Park Village, Highett

Residential Development

Stormwater Management Plan

Prepared for: Sunkin Projects Pty Ltd co/Gallagher Jeffs

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Date: 30/07/2021

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Revision

Revision	Date	Comment	Prepared By	Approved By
A	13/06/2020	DRAFT	MHU	DMCG
B	17/06/2020	DRAFT	MHU	DMCG
C	12/11/2020	DRAFT	MHU	DMCG
D	11/12/2020	FINAL	MHU	DMCG
E	5/03/2021	FINAL (REVISED)	PM	DMCG
F	22/07/2021	FINAL (REVISED)	ELP	DMCG
G	30/07/2021	FINAL (REVISED)	ELP	DMCG

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Glossary of Terms

Average Recurrence Interval (ARI)	The average or expected value of the period between exceedances of a given rainfall total accumulated over a given duration. Eg. 1% AEP flood is expected to be exceeded once every 100 years on average (taken to be equivalent to 1% AEP). It is implicit in this definition that the periods between exceedances are generally random.
Catchment	Area draining to a site. It always relates to a particular location and may include the catchment of tributaries as well as the mainstream.
Discharge	The rate of flow of water measured in terms of volume over time.
Runoff	The amount of rainfall that actually ends up as stream or pipe flow, also known as rainfall excess.

1. Introduction

Stantec have been commissioned by Sunkin Projects Pty Ltd to prepare this Stormwater Management Plan (SWMP) for the Park Village residential development at 37 Graham Road, Highett (referred herein as 'the Development').

The Development proposal includes a combination of residential building blocks and townhouses. In total there are 14 building blocks proposed ranging from 4 to 7 stories in height, each with basement car parking. There are 76 townhouses proposed. For details of the development proposal reference should be made to the Masterplan prepared for the Development by Clarke Hopkins Clarke architects.

This SWMP provides an outline of the proposed stormwater drainage strategy for the development and has been prepared to support the planning application to be lodged with Bayside City Council (BCC).

This stormwater management plan demonstrates the application of suitable Water Sensitive Urban Design (WSUD) principles and illustrates that the proposed development complies with relevant authority requirements including:

- Bayside City Council Planning Scheme Clauses 22.08 and 53.18, standards and guidelines for stormwater, and
- Melbourne Water pre-development advice.

2. Purpose and Scope

2.1 Purpose

The purpose of this SWMP is to evaluate the quantity and quality of stormwater associated with the proposed development plan to demonstrate that an appropriate stormwater management strategy has been adopted that complies with the relevant water authority requirements

The SWMP specifically addresses the following items for operational phases of the development:

- Stormwater runoff volumes and detention (Stormwater Quantity);
- Stormwater quality treatment measures (Stormwater Quality); and
- Maintenance of water quality treatment devices.

The following will be achieved with the correct application of this SWMP report:

- Appropriate standards to be maintained on all aspects of stormwater within the site;
- Pollution control to be maintained;
- Examination of the surrounding area and properties to ensure they will not be adversely affected nor unduly disrupted by stormwater; and
- Establishment of a unified, clear and concise stormwater management strategy.

2.2 Scope

Key statutory requirements for the proposed development in relation to stormwater include the following:

- Whenever land is developed a duty of care is owed to any property owners who receive stormwater flows which may be altered by the development, to ensure that such properties are not adversely affected by hydraulic or water quality impacts during the construction, maintenance and operational phase of the development.
- Stormwater discharging from the site is to be at an acceptable discharge standard with respect to water quality.
- Reasonable and practical measures must be implemented to avoid inappropriate use of any floodway or waterway.

- All reasonable and practical measures must be taken to minimise or prevent environmental harm.
- All proposed stormwater infrastructure design must have due regard for public safety.

3. Reference Documents

The following standards and guidance documents were referred to in preparation of the SWMP.

Guidance documents:

- Bureau of Meteorology for Rainfall Data and IFD Charts.
- CSIRO, Urban Stormwater: Best Practice Environmental Management Guidelines, 1999.
- Melbourne Water, WSUD Engineering Procedures – Stormwater, 2005.
- Melbourne Water, MUSIC Guidelines.
- Bayside Planning Scheme 22.08, Water Sensitive Urban Design (Stormwater Management).
- Bayside Planning Scheme 53.18, Stormwater Management in Urban Development.

Reference documents:

- Clarke Hopkins Clarke, Park Village Highett, Masterplan, October 2020.
- GeoAust, Proposed Residential Development 'Park Village', Geotechnical Investigation, 5 October 2020.
- Engeny, Flood Impact Assessment (Memorandum), 17 June 2020.
- Niche Planning Studio, Planning Report – 37 Graham Road, Highett.
- Urbis, Town Planning Information Report, CSIRO Site – Graham Road, Highett, April 2019.
- Taylors, Plan of Subdivision PS839314X/S1, Edition 1, Draft D.1.

4. Property Site Details

4.1 Property Details

Address: 37 Graham Road, Highett

Real Property Description: Lot 172 LP9880

As presented in figure 1, the site is bounded by Bay Road to the south, Graham Road to the east, Middleton Street to the west and by Highett Road to the north.

The Development site is 9.33 hectares in area and was previously owned by CSIRO. The site is now owned by Sunkin Projects Pty Ltd.

Figure 1 Site Locality Plan

The site was previously used by CSIRO as a base for material and infrastructure research. Previous development across the site included a number of buildings, internal access roads and localised vegetated areas.

Since transfer of ownership of the site to Sunkin Projects (circa 2016) all previous development has been demolished and the Development site is now largely cleared brownfield, with the exception being the southern portion of the site where remnant trees and soft landscape has been retained.

4.2 Special Building Overlay

The property is subject to a Special Building Overlay (SBO) as depicted in Figure 2 below.

Figure 2 Extent of SBO across the Development Site (Source: DEWLP)

Flood impact assessment that considers the SBO in relation to the Development has been completed by Engeny. Summary findings from this assessment are provided in Section 4.5.

4.3 Existing Site Drainage

Existing drainage passing through the site is presented in Figure 3 below.

Existing drainage through the site includes a 1575 DIA Melbourne Water Main Drain that passes through the site. Diversion of this drain is proposed that is discussed in Section 7.1.

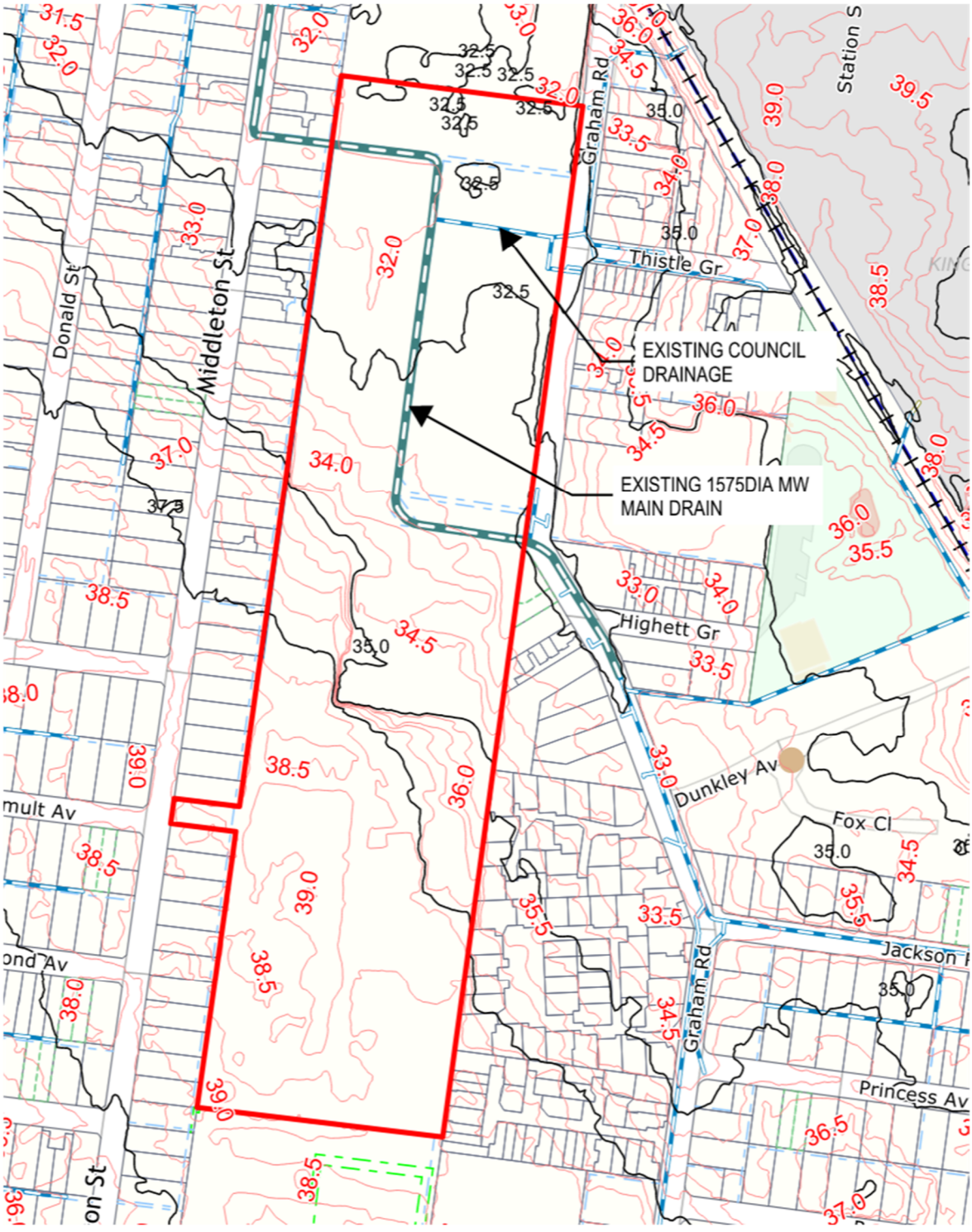


Figure 3 Existing Site Drainage

4.4 Geotechnical Investigation

Geotechnical investigation of the development site has been undertaken be Geo Aust Geotechnical Engineers. Key finding from the report relevant to the drainage civil works are summarised to include:

- The subsurface conditions across the site include:
    - FILL – depth of varies greatly across the site from nil to depth up to 3.3m. Though values of fill in the order of 0.1m to 1.0m where present.
    - NEAR SURFACE SAND – thin silty, to medium grained sand that was part of the original topsoil layer of the site.
    - CLAY – medium to high plasticity that will be prone to shrink and swell with moisture variations, i.e. highly reactive.
    - CLAYEY AND SILTY SAND CLAY
- Perched groundwater was encountered in some boreholes across the site at shallow depth in order of 0.3m to 1.95m.
- Standing groundwater was encountered across the site and various depth from 2.92 to 9.84m. Geo Aust reported that proposed basements of Buildings A to D, L and M are not anticipated to extend below the groundwater table. However proposed basement of Buildings D2 and E to are anticipated to be below the groundwater table.
- Fill to achieve pavement subgrade level should be completed using imported structural fill.
- Pavement construction over the native expansive clays should be designed in accordance with VicRoads Code of Practice RC 500.22 and include 200mm min thickness of capping material.
- The uncontrolled FILL and NEAR SURFACE SAND are not considered suitable for pavement subgrade material and should be removed and replace with suitable fill material.
- All pavement should be provided with effective surface and perimeter cut off drains to ensure the pavement layers and subgrade cannot become saturated

4.5 Flood Assessment by Engeny

Assessment of site flooding and proposed flood management strategies associated with the SBO passing through the site has been completed by Engeny. Finding of this assessment are presented in their Memorandum dated 19/02/2021.

5. Proposed Development

5.1 Plan of Subdivision

Referring to the draft Plan of Subdivision PS839314X/S1 prepared by Taylors, the it is proposed to subdivide the Development site into 3 separate parcels:

- 3 hectares will be gifted back to the Bayside City Council for conservation – Reserve No. 1 at the southern end of the site.
- 1 hectares will be gifted back to the Bayside City Council for Public Open Space – Reserve No. 2 and 3 located on the north-east side of the site.
- The remaining 5.33 hectares is to be developed by Sunkin Projects Pty Ltd under the residential scheme. This development sit is the subject of this SWMP.

5.2 Residential Masterplan

The Masterplan for the Development site has been prepared by Clarke Hopkins Clarke Architects and relevant extracts from the masterplan document have been included in Appendix A for reference.

It is proposed to develop the 5.33 hectare residential parcel into a mixture of townhouses and residential apartment blocks. The development proposal includes:

- 76 no. 2 and 3 story townhouses across four townhouse blocks.
- 14 building blocks ranging from 4 to 7 stories in height, each with basement car parking.
- Common Property – Private Roads 1, 2 and 3.

Figure 4 Masterplan (by Clarke Hopkins Clarke)

6. Relevant Authority Requirements

6.1 Bayside City Council – Legal Point of Discharge

The Bayside City Council (BCC) has nominated the Legal Point of Discharge (LPD) for the property to be the 1575Ø Melbourne Water pipe located at the northeast corner of the site or the multiple council pits along Graham Rd and western boundary whichever is suitable.

The Council has also advised that alternative LPD locations maybe considered upon application by the developer subject to approval by Council

A copy of the approved Legal Point of Discharge is included in Appendix B.

6.2 Melbourne Water

As the site is within a Special Building Overlay, Melbourne Water (MW) is a referral authority for building and works for planning and building permit applications.

Preliminary servicing advice by MW (letter dated 02/05/2019) provided the following comments on drainage requirements on the development proposal:

- The redevelopment is to treat the stormwater runoff from the site to best practice in accordance with 'Urban Stormwater Best Practice Environmental Management Guidelines' (CSIRO, 1999) prior to discharge into the Melbourne Water underground stormwater pipeline.
- Roads within the development are to be designed to contain and convey the 1% AEP flow exceeding the capacity of the underground drainage system to the overland flow path traversing the site.
- If the redevelopment includes the construction of the dwellings, then finished floor levels of the dwellings and garages are to be at least 300mm and 150mm respectively, above the 1% AEP flood level calculated for the design of the development. Otherwise, all lots / multi storey building footprints are to be flood free, which requires the finished surface level of the lot / footprint to be at least 300mm above the applicable 1% AEP flood level calculated for the design of the development.
- The minor stormwater drainage system for the Development will include minor below ground pipe drainage system designed to carry runoff from the 20% AEP storm events.

7. Stormwater Drainage Strategy

7.1 MW Main Drain Diversion

To make way for the construction of Apartment Building E, F G, H, I and J it is proposed to divert the existing MW 1575Ø main drainage through the Public Open Space adjacent to Graham Road. This proposal will involve abandoning 245m of existing and construction of 243m of new 1575Ø main drainage.

The new drainage through the POS is proposed to be contained in 6m wide easement in favour of Melbourne Water.

The drainage works will be carried under developer funded works agreement with Melbourne Water that are currently being applied for.

Preliminary design drawings of the proposed main drainage diversion including plan and long sections is provided in Appendix D.

7.2 Catchments and Discharge Points

For the purpose of stormwater drainage, the development site will be split into three separate systems that will connect to the authority drainage three discrete locations. These three drainage networks are illustrated in Figure 5 below.

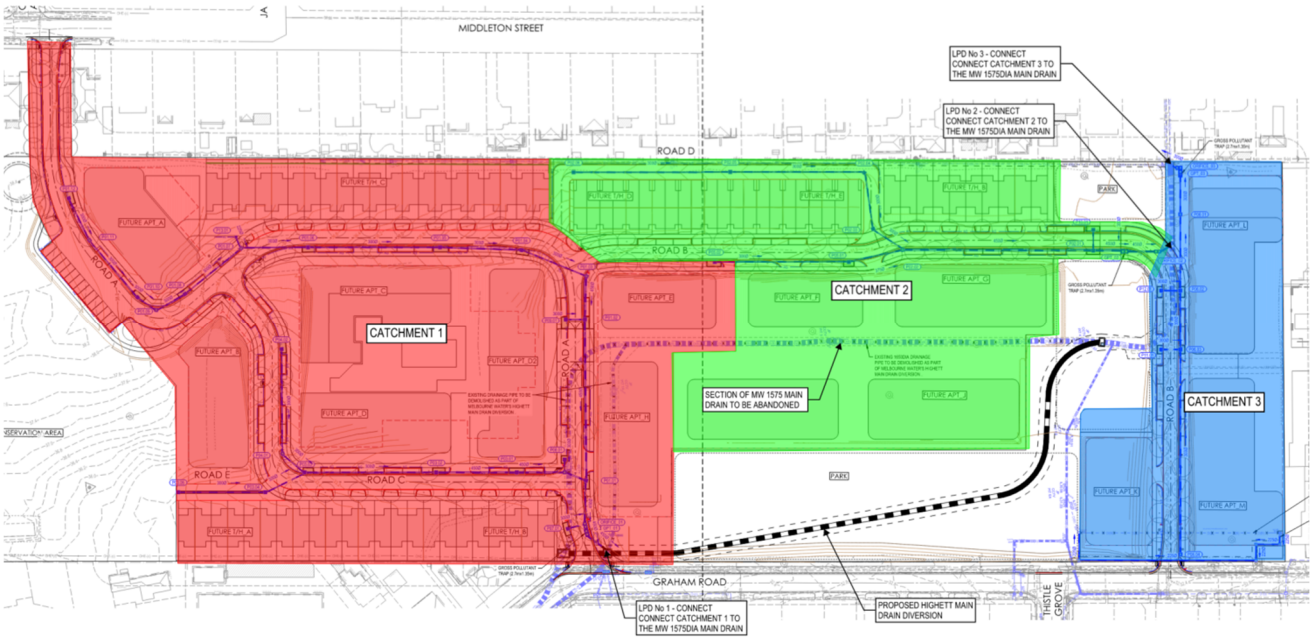


Figure 5 Drainage LPD and Catchment Plan

The three catchments are summarised as follows:

- **Catchment 1** that includes the southern portion of the residential development is 2.99 hectares in area is proposed to connect to the MW 1575Ø main drain at Graham Street
- **Catchment 2** that includes the central portion of the residential development is 1.53 hectares in area is proposed to connect to the MW 1575Ø main drain at Private Road B within the development site.
- **Catchment 3** that includes the northern portion of the residential development is 0.80 hectares in area is proposed to connect to the MW 1575Ø main drain at western boundary of the development site.

7.3 Catchment Mapping

The catchment mapping plan has been analysed to define the existing and post development catchment. This is presented in Figure 6 & Appendix E.

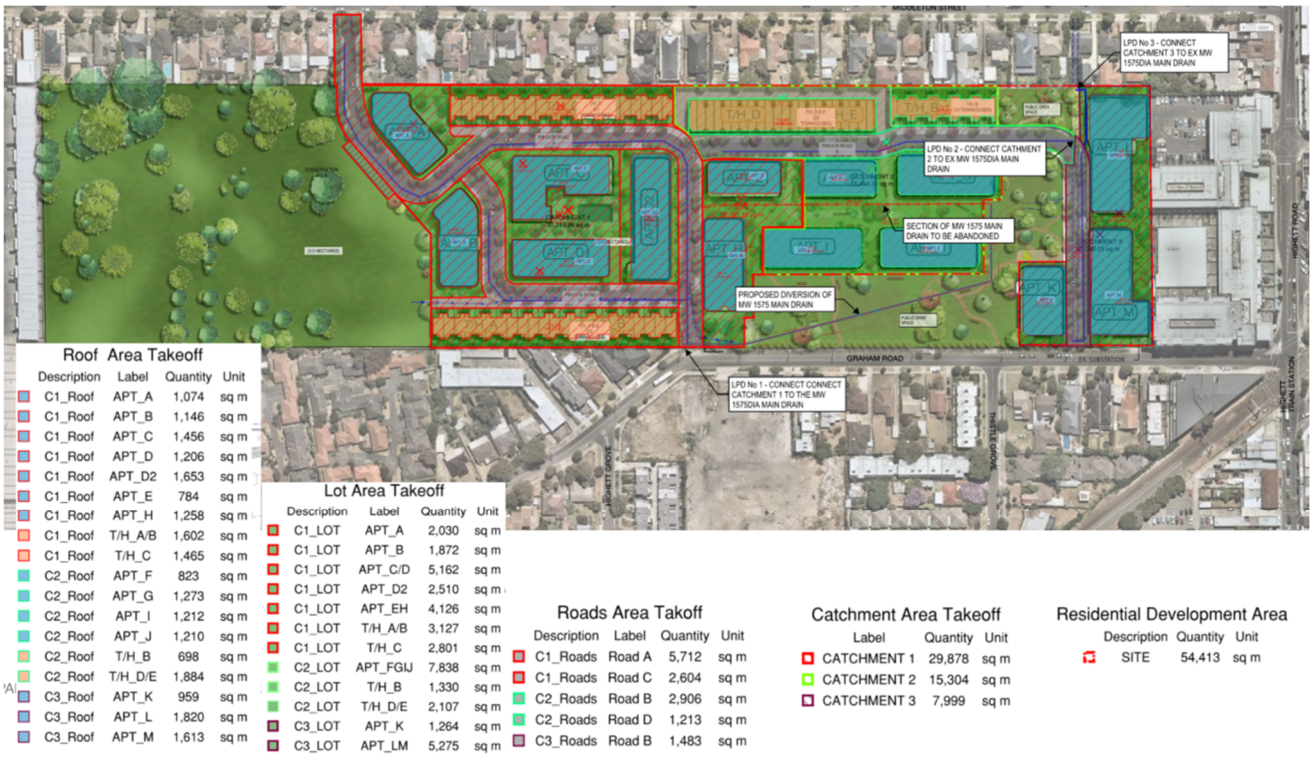


Figure 6 Stormwater Detailed Catchment Plan and Areas Take-off

The post-development Effective Impermeable Areas (EIA) are as summarised in Table 1 below.

Table 1 Post-development Effective Impermeable Area Schedule

Catchment				Roof				Landscape				Roads			
Name	Area	C_v	Eff Imp Area	Name	Area	C_v	Eff Imp Area	Name	Area	C_v	Eff Imp Area	Name	Area	C_v	Eff Imp Area
C1	29,944			APT_A	1,074	1.0	1,074	APT_A	956	0.3	287	Road A	5,712	0.85	4,855
				APT_B	1,146	1.0	1,146	APT_B	726	0.3	218	Road C	2,604	0.85	2,213
				APT_C-D	2,662	1.0	2,662	APT_C/D	2,500	0.3	750				
				APT_D2	1,653	1.0	1,653	APT_D2	857	0.3	257				
				APT_E-H	2,042	1.0	2,042	APT_E/H	2,084	0.3	625				
				T/H_A-B	1,602	1.0	1,602	T/H_A/B	1,525	0.3	458				
				T/H_C	1,465	1.0	1,465	T/H_C	1,336	0.3	401				
Sub Total_C1	29,944	0.72	21,708		11,644		11,644		9,984		2,995		8,316		7,069
C2	15,394			APT_F-G-I-J	4,518	1.0	4,518	APT_F-G-I-J	3,320	0.3	996	Road B	2,906	0.85	2,470
				T/H_B	698	1.0	698	T/H_B	632	0.3	190				
				T/H_B	1,884	1.0	1,884	T/H_B	223	0.3	67	Road D	1,213	0.85	1,031
Sub Total_C2	15,394	0.77	11,854		7,100		7,100		4,175		1,253		4,119		3,501
C3	8,022			APT_K	959	1.0	959	APT_K	305	0.3	92	Road B	1,483	0.85	1,261
				APT_L-M	3,433	1.0	3,433	APT_L-M	1,842	0.3	553				
Sub Total_C2	8,022	0.78	6,297		4,392		4,392		2,147		644		1,483		1,261
Total	53,360	0.75	39,858		23,136		23,136		16,306		4,892		13,918		11,830

7.4 Stormwater Detention

Assessment of the requirements for On-Site Detention (OSD) for the Development has been undertaken by Engeny and findings of this study are presented in Engeny Memorandum dated 28 January 2021. Copy of this memo is included in Appendix F.

It is Engeny's view from the assessment is that OSD is not be required for the following reasons:

- The existing conditions should be considered as being when the Site was fully developed and owned by the CSIRO, not when the Site has been demolished and remediated.
- The proposed development has a greater amount of open space than the Site did in the existing conditions – therefore will generate less surface water from the Site.
- Detaining the water on site will likely coincide with the peak flow through the Highett Main Drain in the 1% AEP flood event. Letting water drain from the Site prior to the peak time in the drain will aid flooding throughout the catchment.

Based on these finding by Engeny it is proposed that no OSD is included in the drainage scheme and the minor pipe drainage network be allowed to discharge freely to the receiving waterway, i.e. the Highett Main Drain. This strategy has been discussed with MW who have provided in principal agreement for the strategy conditional upon the peak discharge rate of the minor pipe drainage system serving the Development be limited to the 20% AEP event.

7.5 Permissible Site Discharge

In accordance to MW requirement the overall Permissible Site Discharge (PSD) of the minor drainage system discharging the Highett Main Drain must be limited to the 20% AEP event.

Stantec has completed a Rational Method calculation to determine the peak 20% AEP flows for each drainage catchment discharging to the Highett Main Drain. Table 2 shows the summary of parameters and estimated 20% AEP peak flow estimates.

Table 2 Permissible Site Discharge

Catchment	Time of Concentration, min	Runoff Coefficient, C_v	Rainfall Intensity, mm/hr	Area, Ha	Peak Flow, cu.m/s
Catchment 1	20	0.72	51	2.99	0.305
Catchment 2	20	0.77	51	1.53	0.167
Catchment 3	20	0.78	51	0.80	0.088

7.6 Minor Drainage Network

The minor stormwater drainage system for the Development will include minor below ground pipe drainage system designed to carry runoff from the 20% AEP storm events. Presented Appendix C is the stormwater drainage plan that details the proposed pipe drainage network and discharge points.

The peak flow rate of the minor drainage discharging to the Highett Main Drain controlled by orifice flow control fitted to the last pit in the network prior to the discharge point. The orifice flow control will be sized to limit flows to the PSD values calculated in Table 2.

Catchment	Peak Flow, cu.m/s	C_d	Head, m	Diameter, m
Catchment 1	0.305	0.62	1.0	0.38
Catchment 2	0.167	0.62	1.0	0.28
Catchment 3	0.088	0.62	1.0	0.20

8. Stormwater Quality

8.1 Stormwater Performance Objectives

The stormwater management plan has been developed to comply with the Melbourne Water requirements. Specifically, the redevelopment is to treat stormwater runoff from the site to best practice in accordance with 'Urban Stormwater Best Practice Environmental Management Guidelines' (CSIRO, 1999) prior to discharge into the Melbourne Water underground stormwater pipeline.

Accordingly, the current best practice performance objectives for the development stormwater drainage system are summarised in

The objectives for on-site treatment of stormwater are in accordance with values set out in the Victorian Stormwater Committee (1999) *Urban Stormwater Best Practice Environmental Management Guidelines* that have been reproduced in Table 3 below.

Table 3 Best Practice Performance Objectives

Pollutant	Current Best Practice Performance Objective
Suspended Solids (SS)	80% retention of typical urban annual load
Total Phosphorous (TP)	45% retention of typical urban annual load
Total Nitrogen (TN)	45% retention of typical urban annual load
Gross Pollutants/Litter (GP)	70% retention of typical urban annual load.

To achieve the stormwater performance objectives, it is proposed to incorporate current best practice water sensitive urban design (WSUD) principals into the drainage scheme that is discussed in the following sections.

8.2 Stormwater Treatment Measures

8.2.1 Overview

Measures to treat stormwater runoff prior to discharge into the receiving watercourse will include a series of primary, secondary and tertiary treatment systems aimed to target a range of stormwater pollutants including:

- Rainwater harvesting and re-use
- Primary treatment - targeting gross pollutants and coarse sediments
- Secondary and tertiary treatment – targeting nutrients, heavy metals hydrocarbons, fine particles and attached pollutants

Presented Appendix C is the stormwater drainage plan that details the proposed pipe drainage network and discharge points.

8.2.2 Rainwater Harvesting and Re-use

Throughout the development rainwater harvesting and reuse is proposed that will reduce the overall volume of stormwater load going to the receiving water course. It is proposed to provide rainwater harvesting tanks (RWT's) to each apartment building and townhouse to capture roof runoff for re-use as toilette flushing.

Demand calculations have been based on the following assumption:

- Water demand allowance of 20 litres/person/day.
- Population factor of 1.5 applied to each bedroom.
- Rainwater capture calculated for each apartment roof assuming a runoff coefficient of 100%.

Based on the above assumptions the daily water demand for each apartment is summarised in Table 4 below.

Table 4 Water Demand Summary

Apartment/Bed No.	Roof Area (Ha)	Apartment No.	Population Factor	Population	Demand/ Person/Day (litres/day)	Demand/Day (kL/day)
CATCHMENT 1						
APT_A						
1		2	1.5	3	20	0.06
2		28	2.5	70	20	1.4
3		6	3.5	21	20	0.42
Total APT_A	0.1074	36		94	60	1.88
APT_B						
1		4	1.5	6	20	0.12
2		25	2.5	63	20	1.25
3		16	3.5	56	20	1.12
Total APT_B	0.1146	45		125		2.49
APT_C/D						
1		37	1.5	56	20	1.11
2		107	2.5	268	20	5.35
3		16	3.5	56	20	1.12
Total APT_C/D	0.2662	160		379		7.58
APT_D2						
1		18	1.5	27	20	0.54
2		38	2.5	95	20	1.9
03-Apr		26	3.5	91	20	1.82
Total APT_D2	0.1653	82		213		4.26
APT_E-H						
1		34	1.5	51	20	1.02
2		71	2.5	178	20	3.55
03-Apr		23	3.5	81	20	1.61
Total APT_E-H	0.2042	128		309		6.18
CATCHMENT 2						
APT_F						
1		21	1.5	32	20	0.63
2		30	2.5	75	20	1.5
3		1	3.5	4	20	0.07
Total APT_F	0.0823	52		110		2.20
APT_G						
1		15	1.5	23	20	0.45
2		42	2.5	105	20	2.1
3		16	3.5	56	20	1.12
Total APT_G	0.1273	73		184		3.67
APT_I						
1		16	1.5	24	20	0.48

Apartment/Bed No.	Roof Area (Ha)	Apartment No.	Population Factor	Population	Demand/ Person/Day (litres/day)	Demand/Day (kL/day)
2		48	2.5	120	20	2.4
3		14	3.5	49	20	0.98
Total APT_I	0.1212	78		193		3.86
APT_J						
1		17	1.5	26	20	0.51
2		46	2.5	115	20	2.3
3		15	3.5	53	20	1.05
Total APT_J	0.121	78		193		3.86
CATCHMENT 3						
APT_K						
1		14	1.5	21	20	0.42
2		26	1.5	39	20	0.78
3		1	1.5	2	20	0.03
Total APT_K	0.0959	41		62		1.23
APT_L						
1		16	1.5	24	20	0.48
2		71	1.5	107	20	2.13
3		9	1.5	14	20	0.27
Total APT_L	0.182	96		144		2.88
APT_M						
1		26	1.5	39	20	0.78
2		68	1.5	102	20	2.04
3		9	1.5	14	20	0.27
Total APT_M	0.1613	103		155		3.09
TOTALS	1.7487	972		2580		43.18

The rainwater harvesting proposal for the development includes provision of 15kL RWT's for each apartment building and 2kL tanks for each townhouse. The effectiveness of the tanks in reducing toilette flushing water demand has bene assessment in the MUSIC model and summarised in Table 5 below.

Table 5 RWT MUSIC Assessment Results

Apartment	RWT Size Trialled (kL)	Flow (ML/yr)	Pipe Out (ML/yr)	Reuse Supplied (ML/yr)	Reuse Requested (ML/yr)	Re-use Demand Met %	Load Reduction %
APT_A	15	0.62	0.21	0.42	0.84	50.1	66.9
APT_B	15	0.66	0.25	0.41	0.74	55.8	62.6
APT_D2	30	1.55	0.58	0.97	2.12	45.8	62.6
APT_C/D	15	0.96	0.41	0.55	1.26	44.1	57.0
APT_E-H	30	1.19	0.56	0.63	1.58	39.8	53.0
APT_F-G	30	1.22	0.35	0.87	2.17	40.3	71.1
APT_I-J	30	1.41	0.43	0.98	0.98	34.6	69.6
APT_L-M	30	2.00	0.92	1.07	2.19	49.0	53.9
APT_K	15	0.55	0.24	0.31	0.42	75.2	56.6
TOTALS	**210**	**10.16**	**3.95**	**6.21**	**12.30**	**50%**	**61%**

The rainwater tank sizes and reuse demand assumptions is based on the latest architectural Masterplan and Development Schedule (Refer Appendix A). The rainwater tank sizes specified in the SWMP plan are the minimum required for to achieve the treatment objectives, however maybe subject to change/optimisation by the apartment building services engineers through the detailed design of the buildings.

8.2.3 Primary Treatment

Primary treatment of stormwater it proposed by a proprietary end of line Gross Pollutant Trap (GPT) that will target gross pollutants and course sediments.

The nominated GPT unit it the Ecosol Gross Pollutant and performance summary provided in Table 6 below.

Table 6 Ecosol GPT Pollution Capture Efficiency

Pollutant	Capture Efficiency	Details
Gross Pollutants (GP)	98%	Particulate > 2000 micron
Total Suspended Solids (TSS)	61%	Particulate 20 - 2000 micron (mean averages)
Total Phosphorus (TP)	29%	Particulate and dissolved mean average efficiency less standard deviation
Total Nitrogen (TN)	1%	Particulate and dissolved mean average efficiency less standard deviation
Total Petroleum/ Hydrocarbon (TPH)	99%	In dry weather emergency oil spill situations

The Ecosol GPT's have been sized or each catchment as summarised in Table 7 below.

Table 7 GPT Unit by Catchment

Catchment	Ecosol GPT Product Code	Approximate External Dimensions (L x W x D) (mm)	Pollution Holding Capacities		
			Solid Pollutants >2mm	Free Oils and Grease	Water
			m3	Litres	Litres
Catchment 1	GPT 4300	2700 x 1350 x 750	0.32	469	1,181
Catchment 2	GPT 4300	2700 x 1350 x 750	0.32	469	1,181
Catchment 3	GPT 4300	2700 x 1350 x 750	0.32	469	1,181

8.2.4 Secondary and Tertiary Treatment

Secondary and Tertiary treatment of stormwater it proposed by inclusion of raingardens to treat runoff from roads prior to discharge to the minor drainage system that will target fine particles (TSS) nutrients (TP and TN) and heavy metals.

Raingardens are vegetated areas where stormwater is passed through densely planted filter media (loamy sand) allowing the plants to absorb the collected and stored nutrients. Raingardens utilise temporary ponding above the vegetated surface to increase the volume of stored water for treatment. Raingardens can take a number of forms but all have common features including the extended detention depth above the media surface, the filter media and a low level drainage media and subsoil system. These are shown in the figure below.

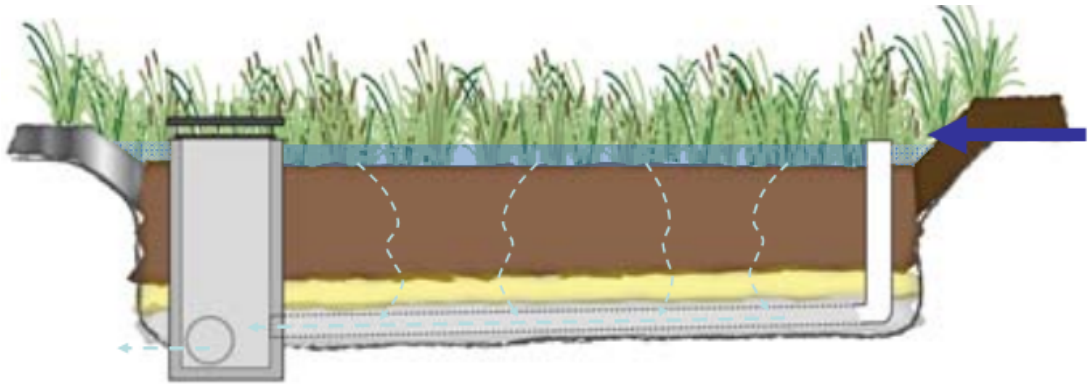


Figure 6: Typical Section of a generic Bio-retention system (Source: Water by Design)

The basin will have a total depth of 0.75m below the surface of the basin. The bio-retention system will comprise of 3 layers as outlined below:

1. Filter Media 0.50m, Saturated Hydraulic Conductivity will be between 180mm/hr and will be loamy sand.
2. Transitional Layer 0.10m, Sand/Course sand material.
3. Drainage Layer 0.150m, coarse material (e.g. fine gravel).

Perforated sub-soil drains will be placed within the system at no greater spacing than 1.5m (centre to centre) unless specifically modelled. Where possible the perforated pipes will have a minimum grade of 0.5% towards the outlet and have an accessible flushing point to allow maintenance. The perforated sub-soil drains will be a maximum 100mm diameter to minimise the thickness of the drainage layer.

The proposed bio-retention basins will have the following MUSIC modelling properties:

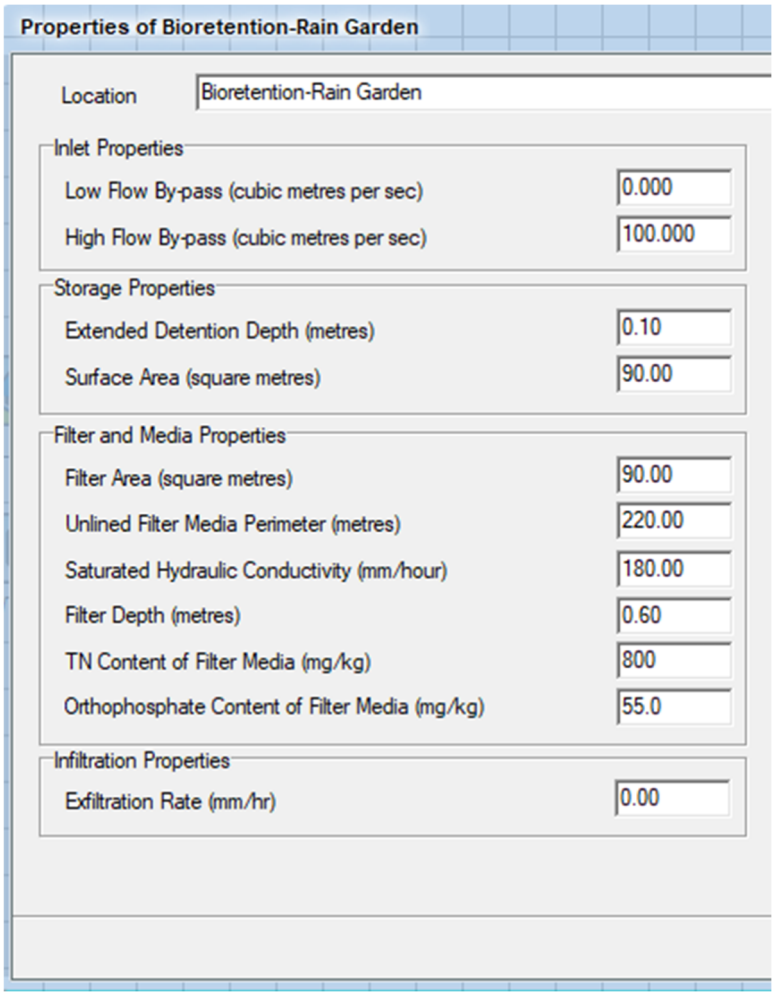


Figure 7: Typical Bio-Retention Properties for MUSIC modelling

Roadside raingardens are proposed to capture and treat stormwater runoff close to its source. Like larger bio-retention basins, these roadside gardens rely on bio-filtration processes to reduce stormwater pollutants. They are suitable for installation in greenfield developments as well as for retrofitting in existing developed areas. Roadside raingardens will be placed within the development as shown in Appendix C.

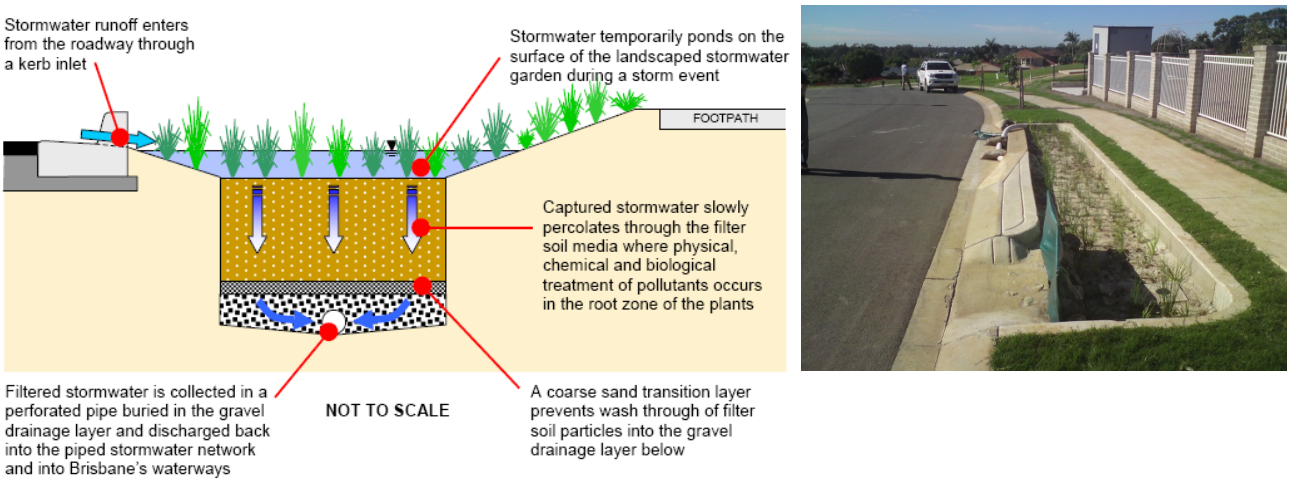


Figure 8: Typical Roadside Bio-Retention (Source: Brisbane City Council, 2007 & Stantec)

The raingarden filter media will be certified by a qualified consultant to verify that the media is in accordance with the most current version of the guideline for Bioretention and Tree Pit Media Specifications as produced by the Facility for Advancing Water Bio-filtration (FAWB). The minimum filter media parameters to be tested include hydraulic conductivity, particle size distribution, organic matter content, pH, electric conductivity and phosphorus concentration.

The hydraulic design of raingardens is essential to ensure effective stormwater treatment performance. The following typical guidelines will be incorporated within raingarden design:

1. The finished surface of the raingarden filter media must be horizontal to ensure full engagement of the filter media by stormwater flows and to prevent concentration of stormwater flows within depressions and ruts resulting in potential scour and damage to the filter media.
2. Where possible, the overflow pit or bypass channel should be located near the inflow zone to prevent high flows passing over the surface of the filter media.
3. Where the field inlets in a bio-retention system are required to convey the minor storm flow, the inlet must be designed to avoid blockage, flow conveyance and public safety issues.

8.3 MUSIC Modelling

The effectiveness of proposed treatment measures and impact of the proposed development against performance targets has been modelled in MUSIC. The modelling has been completed in accordance with Melbourne MUSIC Guidelines.

8.3.1 Climate Data

Climate data used in the MUSIC model has been selected to align with MW Rainfall Distribution mapping for Greater Melbourne and for the Highett site this aligns with Melbourne City band with rainfall range of 650 to 750mm. The Melbourne City 6-minute rainfall template used in the model was downloaded from the MW website.

8.3.2 Treatment Train

The stormwater treatment train schematics as modelled in MUSIC are shown below:

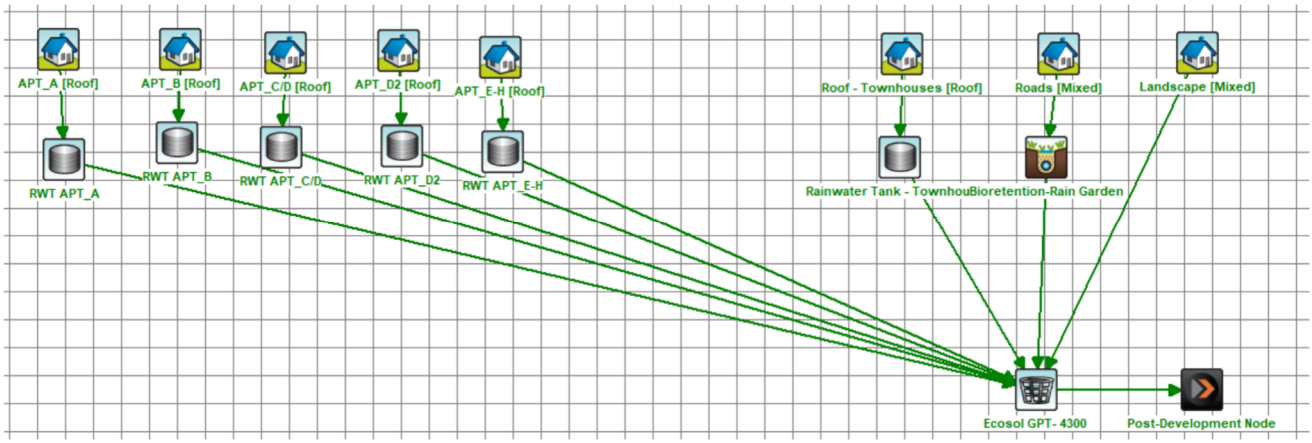


Figure 9 WSUD MUSIC Model Catchment 1

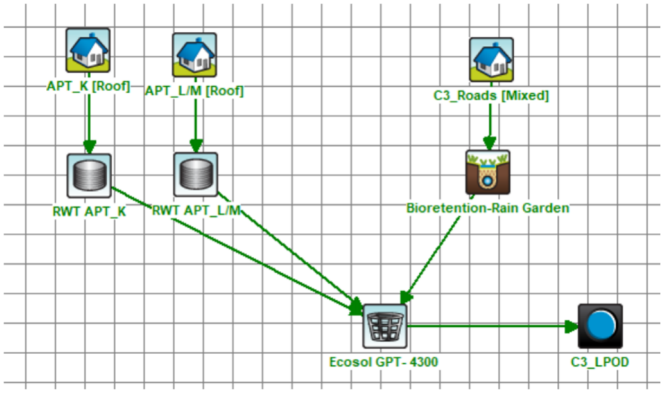


Figure 10 WSUD MUSIC Model Catchment 2

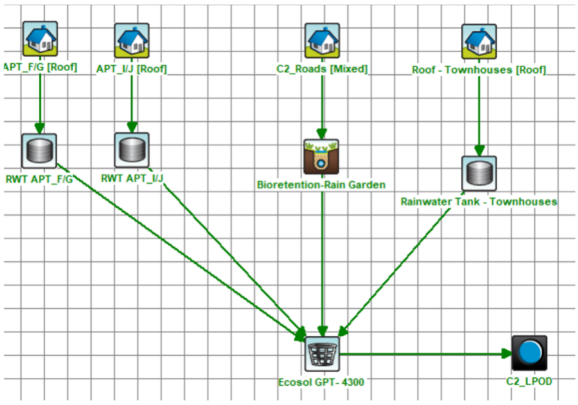


Figure 11 WSUD MUSIC Model Catchment 3

In order to meet the water quality objectives, pollutant export modelling software (MUSIC) has been used to confirm the proposed treatment measures and average pollutant load reduction from the site.

8.4 Stormwater Treatment Train Effectiveness

The effectiveness of the treatment device proposed in the above section has been modelled using MUSIC with the overall treatment train efficiency results shown in 7 below.

Table 7 Treatment Train Effectiveness Catchment 1

	Unit	Source Load	Residual Load	% Reduction	Target Reduction %	Reduction Target Achieved
Flow	ML/yr	12.9	8.99	30.6	-	-
Total Suspended Solids, TSS	kg/yr	1330	210	84.2	80	YES
Total Phosphorous, TP	kg/yr	3.43	1.3	62.1	45	YES
Total Nitrogen, TP	kg/yr	32.2	16.4	49.7	45	YES
Gross Pollutants	kg/yr	479	2.31	99.5	70	YES

Table 8 Treatment Train Effectiveness Catchment 2

	Unit	Source Load	Residual Load	% Reduction	Target Reduction %	Reduction Target Achieved
Flow	ML/yr	6.54	3.98	39.2	-	-
Total Suspended Solids, TSS	kg/yr	501	35.1	93	80	YES
Total Phosphorous, TP	kg/yr	1.48	0.424	71.4	45	YES
Total Nitrogen, TP	kg/yr	15.7	6.64	57.6	45	YES
Gross Pollutants	kg/yr	241	0	100	70	YES

Table 9 Treatment Train Effectiveness Catchment 3

	Unit	Source Load	Residual Load	% Reduction	Target Reduction %	Reduction Target Achieved
Flow	ML/yr	3.23	1.80	44.3	-	-
Total Suspended Solids, TSS	kg/yr	199	13	93.5	80	YES
Total Phosphorous, TP	kg/yr	0.665	0.184	72.3	45	YES
Total Nitrogen, TP	kg/yr	7.57	3.07	59.4	45	YES
Gross Pollutants	kg/yr	119	0	100	70	YES

From the results presented in Table 7, 8 and 9 it can be seen that the proposed WSUD treatment train provides effective mitigate the water quality impacts of the development and meet the required Water Quality Objectives thus ensuring stormwater quality is appropriately managed.

8.5 Maintenance Plan

The following maintenance schedules are proposed for the various Stormwater Quality Improvement Devices to ensure they continue to operate as planned.

Table 10 Summary of WSUD Maintenance Responsibility

Stormwater Quality Improvement Devices	Maintenance Responsibility	
	On Maintenance period	Off Maintenance period
Rainwater Tanks	Individual house owners	Individual house owners
Raingardens	Developer	Body Corporate
Gross Pollutant Trap	Developer	Body Corporate

Table 10 WSUD Maintenance Plan

Rain Gardens		
Filter Media	• Remove leaf litter and gross pollutants • Check for biofilms (algal biofilms may develop on the surface of the filter media leading to clogging issues) • Monitor ponding of water following rainfall events • Check for permanently boggy/pooled areas	3 Months or following major storm event
Erosion	• Check for erosion/scouring • Check for evidence of preferential flow paths • Replace filter media in eroded areas • Add rock protection around inlets (if required)	3 Months or following major storm event
Mulch	• Check depth and even distribution of mulch • Check mulch is not touching plant stems • Check for sediment/silt accumulation in mulch layer • Replace mulch (if required) • Retain mulch using jute mats or nets (if required)	3 Months or following major storm event
Vegetation	• Inspect plant health and cover • Replace dead plants (maintain a consistent vegetation density of 6–10 plants per square metre across the raingarden filter media) • Remove weeds (avoid use of herbicides) • Prune plants (where applicable) • Water plants (if required during establishment phase)	3 Months or following major storm event
Civil components	• Check infrastructure for damage and repair as required • Ensure inlet and outlet points are clear of sediment, litter and debris • Inspection opening for underdrain (slotted drainage pipe): • Check water level • Check for sediment accumulation • Flush the underdrain system (if required)	Annually

9. Summary and Conclusion

This Site Based Stormwater Management Plan has been prepared for the proposed development at 37 Graham Road, Highett. The proposed development comprises the construction of 76 townhouses and 14 apartment buildings. If unmitigated, the proposed development will increase the volume of stormwater runoff from the site due to the new impervious surfaces. Furthermore, the development would have an effect on runoff water quality from the site.

Stormwater attenuation and treatment devices have been proposed in this report to minimise the impact the development has on the external environment.

This report has demonstrated that the recommended devices exceed the required Water Quality Objectives by incorporating Water Sensitive Urban Design into the proposed stormwater drainage system for Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants.

As such from a stormwater management perspective, we believe the development can be undertaken in accordance with the Bayside City Council Planning Scheme Clauses 22.08 and 53.18, Melbourne Water guidelines and requirements, and should be endorsed for approval.

Appendix A Masterplan & Development Schedule

1.9 Masterplan - Proposed heights

BUILDING HEIGHTS LEGEND

- 7 Storeys
- 6 Storeys
- 5 Storeys
- 4 Storeys
- 3 Storeys
- 2 Storeys

View Tag 1

DEVELOPMENT TYPOLOGIES & MIX

Approximately 1048 dwellings, 97,330m² GFA

- 1 bedroom dwellings (20 – 25%)
- 2 bedroom dwellings (55 – 60%)
- 3 bedroom dwellings (20 – 25%)
- 4 bedroom dwellings (1 – 5%)
- Subject to future housing market conditions

Cafe/Gym Tenancies (NLA TBC)

Community Facility (1,000m²)

SITE SETBACKS & NOTES

- 6.0m minimum setback from Graham Road
- 12.0m building separation to habitable windows/rooms.
- 3.0m to 4.0m upper level setbacks, generally.
- 2 & 3 storey building height to East & West boundaries
- Communal amenities to be provided during design development

BUILDING	RL RANGE	BUILDING	RL RANGE
APT A	54.50 - 55.10	APT H	55.90 - 56.50
APT B	54.20 - 54.80	APT I	55.00 - 55.60
APT C	56.40 - 57.00	APT J	55.00 - 55.60
APT D	52.30 - 52.90	APT K	56.00 - 56.60
APT D2	55.90 - 56.50	APT L	55.30 - 55.90
APT E	55.70 - 56.30	APT M	55.80 - 56.40
APT F	55.70 - 56.30		
APT G	55.10 - 55.70		

SCALE 1:1500 @A3 FOR DISCUSSION JUNE 2021

Appendix B Legal Point of Discharge

Bayside
CITY COUNCIL
76 Royal Avenue, SANDRINGHAM
PO BOX 27 SANDRINGHAM VIC 3191
T (03) 9599 4444
F (03) 9598 4474
enquiries@bayside.vic.gov.au
www.bayside.vic.gov.au

Our Ref : LPD 2019/1292/1
Enquiries: Mrs A Adhikari
Telephone: 9599 4444

12 November 2019

Wood & Grieve Engineers
Level 22 570 Bourke street
MELBOURNE VIC 3000

Dear Vinh

Subject: Advice of Legal point of discharge
Proposal: More than two units with basement
Property Address: 37 Graham Road HIGHETT

Thank you for the legal point of discharge application received on 12/11/2019 for the above development. The legal point of discharge for the development is to 1575 mm diameter Melbourne water pipe or multiple council pits along Graham Road and western boundary whichever is suitable.

The existing stormwater connection at the site may be in an alternative location but appropriate for use as the legal point of discharge. This location would need to be confirmed on site and requested as the legal point of discharge. Council would need to respond to this request with approval in writing, prior to any works commencing. Please note Council does not have information regarding the internal drainage system within residential properties.

Any subsurface water captured on the site arising from the development, are to be discharged in accordance with Council's Policy for "Works on Assets within the Road Reserve Policy 2018". This Policy is available on the Councils website.

Before the development begins, all information provided by the Council must be confirmed on the site by the applicant. Please report any variations to the

Council. No liability will be accepted for any discrepancy between the information provided by Council and the situation on site.

The stormwater discharge of the proposed development must not exceed the existing pre-development level of peak stormwater discharge. To achieve this outcome, the development must have a stormwater detention system design capacity that is approved by Council. To enable Council to provide the total storage volume and permissible site discharge information, **please forward the total site and impervious areas (including driveways and hard paving) to Council's Infrastructure Assets Department.**

Before the development begins, the applicant must submit detailed plans to Council's Infrastructure Assets Department via enquiries@bayside.vic.gov.au indicating the method of stormwater discharge to the nominated 'Legal Point of Discharge' and any stormwater detention. Alternatively, hard copies may be sent to the Council Offices at 76 Royal Avenue, Sandringham. The plans must be lodged with Council's Infrastructure Assets Department for approval.

The above requirements are only applicable for stormwater. The following generally applies to any development including new builds, additions, extensions and alterations. It is the responsibility of the Registered Building Surveyor to ensure that the system is designed and installed in accordance with the relevant building regulations.

Please note that a Council Stormwater **Tapping Permit** is required before the commencement of the connection of the proposed drainage system to the council asset. This can be obtained at the Council Offices, 76 Royal Avenue, Sandringham. The current cost of the permit is $200.00. Failure to obtain a stormwater tapping permit (where required) may result in a fine of $500.00.

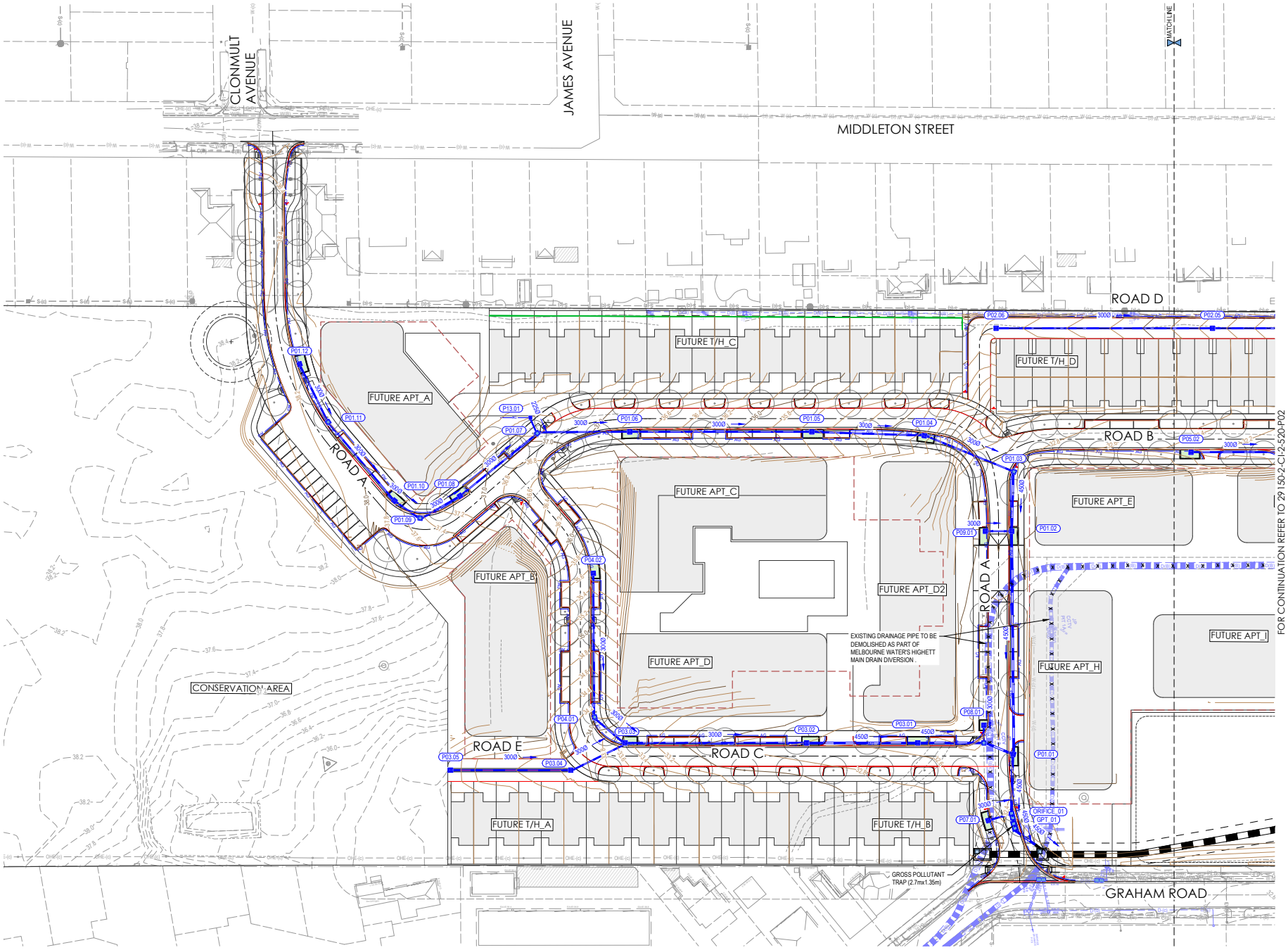
Please note that this is not a permit to remove, cut or trim a tree protected by Council's Local Law. A valid Local Law permit is required prior to any works being undertaken on a tree protected by the Local Law, including impact to the roots of the tree. For more information on trees protected by the Local Law, contact Council's Local Laws department on 9599 4626.

If you have any queries in relation to this matter, please contact Council's Drainage Assets Engineer Anu Adhikari on 9599 4444.

Yours sincerely,

Anu Adhikari
Drainage Asset Engineer

Appendix C Stormwater Drainage Plan



NOTES:

1.

LEGEND

- PROPOSED STORMWATER PIT AND DRAIN
- PROPOSED MELBOURNE WATER DIVERSION
- PROPOSED AG DRAIN
- PROPOSED SWALE
- PIT REFERENCE
- GP PROPOSED GRATED PIT
- JP PROPOSED JUNCTION PIT
- SEP PROPOSED SIDE ENTRY PIT
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED RAINGARDEN

1:500 1:1000 5 0 5 10 15 20 25 A1 A3

REV	DESCRIPTION	DRAWN	APPD	DATE
B	TOWN PLANNING ISSUE	DG	DMcG	28/05/21
A	PRELIMINARY ISSUE	DG	DMcG	30/04/21

SUNKIN

ARCHITECT/CLIENT

CSIRO HIGHETT
37 GRAHAM ROAD,
HIGHETT

PROJECT

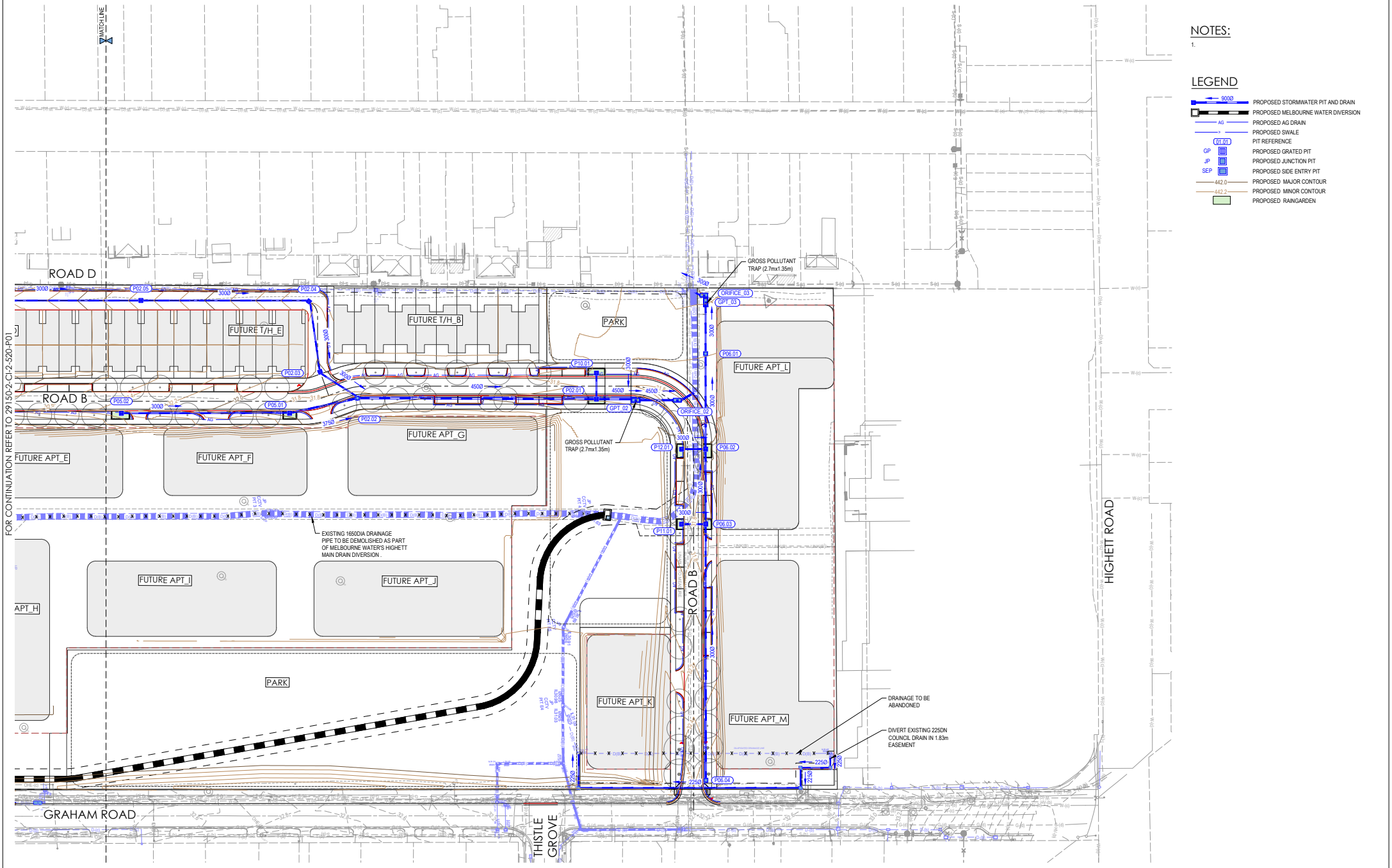
STORMWATER DRAINAGE PLAN - SHEET 1

TITLE

Stantec

TOWN PLANNING ISSUE

COORDS	DATUM	SCALE @ A1	PROJECT No	DRAWING No	REV
MGA55	mAHD	1:500	29150-2	CI-2-520-P01	B



REV	DESCRIPTION	DRAWN	APPD	DATE
B	TOWN PLANNING ISSUE	DG	DMcG	28/05/21
A	PRELIMINARY ISSUE	DG	DMcG	30/04/21

SUNKIN

ARCHITECT/CLIENT

CSIRO HIGHETT
37 GRAHAM ROAD,
HIGHETT

PROJECT

STORMWATER DRAINAGE PLAN - SHEET 2

TITLE

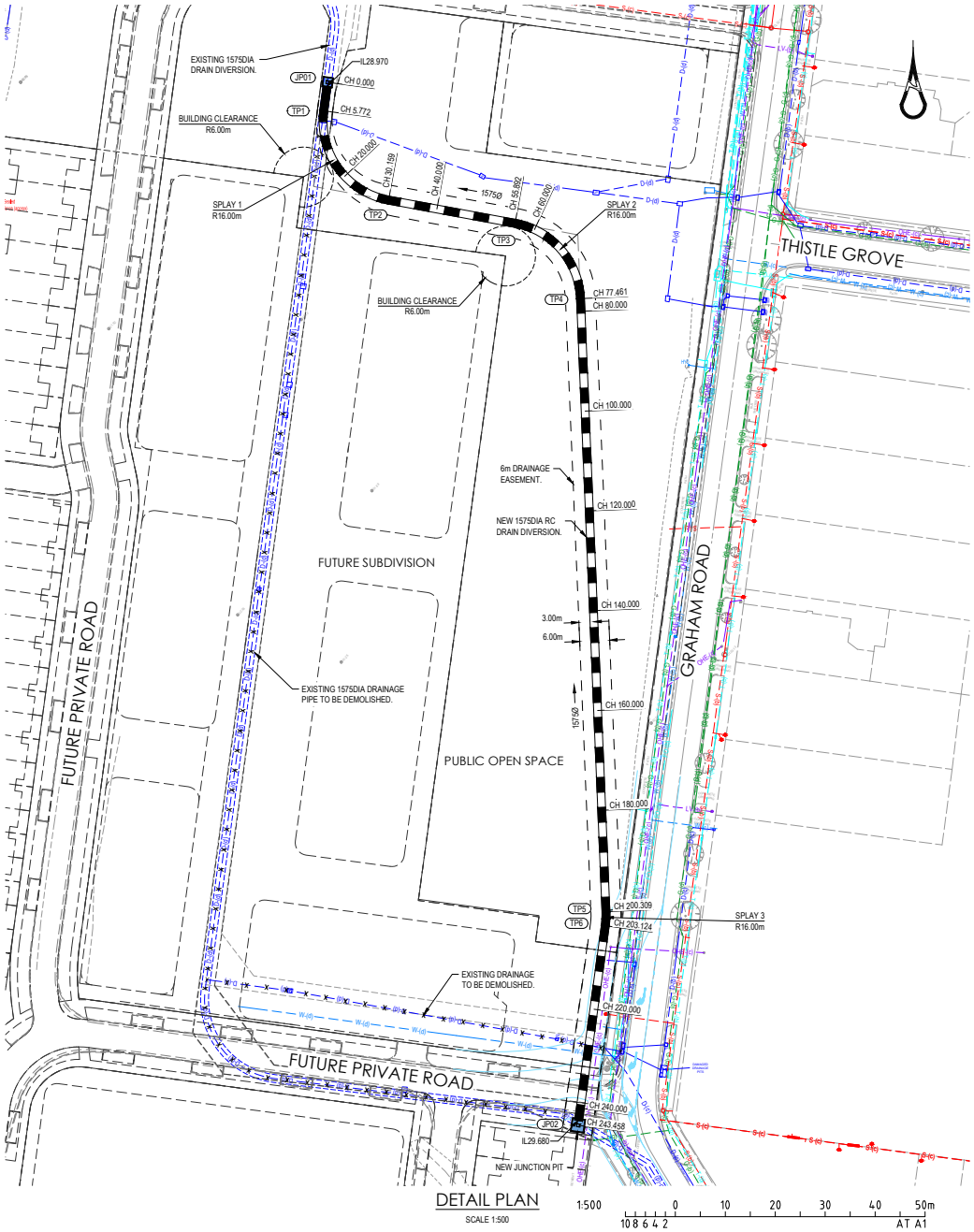
Stantec

TOWN PLANNING ISSUE

COORDS	DATUM	SCALE @ A1	PROJECT No	DRAWING No	REV
MGA55	mAHD	1:500	29150-2	CI-2-520-P02	B

1:500 5 0 5 10 15 20 25 A1
1:1000 A3

Appendix D MW Main Drain Diversion Proposal



DETAIL PLAN
SCALE 1:500

1:500 0 10 20 30 40 50m
10 8 6 4 2 AT A1

STRUCTURE TABLE

PIT NAME	PIT TYPE	INTERNAL DIM (mm)	INLET DIA (mm)	INLET INV (m)	OUTLET DIA (mm)	OUTLET INV (m)	PIT SETOUT RL	PIT DEPTH (m)	NOTES
JP01	JP	1750Lx1750W	1575Ø	28.970			31.771	2.801	
JP02	JP	2500Lx2500W			1575Ø	29.680	32.378	2.698	

CO-ORDINATE TABLE

PIT NAME	EASTING	NORTHING
JP01	327859.415	5797927.513
JP02	327909.594	5797718.677
TP1	327858.640	5797921.793
TP2	327871.613	5797903.908
TP3	327896.924	5797899.271
TP4	327910.027	5797884.197
TP5	327915.128	5797761.456
TP6	327914.997	5797758.648

LEGEND

- 1575Ø — PROPOSED STORMWATER PIT AND DRAIN
- JP01 — PROPOSED JUNCTION PIT
- PIT REFERENCE
- D — EXISTING DRAINAGE
- W — EXISTING WATER
- E — EXISTING ELECTRICAL
- HV — EXISTING ELECTRICAL HIGH VOLTAGE
- LV — EXISTING ELECTRICAL LOW VOLTAGE
- OHE — EXISTING ELECTRICAL OVERHEAD
- G — EXISTING GAS
- T — EXISTING TELECOMMUNICATIONS
- COMM
- NBN — EXISTING NBN
- FO — EXISTING FIBRE OPTIC
- S — EXISTING SEWER
- RM — EXISTING SEWER RISING MAIN

CONTRACT TO CONFIRM THE INVERT LEVEL OF DRAINAGE CONNECTION PRIOR TO WORKS COMMENCING.

DIAL BEFORE YOU DIG www.1100.com.au

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	COMPANY	PROJECT OR WO NUMBER	DRAWN	ENG. CHECK	PR. MAN. APP'D	DATE
P3	PRELIMINARY ISSUE - REVISED TO SUIT MELBOURNE WATER COMMENTS	STANTEC	-	DG	PLM	DMcG	04.02.21
P2	PRELIMINARY ISSUE - REVISED TO SUIT MELBOURNE WATER COMMENTS	STANTEC	-	DG	PLM	DMcG	29.01.21
P1	PRELIMINARY ISSUE	STANTEC	-	DG	PLM	DMcG	28.01.21

Stantec

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Melbourne
Victoria 3000
Phone: +61 3 8554 7000
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Email enquiries.mel@stantec.com
Web www.stantec.com
PERTH MELBOURNE SYDNEY BRISBANE ALBANY BUSSELTON

Melbourne Water

PROJECT NUMBER - AND DESCRIPTION

DRAFTER	DESIGNER	DESIGN MANAGER APPROVAL	PROJECT MANAGER APPROVAL
D.Gros	D.Gros	P.Munzel	D.Mcgrenaghan
DRAFTING CHECK	ENGINEERING REVIEW		
D.Gros	P.Munzel		

TITLE
HIGHETT MAIN DRAIN DIVERSION -
40 GRAHAM ROAD, HIGHETT -
DETAIL PLAN, STRUCTURE PLAN AND COORDINATE SCHEDULE

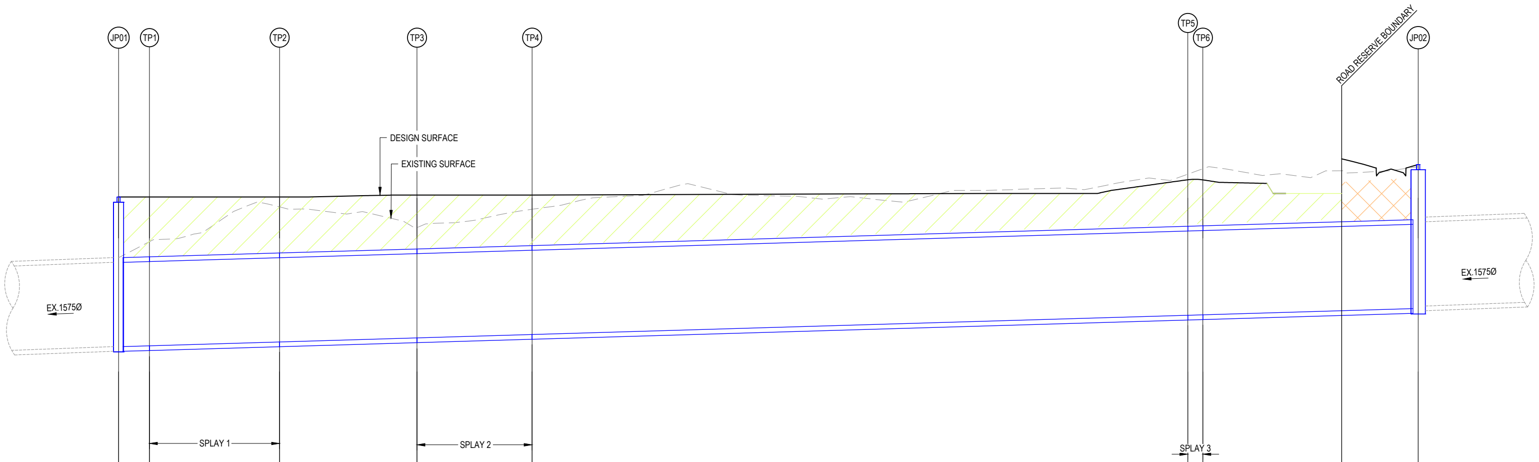
PROJECT DATUM	Original Size	MELBOURNE WATER CORPORATION	
MGA94 ZONE 55	A1	C	CI-1-060-P01	P3
SCALE 1:500		CODE	MWC DRAWING NUMBER	REV

CAD FILE: 21100-2-CI-1-060-P01.DWG
DATE PLOTTED: 4/02/2021 11:45:53 AM BY: GROS, DAVID

LEGEND

- SUITABLE SITE WON FILL MATERIAL
- BACKFILL 20MM CLASS 2 OR 3 CRUSHED ROCK

CONTRACT TO CONFIRM THE INVERT LEVEL OF DRAINAGE CONNECTION PRIOR TO WORKS COMMENCING.



	JP01–TP1	TP1–TP2	TP2–TP3	TP3–TP4	TP4–TP5	TP5–TP6	TP6–JP02
FLOW (m3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PIPE DIAMETER (mm)	1575Ø	1575Ø	1575Ø	1575Ø	1575Ø	1575Ø	1575Ø
GRADE	1:340	1:340	1:340	1:340	1:340	1:340	1:340

PIPE CLASS & BEDDING TYPE: CLASS 2 / H2 (JP01 to road reserve boundary); CLASS 2 / HS2 (road reserve boundary to JP02)

DATUM 25.000

	JP01	TP1	TP2	TP3	TP4	TP5	TP6	JP02
DEPTH TO INVERT	2.800	2.785	2.714 / 2.714	2.673 / 2.673	2.611 / 2.611	2.537	2.526	2.670
DESIGN INVERT LEVEL	28.970	28.985	29.056 / 29.056	29.132 / 29.132	29.195 / 29.195	29.556	29.564	29.680
DESIGN SURFACE LEVEL	31.771	30.737	30.809	30.884	30.948	31.309	31.317	32.378
EXISTING SURFACE LEVEL	30.633	30.933	31.586	31.198	31.541	32.198	32.298	32.336
CHAINAGE	0.000	5.772	30.159	55.892	77.461	200.309	203.124	243.458

LONGITUDINAL SECTION - MW DRAIN
SCALE H1:500, V1:50

1:500 — 10 8 6 4 2 0 10 20 30 40 50m — AT A1

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PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	COMPANY	PROJECT OR WO NUMBER	DRAWN	ENG. CHECK	PR. MAN. APP'D	DATE
P3	PRELIMINARY ISSUE - REVISED TO SUIT MELBOURNE WATER COMMENTS	STANTEC	-	DG	PLM	DMcG	04.02.21
P2	PRELIMINARY ISSUE - REVISED TO SUIT MELBOURNE WATER COMMENTS	STANTEC	-	DG	PLM	DMcG	29.01.21
P1	PRELIMINARY ISSUE	STANTEC	-	DG	PLM	DMcG	28.01.21

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Email: enquiries.mel@stantec.com
Web: www.stantec.com
PERTH MELBOURNE SYDNEY BRISBANE ALBANY BUSSELTON

Melbourne Water
PROJECT NUMBER - AND DESCRIPTION

DRAFTER	DESIGNER	DESIGN MANAGER APPROVAL	PROJECT MANAGER APPROVAL
D.Gros	D.Gros	P.Munzel	D.Mcgrenaghan
DRAFTING CHECK: D.Gros	ENGINEERING REVIEW: P.Munzel		

TITLE HIGHETT MAIN DRAIN DIVERSION -
42 GRAHAM ROAD, HIGHETT -
LONGITUDINAL SECTION - SHEET 1

PROJECT DATUM: MGA94 ZONE 55
SCALE: 1:500
Original Size: A1
MELBOURNE WATER CORPORATION
CODE: C | MWC DRAWING NUMBER: CI-1-522-L01 | REV: P3

DATE PLOTTED: 4/02/2021 11:42:54 AM BY : GROS, DAVID
CAD FILE: 20150-2-CI-1-522-L01.DWG

Appendix E Catchment Plan

Roof Area Takeoff

Description	Label	Quantity	Unit
C1_Roof	APT_A	1,074	sq m
C1_Roof	APT_B	1,146	sq m
C1_Roof	APT_C	1,456	sq m
C1_Roof	APT_D	1,206	sq m
C1_Roof	APT_D2	1,653	sq m
C1_Roof	APT_E	784	sq m
C1_Roof	APT_H	1,258	sq m
C1_Roof	T/H_A/B	1,602	sq m
C1_Roof	T/H_C	1,465	sq m
C2_Roof	APT_F	823	sq m
C2_Roof	APT_G	1,273	sq m
C2_Roof	APT_I	1,212	sq m
C2_Roof	APT_J	1,210	sq m
C2_Roof	T/H_B	698	sq m
C2_Roof	T/H_D/E	1,884	sq m
C3_Roof	APT_K	959	sq m
C3_Roof	APT_L	1,820	sq m
C3_Roof	APT_M	1,613	sq m

Lot Area Takeoff

Description	Label	Quantity	Unit
C1_LOT	APT_A	2,030	sq m
C1_LOT	APT_B	1,872	sq m
C1_LOT	APT_C/D	5,162	sq m
C1_LOT	APT_D2	2,510	sq m
C1_LOT	APT_EH	4,126	sq m
C1_LOT	T/H_A/B	3,127	sq m
C1_LOT	T/H_C	2,801	sq m
C2_LOT	APT_FGIJ	7,838	sq m
C2_LOT	T/H_B	1,330	sq m
C2_LOT	T/H_D/E	2,107	sq m
C3_LOT	APT_K	1,264	sq m
C3_LOT	APT_LM	5,275	sq m

Roads Area Takoff

Description	Label	Quantity	Unit
C1_Roads	Road A	5,712	sq m
C1_Roads	Road C	2,604	sq m
C2_Roads	Road B	2,906	sq m
C2_Roads	Road D	1,213	sq m
C3_Roads	Road B	1,483	sq m

Catchment Area Takeoff

Label	Quantity	Unit
CATCHMENT 1	29,878	sq m
CATCHMENT 2	15,304	sq m
CATCHMENT 3	7,999	sq m

Residential Development Area

Description	Quantity	Unit
SITE	54,413	sq m

Appendix F Engeny Memo – On Site Detention

MEMORANDUM

Project:	37 Graham Road, Highett	**Date:**	5 February 2021
To:	Melbourne Water	**From:**	Jack Haywood
ATT:	Indi Prathapasinghe	**CC:**	Dara McGrenaghan, Vinh Do
Subject:	MWA – 1123250 - On-site Detention and Existing/Developed Flows		

Dear Indi,

This memorandum has been written to address the comments Stantec received regarding the On-Site Detention comments raised in your email dated 16/12/2020. Specifically, the assessment completed by Melbourne Water with regards to the site of 37 Graham Road, Highett (the Site) being in an undeveloped state.

THE SITE'S HISTORY

The Site is a 9.27 hectare site, currently has a Melbourne Water asset (Highett Main Drain) running through the Site, which was constructed in 1982 (according to Melbourne Water records). Whilst the Site is currently undeveloped, it used to be fully developed from 1970, and was owned by the CSIRO. Demolition and land remediation works were completed by the CSIRO in early 2020 before its sale in June 2020.

It can therefore be assumed that the Highett M.D. was sized to account for the fully developed CSIRO Site, as the pipe construction occurred 12 years' after the development of the Site and has been under those developed conditions of the Site for the life of the asset (38 years').

ON-SITE DETENTION ASSESSMENT

To determine the requirements for On-Site Detention on the Site, Engeny have performed an assessment on the Fraction Imperviousness for the existing conditions (CSIRO fully developed) and the developed conditions (the current development proposal). This is due to the following reasons:

- The current "undeveloped" nature of the Site is temporary and should not be considered as the existing conditions, as the Highett M.D. through the Site was built prior to the demolition of the CSIRO development;
- Fraction imperviousness is the driving factor on the Site which will determine a difference in flow between the existing and developed conditions; and
- The entire Site flows towards the Highett M.D.

The proposed development of the Site consists of a nature reserve to the south of the site (approximately 3 hectares) as well as more than 1 hectare of open space and parkland throughout the development to the north.

FRACTION IMPERVIOUS ASSESSMENT

To assess the fraction imperviousness of the Site, Engeny created “Open Space” GIS tables for both the existing and developed conditions. For the existing case, aerial imagery (dated 02/09/2009) was used to determine the usage of the Site, whist the proposed layout plan was used for the developed case. Figure 1 shows the open spaces for both the existing and developed cases, whilst Table 1 details a comparison of the amount of open space for each case.

Figure 1 – Open Space Comparison

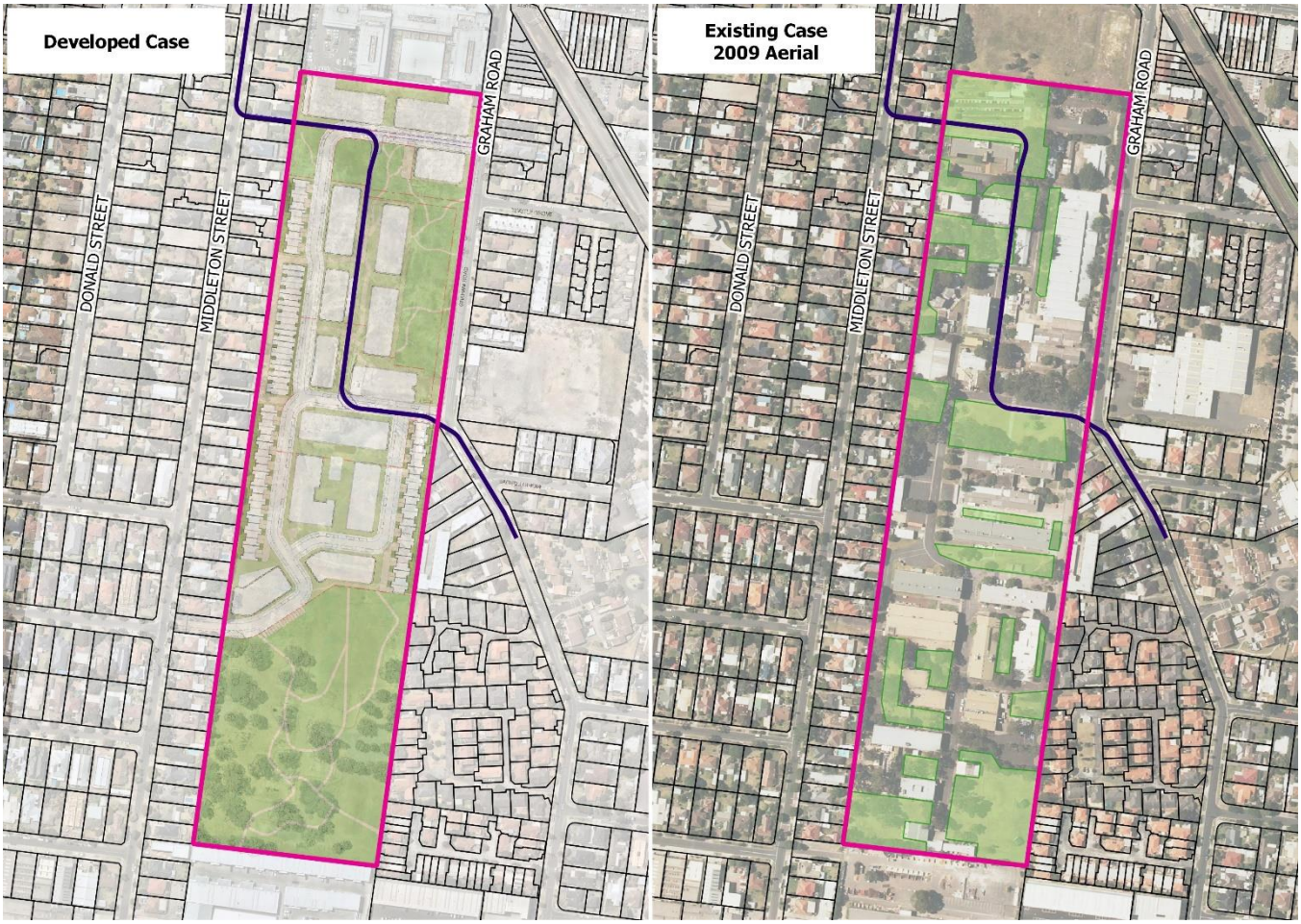

Table 1 – Open Space Comparison

Case	Total Open Space (ha)	% of Site
Existing Conditions (2009 Aerial)	2.64	28.48 %
Developed Conditions	4.08	44.01 %

The assessment shows that with the whole Site draining towards the Highett M.D, as well as the large southern section of the site being designated as a nature reserve, the amount of open / pervious space in the developed conditions is less that the existing conditions, where the CSIRO buildings were still in place.

DETENTION OF PEAK FLOW

Engeny has also completed a Rational Method calculation to determine the peak 1 % AEP flow that would come from the Site in fully developed conditions. Table 2 shows the summary of the parameters and estimated 1 % AEP Peak Flow. Fraction Impervious was estimated conservatively by assuming all non-open space was impervious, where in reality this is not the case.

Table 2: Rational Method Summary

Parameter	Value
Time of Concentration	18.6 minutes (rounded to 20 min)
Fraction Impervious	0.56
Runoff Coefficient (C_{100})	0.67
Intensity (1 % AEP)	32 mm/hr
Peak Flow (1 % AEP)	**0.56 m^3/s**

The Highett M.D. services approximately 60-70 hectares of urban catchment upstream of the Site. The peak flow through the drain is 4.14 m^3/s at 80 minutes during the 1 hour event which is the critical duration for flooding within the Site in a 1 % AEP event due to the capacity of the drain. A triangular hydrograph shape was assumed for the Rational Method estimate of peak flow from the Site, based on the time of concentration. Figure 2 shows the hydrographs of the Rational Method and the Highett M.D from the TUFLOW model.

Figure 2: 1 % AEP hydrographs

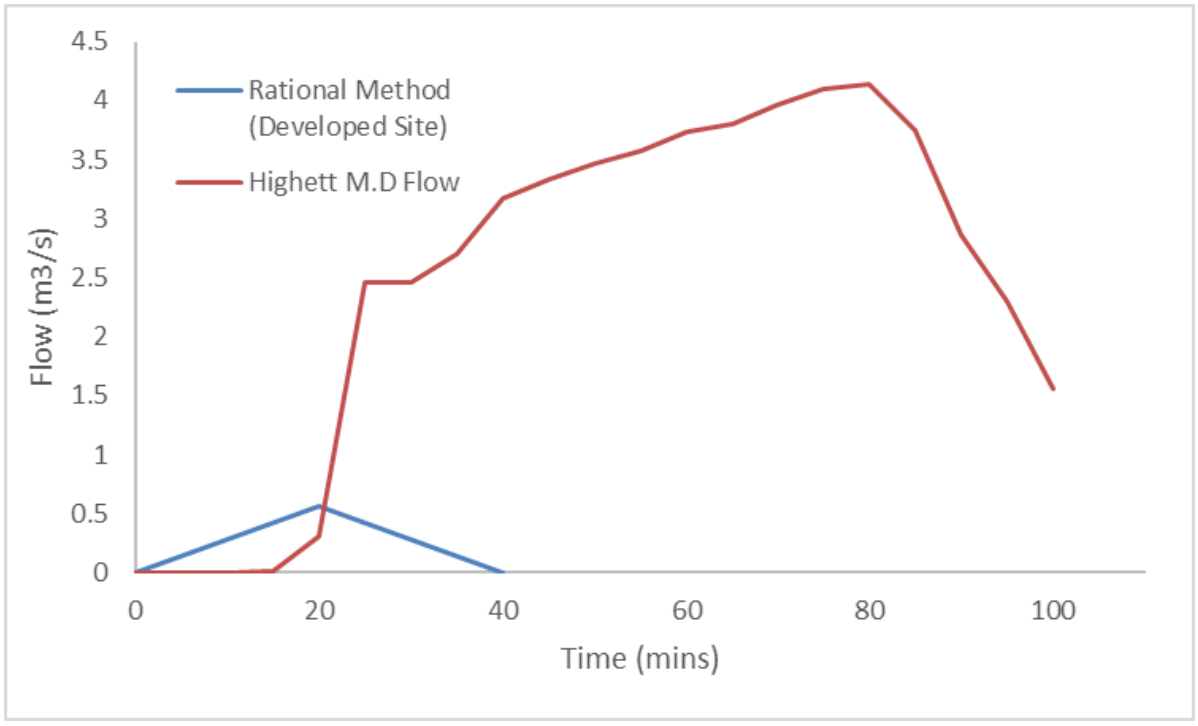

Figure 2 shows that any detention of stormwater from the Site will delay the peak flow from the Site and may cause the peak discharge from the Site to occur when the Highett M.D is running full. This in turn, could cause the detention to have a negative impact on flooding through the area.

If no detention was used on the Site, the 1 % AEP flows would drain through the Highett M.D. before the peak flow in the drain occurs given the differences in times of concentration.

CONCLUSION

Engeny have assessed the requirements for On-Site Detention for the development located at 37 Graham Road, Highett. It is Engeny's view from the assessment is that On-Site Detention is not be required for the following reasons:

- The existing conditions should be considered as being when the Site was fully developed and owned by the CSIRO, not when the Site has been demolished and remediated.
- The proposed development has a greater amount of open space than the Site did in the existing conditions – therefore will generate less surface water from the Site.
- Detaining the water on Site will likely coincide with the peak flow through the Highett Main Drain in the 1 % AEP flood event. Letting water drain from the Site prior to the peak time in the drain will aid flooding throughout the catchment.

Should you have any questions, please do not hesitate to contact the undersigned.

Kind Regards

Jack Haywood
Senior Water Engineer

Design with
community in mind

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