary treatment within roadside pits and end of line tertiary treatment via a proprietary filter.

On-site drainage assets are to be owned and maintained by the retirement village operator.

Figure 12. SWMS Concept

Appendices

Appendix A Figures

D23-1786

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On behalf of

Summerset

0 15 30 45 60 75 m

1:1000

Disclaimer: All GIS information is indicative and should be confirmed

Project Title	Golf Rd (52) Oakleigh South	Date	29/11/2022
Project Number	#22-0331	Drawn By	N.Matamala
Drawing Title	Site Overview	Checked By	O.Thaha

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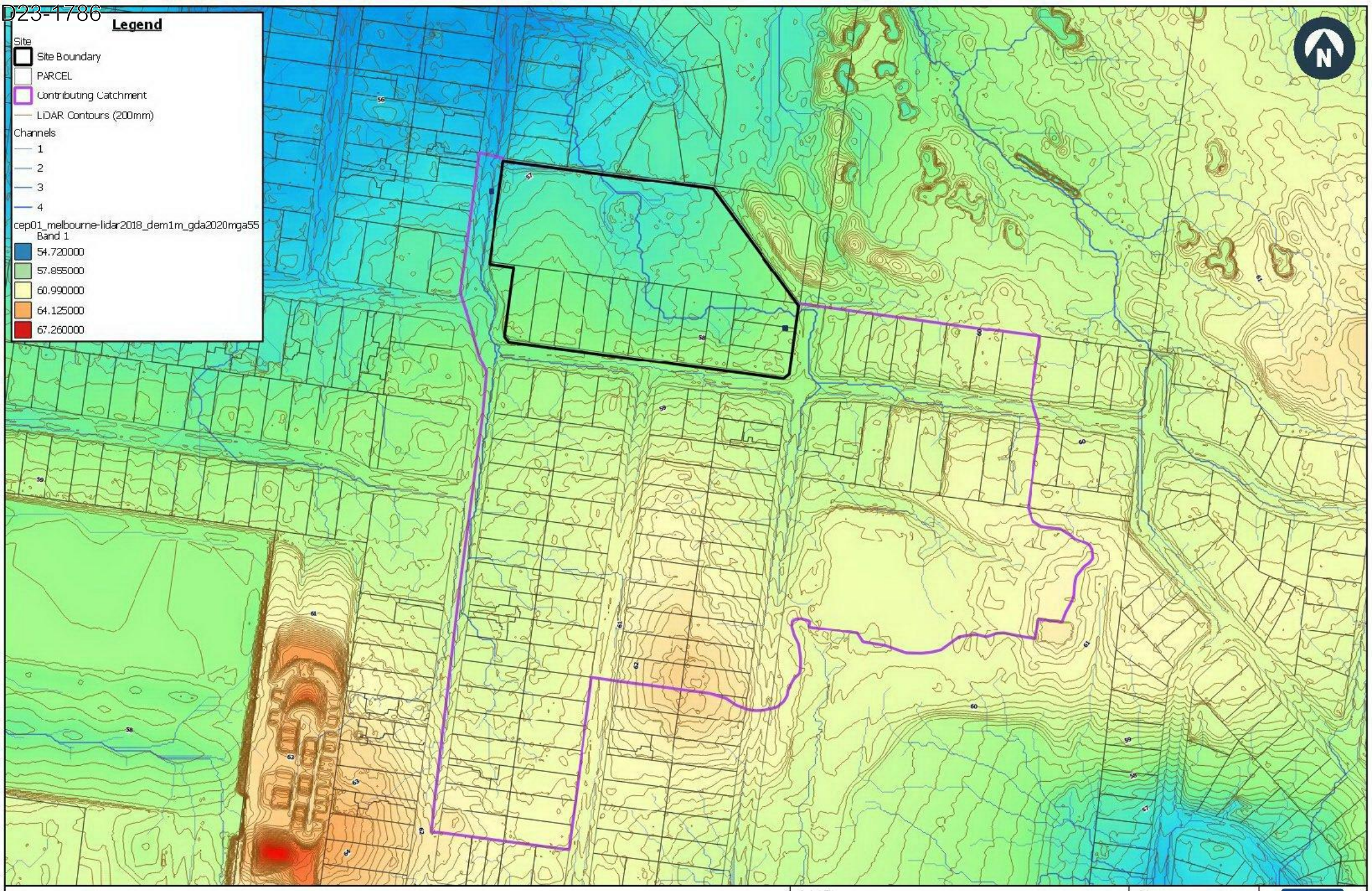
D23-1786



On behalf of

0 30 60 90 120 150 m

1:2000

Project Title	Golf Rd (52) Oakleigh South	Date	10/10/2022
Project Number	#22-0831	Drawn By	N.Matamala
Drawing Title	Hydrological Analysis	Checked By	O.Thaha

Disclaimer: All GIS information is indicative and should be confirmed

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Summerset

0 15 30 45 60 75 m

1:1000

Project Title	Golf Rd (52) Oakleigh South	Date	01/12/2022
Project Number	#22-0331	Drawn By	N. Matamala
Drawing Title	1% AEP Flood Depths - Existing	Checked By	J. Barker

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D23-1786

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On behalf of

Summerset

0 15 30 45 60 75 m

1:1000

Disclaimer: All GIS information is indicative and should be confirmed

Project Title	Golf Rd (52) Oakleigh South	Date	01/12/2022
Project Number	#22-0331	Drawn By	N. Matamala
Drawing Title	1% AEP Flood Depths - Developed	Checked By	J. Barker

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Legend

Site
- Site Boundary
- Was Wet Now Dry
- Was Dry Now Wet

Afflux
- <-1.0m
- -1.0 - -0.50m
- -0.50 - -0.25m
- -0.25 - -0.15m
- -0.15 - -0.1m
- -0.1 - -0.05m
- -0.05 - -0.03m
- 0.03 - 0.05m
- 0.05- 0.15m
- 0.15 - 0.25m
- 0.25 - 0.50m
- > 0.50m

N

Colliers

On behalf of

Summerset

0 15 30 45 60 75 m

1:1200

Disclaimer: All GIS information is indicative and should be confirmed

Project Title	Golf Rd (52) Oakleigh South	Date	12/10/2022
Project Number	#22-0331	Drawn By	C.Cosgriff
Drawing Title	Afflux - Wet Dry Analysis	Checked By	O.Thaha

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Legend

Site

Site Boundary

SWMS

Underground Drainage Flows

SPEL Hydrosystem

SPEL Stormsacks (Indicative)

Underground Detention Basin

100yr External Pipe

Golf_Rd_pr02_100y_20mtp27_v1_d_Max
Band 1

0.00 - 0.03m

0.03- 0.05m

0.05 - 0.10m

0.10 - 0.25m

0.25 - 0.50m

0.50 - 1.00m

1.00 - 1.50m

Greater than 1.50m

N

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0 15 30 45 60 75 m

1:1000

Disclaimer: All GIS information is indicative and should be confirmed

Project Title	Golf Rd (52) Oakleigh South	Date	30/11/2022
Project Number	#22-0331	Drawn By	N.Matamala
Drawing Title	SWMS Concept	Checked By	O.Thaha

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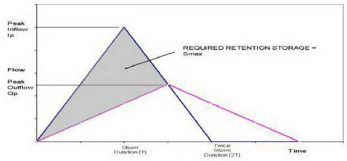
Appendix B Calculations

D23-1786

Project Name: Golf Road (52) Oakleigh South
Project No.: 22-0331
Author: Nicholas Matamala
Date: 29/11/2022

Description: **Detention Tank**

Definitions



Boyd's Equation: $S_{max} = V_1\left(1-\frac{Q_p}{I_p}\right)$

Where:
S_{max} = Maximum Volume of Temporary Storage (m^3)
V_1 = Volume of Inflow Flood (m^3)
I_p = Peak discharge of inflow hydrograph (m^3/s)
Q_p = Peak discharge of outflow hydrograph (m^3/s)

Input

Pre-Developed Catchment Modelling

AEP	Area Ha	Cy	Tc min	I mm/hr	∑ Ae Ha	Q m^3/s
63.20%	1.826	0.185	19.13	33.30	0.338	0.03
50%	1.826	0.197	18.06	38.45	0.359	0.04
20%	1.826	0.220	15.42	57.02	0.401	0.06
10%	1.826	0.231	14.05	71.99	0.423	0.08
5%	1.826	0.243	12.94	88.42	0.444	0.11
2%	1.826	0.266	11.70	113.66	0.486	0.15
1%	1.826	0.278	10.91	135.42	0.507	0.19

Post-Developed Catchment Modelling

AEP	Area Ha	Cy	Tc min	I mm/hr	∑ Ae Ha	Q m^3/s
63.20%	1.826	0.530	7.25	54.41	0.968	0.15
50%	1.826	0.563	7.25	60.71	1.029	0.17
20%	1.826	0.630	7.25	82.08	1.150	0.26
10%	1.826	0.663	7.25	98.11	1.211	0.33
5%	1.826	0.696	7.25	115.01	1.271	0.41
2%	1.826	0.762	7.25	139.51	1.392	0.54
1%	1.826	0.796	7.25	159.94	1.453	0.65

Storage AEP 1%
Release AEP 1%

Discharge 0.19 m^3/s

Storage Calculation

Volume Required 250 m^3 Okay

Dur (mins)	I (mm/hr)	C	A	Ae	I_p (m^3/s)	Q_p (m^3/s)	V_1 (m^3)	S_{max} (m^3)	Check
5.00	180.02	0.80	1.826	1.453	0.726	0.19	217.9	160.7	More Storage
6.00	170.48	0.796	1.826	1.453	0.688	0.19	247.7	179.0	More Storage
7.00	161.94	0.796	1.826	1.453	0.653	0.19	274.5	194.3	More Storage
8.00	154.22	0.796	1.826	1.453	0.622	0.19	298.7	207.1	More Storage
9.00	147.20	0.796	1.826	1.453	0.594	0.19	320.7	217.7	More Storage
10.00	140.79	0.796	1.826	1.453	0.568	0.19	340.9	226.4	More Storage
11.00	134.92	0.796	1.826	1.453	0.544	0.19	359.3	233.4	More Storage
12.00	129.53	0.796	1.826	1.453	0.523	0.19	376.3	239.0	More Storage
13.00	124.57	0.796	1.826	1.453	0.503	0.19	392.1	243.3	More Storage
14.00	119.97	0.796	1.826	1.453	0.484	0.19	406.7	246.4	More Storage
15.00	115.72	0.796	1.826	1.453	0.467	0.19	420.3	248.6	More Storage
16.00	111.77	0.796	1.826	1.453	0.451	0.19	433.0	249.8	More Storage
17.00	108.09	0.796	1.826	1.453	0.436	0.19	444.9	250.3	Okay

D23-1786

Treatment Train Effectiveness - LPoD

	Sources	Residual Load	% Reduction
Flow (ML/yr)	7.93	6.52	17.8
Total Suspended Solids (kg/yr)	707	134	81.1
Total Phosphorus (kg/yr)	1.96	0.755	61.4
Total Nitrogen (kg/yr)	19.5	8.47	56.6
Gross Pollutants (kg/yr)	261	0	100

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