Westfield Booragoon
Redevelopment—

Stomwater Managment Strategy

FOR / Civil Engineering Services

CLIENT / Scentre Group

DOCUMENT NO / BGC-BR-CV-RPT-001 REV / B DATE / 26/08/21

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A	22/10/20	Issued for DA Submission	AJH	CB	
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1 INTRODUCTION

The primary aims of the stormwater drainage strategy for Westfield Booragoon are:

- To maintain the peak discharge to pre redevelopment flow rates
- To maintain, if not improve, the water quality discharging from the Site, relative to pre-development conditions.
- To ensure Westfield Booragoon Shopping Centre buildings remains serviceable up to the 100 year ARI event to ensure public health and safety for the full design life of the proposed drainage infrastructure.

To achieve these primary aims, the following criteria has been adopted in the stormwater drainage system design:

- Stormwater discharge must have no adverse impacts on the downstream stormwater infrastructure and existing roads
- The stormwater system must treat pollutants from the first flush event.
- The 100 year ARI event must be safely conveyed by overland flow paths.
- All elements of the stormwater network must make allowance for maintenance.

The stormwater quality requirements will be met through the implementation of pollutant removal devices where possible.

The majority of run-off will be disposed of via piped network to the existing stormwater pipe connections. In larger events some run-off will discharge to the external road network via overland flow.

2 EXISTING SITE CONDITIONS

2.1.1 Groundwater

During geotechnical investigations between March 2015 and July 2015, groundwater was observed between 3.2 mAHD and 3.6 mAHD, which is approximately 25m below the lowest surface elevation on the site.

2.1.2 Infiltration Rate

The geotechincial report recommended adopting an infiltration rate of 8.6 m/day for preliminary design calculations. Further infiltration testing will be required prior to construction to confirm design calculations.

2.1.3 Existing Catchment

The existing site catchment areas have been determined based on site topography, existing stormwater infrastructure identified from survey information, City of Melville GIS information and available as-constructed drawings.

Existing catchment areas are based upon the existing property boundary, which will be changed as part of a land swap agreement between Westfield Booragoon and the City of Melville.

The total site existing catchment area is 17.9 Ha. The pre-redevelopment catchment areas are shown in Appendix A. This is broken down as follows:

- Existing buildings (including portion of Library building) - 9.1 ha
- Hard landscape – 7.5 ha
- Soft landscape – 1.3 ha

Hydrology calculations were undertaken using the Rational Method to determine the peak flows in the 5 year 20 min and 100 year 60 min storm events. Table 1 shows the Site peak discharge and volume of water that discharges from the catchments within the site.

	Area (m^2)			Site Peak Discharge (m3/s)		Site Stormwater Volume (m3)	
Reference	**Total Area**	**Building Area**	**C**	**Q_5**	**Q_{100}**	**V_5**	**V_{100}**
C-01	42465	17100	0.95	0.57	0.51	686	1830
C-02	34494	20690	0.95	0.46	0.41	557	1486
C-03	25610	18676	0.95	0.34	0.31	413	1103
C-04	21295	9190	0.95	0.29	0.25	344	918
C-05	31016	22788	0.95	0.42	0.37	501	1336
C-06	23586	2947	0.95	0.32	0.28	381	1016
Total	**178466**	**91391**					

Table 1 – Existing Catchment Areas – Peak Flows and Total Discharge Volume

2.1.4 Existing Stormwater Drainage Infrastructure

The existing drainage consists of predominantly piped drainage with connections to the City of Melville drainage networks on Riseley Street, Marmion Street and Almondbury Road.

As determined from GIS information supplied by the City of Melville and Site feature survey undertaken by Veris, five existing stormwater connections to the external drainage network within the surrounding road reserves have been identified:

- two connections to the Almondbury Road system
- two connections to the Marmion Street system
- one connection to the Riseley Street system

Catchment	Pipe Location	Pipe Diameter	Ultimate Discharge Location
C1	Marmion Street	600mm	Marmion St Sump
C2	Almondbury Rd	525mm	Leverburgh St Sump
C3	Almondbury Rd	600mm	Leverburgh St Sump
C4	Riseley Street	675mm	Ratcliff Park POS
C5	Marmion Street	600mm	Marmion St Sump

Table 2 – Existing Catchment Discharge Information

The peak discharge rate for the pipes leaving Garden City are shown in Table 3. Peak flows within the pipe have been calculated using Manning's equation based on the pipe flowing full using pipe information from the Survey or City of Melville GIS system.

Catchment	Pipe Location	Pipe Diameter	Max Discharge Rate
C1	Marmion Street	600mm	1.17 m3/s
C2	Almondbury Rd	525mm	0.71 m3/s
C3	Almondbury Rd	600mm	0.41 m3/s
C4	Riseley Street	675mm	1.47 m3/s
C5	Marmion Street	600mm	0.69 m3/s

Table 3 – Existing Catchment Peak Discharge

3 STORMWATER DESIGN CRITERIA

The adopted stormwater design criteria to be adopted for this project is shown in Table 4

Design Parameters	Overall Site	Riseley Street	Marmion Street	Almondbury Road	High Street
Discharge into LGA drainage network from Westfield Booragoon	Limited to existing discharge	Limited to existing discharge	Limited to existing discharge	Limited to existing discharge	Limited to existing discharge
Piped systems	5 years	5 years	5 years	5 years	5 years
ARI for Gutter spread	5 years	5 years	5 years	5 years	5 years
ARI for Kerb Overtopping	n/a	5 years	5 years	5 years	5 years
ARI for Major systems check (flooding of buildings)	100 years	100 years	100 years	100 years	100 years

Table 4 – Stormwater Design Criteria

4 POST-DEVELOPMENT STORMWATER STRATEGY

4.1 Proposed Topography

The flow paths and characteristics of the pre-development Site will be maintained as much as possible. The vertical grade of the surrounding roads will not be modified.

The finished surface surrounding the building is graded away at a minimum of 2% for the entire perimeter of the building. The town centre area will be lower than the adjacent High Street and also lower than the finished floor level of the shopping centre ground floor level.

High Street has been designed to grade towards Almondbury Road north of the crossing between the Council building and the town centre area and towards the Davy Street south of the southwestern crossing location. Along the building frontage, High Street has been designed to provide a relatively flat site for ease of access from the Council building to the west to the Westfield Booragoon ground floor level.

Should the proposed topography of the Site be altered due to landscaping or Architectural updates the stormwater drainage design may need to be updated accordingly, however the drainage principles and strategy outlined within this SWMP will remain largely unchanged.

4.2 Post Development Catchments

The post development catchment area is based upon the proposed cadastral boundary changes, including the new High Street road within the City of Melville land. The post redevelopment catchment areas are shown in Appendix B. The Stage 2 catchment areas will be the same as stage 1, however the portion of the catchments covered by buildings will increase as shown in Table 5 and Table 6.

Stage 1 will increase the building coverage of the site by approximately 1.2 Ha (an increase of approximately 6.4%). The subsequent Stage 2 works will increase the building coverage of the site by a further 2 Ha.

	Area (m2)	
Name	Total Area	Building Area
C-01	42465	12935
C-02	38233	32248
C-03	25610	18676
C-04	21295	9190
C-05	31012	24885
C-06	21399	5655
Total	180014	103589

Table 5 – Post Re-Development Catchment Areas – Stage 1

	Area (m2)	
Name	Total Area	Building Area
C-01	42465	30790
C-02	38233	32248
C-03	25610	18676
C-04	21295	9190
C-05	31012	27817
C-06	21399	5655
Total	180014	124376

Table 6 – Post Re-Development Catchment Areas – Stage 2

The town centre catchment area of 2751m^2 is included within Catchment 2 area in the tables above.

The Almondbury Road catchments to the east of the new roundabout and Links road catchment are not included in the catchment areas in the tables above.

4.3 Stormwater Quality Management

Stormwater that discharges from redeveloped areas via the piped networks will have a Gross Pollutant Trap (GPT) installed as the last pit prior to connection to the external City of Melville system. The GPT's will target removal of sediments and hydrocarbons in the first flush event.

Due to the topography and limited space available, the stormwater system will not include swales and/or bio-retention basins to treat stormwater, except for the town centre area.

4.4 Stormwater Quantity Management

Stormwater discharging from Site will adopt the "Regime in Balance" strategy as described in Australian Runoff Quality (ARQ), which permits post-development flows leaving a site to be the same as the pre-development flows. Pre-Development for this project is the existing site prior to the proposed re-development.

No modifications to the building are proposed within Catchment C-03 and C-04; therefore, existing stormwater connections will remain unaffected by the redevelopment.

The peak flow rate at the discharge location of C-01, C-02 & C-05 are restricted to the available peak discharge rates available at each connection as shown in Table 3. The portion of High Street within C-02 will be diverted from C-02B and connect to the existing system within Links Road (C-02A).

As the impervious area of the Site will not be reduced, the volume of water discharging off-site remains the same as the pre redevelopment volume.

4.5 Major Rainfall Events

Safe passage is provided for overflow routes in all events up to the 100 year ARI to ensure serviceability of the Westfield Booragoon Shopping Centre building while minimising risks to public health and properties.

Overland flow from the site to the external road network in events up to the 100 year event is not expected to increase as the overall impervious area of the site has not increased from the pre-redevelopment. The increase in the building area within the site is likely to reduce overland flow from the redeveloped areas as the rainfall will be captured within the building stormwater collection system.

4.6 Stormwater Discharge

4.6.1 Discharge

Stormwater from the Site will discharge via:

- Infiltration in stormwater tanks within the carpark to the east of Andrea Lane
- Infiltration in swales and stormwater tanks within the town centre area
- Infiltration in stormwater tank within carpark to the south east of the High Street and Andrea Lane intersection
- Infiltration within soakwells within the existing carpark adjacent to Davy Street and north of High Street
- Piped outflow to the existing stormwater pipe systems within the external road reserves
- Overland flow for events up to the 100 year ARI

The Rational Method was used to determine the Site peak discharge and stormwater volume generated from the Site. The peak discharge and volume was calculated for the 5 year 20 minute and 100 year 60 minute design storm events. Table 7 outlines the catchments maximum peak flow rates and the maximum volume discharged from each.

	Area (m2)			Site Peak Discharge (m^3/s)		Site Stormwater Volume (m3)	
Name	Total Area	Building Area	C	Q_5	Q_{100}	V_5	V_{100}
C-01	42465	12935	0.95	0.57	0.51	686	1830
C-02	38233	32248	0.95	0.51	0.46	617	1647
C-03	25610	18676	0.95	0.34	0.31	413	1103
C-04	21295	9190	0.95	0.29	0.25	344	918
C-05	31012	24885	0.95	0.42	0.37	501	1336
C-06	21399	5655	0.95	0.29	0.26	345	922

Table 7 – Stage 1 Post Redevelopment Catchment – Peak Flows and Total Discharge Volume

	Area (m2)			Site Peak Discharge (m^3/s)		Site Stormwater Volume (m3)	
Name	Total Area	Building Area	C	Q_5	Q_{100}	V_5	V_{100}
C-01	42465	30790	0.95	0.57	0.51	686	1830
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C-05	31012	27817	0.95	0.42	0.37	501	1336
C-06	21399	5655	0.95	0.29	0.26	345	922

Table 8 – Stage 2 Post Redevelopment Catchment – Peak Flows and Total Discharge Volume

Given a majority of the stormwater from the site will be collected on the building and conveyed via stormwater pipes, the overland flow entering the external roads is expected to be significantly less than is currently occurring.

As shown in Table 9 the peak discharge from the post development catchment areas are less than the capacity of the receiving pipes within the road reserve. Therefore, the overland flow in the external roads will be reduced and only be caused by the stormwater within the external road catchments.

Catchment	Pipe Location	Pipe Diameter	Max Discharge Rate	Peak Discharge (m^3/s)	
				Q_5	Q_{100}
C1	Marmion Street	600mm	1.17 m3/s	0.57	0.51
C2	Almondbury Rd	525mm	0.71 m3/s	0.51	0.46
C3	Almondbury Rd	600mm	0.41 m3/s	0.34	0.31
C4	Riseley Street	675mm	1.47 m3/s	0.29	0.25
C5	Marmion Street	600mm	0.69 m3/s	0.42	0.37

Table 9 – Flow Capcity Vs Peak Discharge

4.6.2 On-Site Storage

Existing on-site storage is provided by existing soakwells located around the site and an underground tanks constructed as part of the Andrea Lane early works, the tank provided installed has a storage volume of $388m^3$. This effectively reduces the volume discharging from Catchment C-01.

As part of the redevelopment works additional underground storage will be installed around the site where spatial restrictions allow. 2 additional locations have been identified to provide onsite stormwater disposal.

The town centre area will effectively be trapped between the building and the new road so will need to collect and dispose of stormwater from its own catchment. The town centre will have onsite storage to cater for events up to the 100yr design storm, it is expected that a maximum of 82m^3 of storage will be required for this catchment.

Additional onsite storage within the carpark to the south east of the High Street and Andrea Lane intersection will have a storage volume of approximately 985m^3 by installing a 660m^2 underground tank system. In addition, the existing soakwells within the carpark to the north of High Street will continue to provide stormwater disposal for this sub-catchment. This infrastructure will provide enough storage to dispose of the 100yr volume generated within Catchment C-06.

4.7 Stormwater Reuse

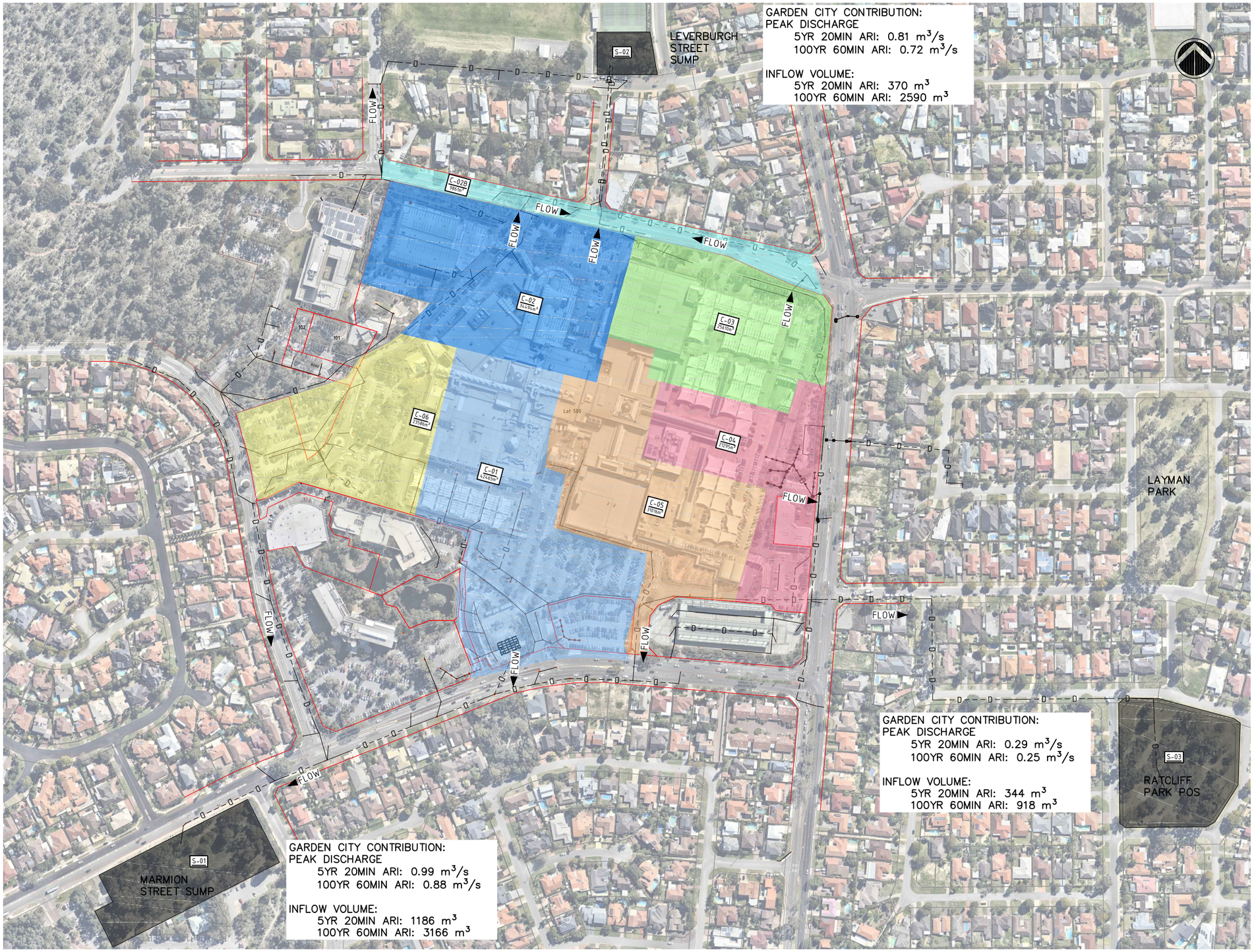
No Stormwater reuse is proposed on this project.

4.8 Flood Levels

The Site is not located within a flood plain as identified on the Department of Water maps. Any flooding would be localised due to stormwater runoff within the immediate catchment.

APPENDIX A

Existing Catchment & Infrastructure



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5YR 20min AND 100yr 60min STORM EVENTS USED.
PEAK FLOW AND VOLUMES CALCULATED USING RATIONAL METHOD

SKETCH ONLY

BG&E

DATE	17/04/18
SCALE	1:2000
GRID	PCG94
PREPARED	AH
SHEET	1 OF 1

PROJECT: AMP GARDEN CITY BOORAGOON

TITLE: STORMWATER CATCHMENT
EXISTING CATCHEMENTS

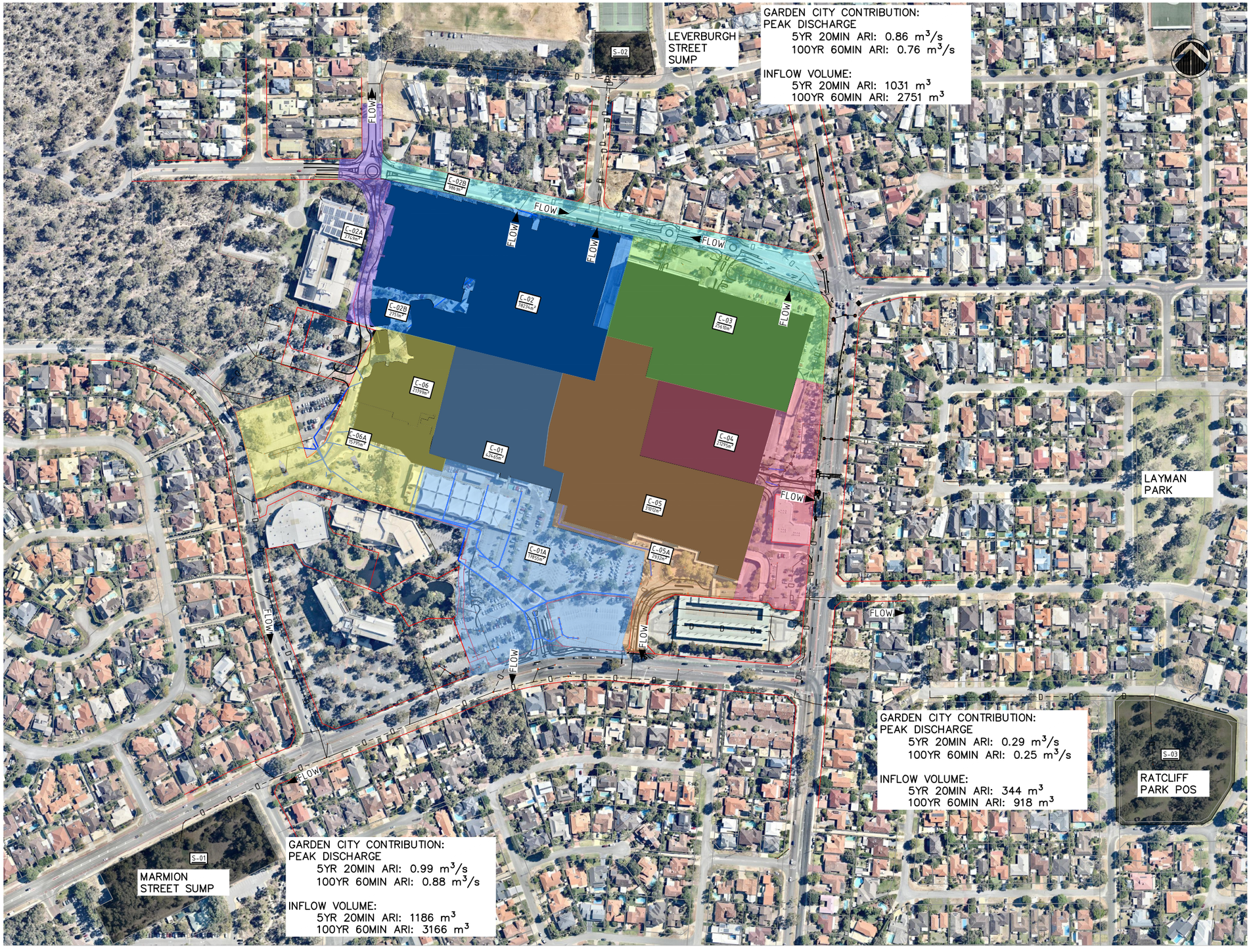
PROJECT No. P16220 | SKETCH No. BGC-BR-CV-SKT-043 | REV P2

SKETCH ONLY

DATE 27/10/2017	PROJECT GARDEN CITY		
SCALE 1:2000	TITLE EXISTING INFRASTRUCTURE		
GRID PCG94			
PREPARED AJH			
SHEET 1 OF 1	PROJECT No. P16220	SKETCH No. BGC-BR-CV-SKT-087	REV P

APPENDIX B

Post Re-Development Catchment Areas



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5YR 20min AND 100yr 60min STORM EVENTS USED.
PEAK FLOW AND VOLUMES CALCULATED USING RATIONAL METHOD

SKETCH ONLY

BG&E

DATE	26/08/2021
SCALE	1:2000
GRID	PCG94
PREPARED	AH
SHEET	1 OF 1

PROJECT: AMP GARDEN CITY BOORAGOON

TITLE: STORMWATER CATCHMENT
POST REDEVELOPMENT CATCHEMENTS

PROJECT No. P20135 | SKETCH No. BGC-BR-CV-SKT-089 | REV Q