

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2019/1003

Date: 31 May 2021



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Site Based Stormwater Management Plan

Engineering Report

Prepared for: Australian Unity

Document no: BR180115-SWMP

Issue no: 3



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REVISIONS

Revision	Date	Purpose	Prepared By	Approved By
Draft	17/01/2019	For Internal Review	Peter Kirby	Matthew Beattie
Draft 2	18/01/2019	For Review	Peter Kirby	Matthew Beattie
1	21/01/2019	For Approval	Peter Kirby	Matthew Beattie
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Review Panel	
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Civil / Brisbane, QLD	Roshan Khadka RPEQ 15945

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Unless otherwise advised, the parties who have undertaken the Review and Endorsement confirm that the information contained in this document adequately describes the conditions of the site located at 300 Herston Road, Herston.

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1 Introduction

1.1 Background

ACOR Consultants (QLD) Pty. Ltd. were engaged by Australian Unity (Client) to prepare a Site Based Stormwater Management Plan (SBSMP) for the proposed Herston Quarter Development (the Development Area), located at 300 Herston Road, Herston QLD except for Precincts 1 and 2 which were managed under a separate report by others.

2 Scope

The following items will be addressed in this report:

- Lawful point of discharge for the development
- Proposed concept stormwater quantity management plan for the Development Area
- Proposed concept stormwater quality management plan for the Development Area

3 Criteria

This report has been compiled based on:

- Existing site survey prepared by Aurecon
- Existing site survey prepared by Landscape Solutions
- Existing site survey prepared by Bennett and Bennett
- Existing site survey prepared by CC Plumbing and Drainage
- Proposed site layout plan prepared by Hassell (Architect)
- Discussions with the Client and the Architect
- Information obtained from Council's online mapping system

4 Site Characteristics

4.1 Location and Description

The site is located at 300 Herston Road, Herston QLD 4006 over lot described as Lot 545 on SP289113 (Development Area).

The total area of the site is approximately 5.292 Ha, with the Development Area covered in the scope of this report being 3.206 Ha (Refer Figure 1).

The Development Area is fronted by Bramston Terrace along its south western boundary and Herston Road along the southern boundary.

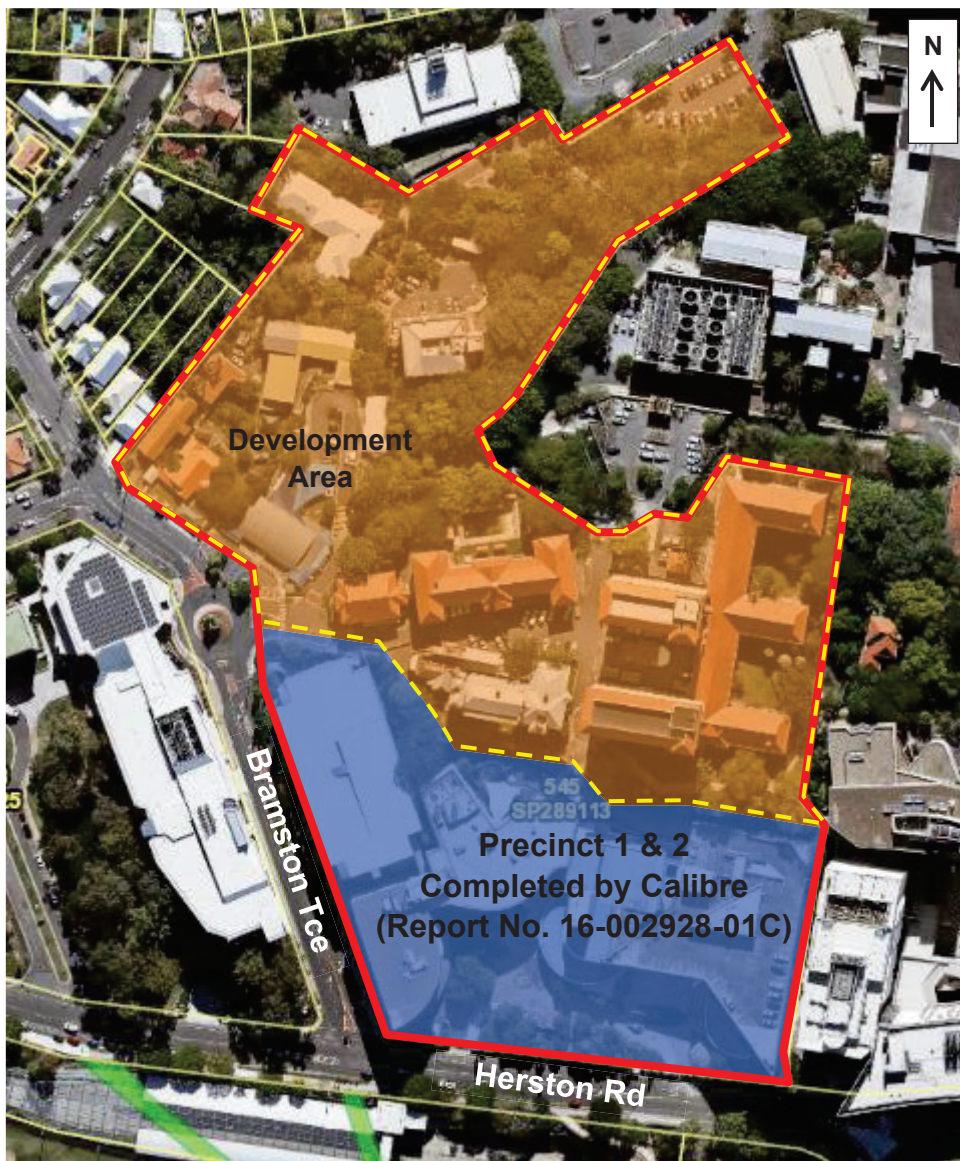


Figure 1 - Site Location

Source: ©State of Queensland 2019

4.2 Watercourses and Topography

There are no watercourses within the Development Area.

The major flow paths through the site are the existing internal access roads.

The Development Area levels range between around 47.2m AHD and 2.5m AHD.

Refer to **Appendix A** for detailed survey of the Development Area.

4.3 Existing Land Use and Proposed Development

The overall Herston Quarter site currently exists as an existing health precinct with several existing buildings including commercial buildings such as an existing childcare centre and car parking facility.

The proposed development covered in this report is a mixed-use development that consists of multi-unit residential, commercial, retail and office buildings, hospital building, car parking facility and aged-care and retirement living buildings.

Refer to **Appendix B** for the proposed development plans

4.3.1 Existing Stormwater Infrastructure and Lawful Points off Discharge

There is an existing underground stormwater pits and pipes network within the development area.

Refer to **Appendix A** for the survey showing existing stormwater layout for the site.

Based on our review of existing site conditions, we have identified the following four existing discharge locations for the proposed Development Area:

- Discharge Location A – The northern catchment of the development site will discharge to the existing stormwater network within internal access road drainage systems within the adjoining Royal Brisbane and Women's Hospital (RBWH) property described as Lot 546 on SP289113. Stormwater will then continue to flow to the Council drainage system located within Butterfield Street.
- Discharge Location B – The south-western catchment of the development site will discharge to the existing stormwater infrastructure within Bramston Terrace.
- Discharge Location C – The eastern catchment of the development site will discharge via overland flow to Central Drive to the RBWH property.
- Discharge Location D – The southern Heritage Precinct catchment will discharge to the south to Herston Road.

Refer to Catchment plans in **Appendix C** -that show these proposed discharge locations.

These existing discharge locations are considered to be the lawful points of discharge for the Development Site.

5 Stormwater Quantity Management

5.1 Hydrological Modelling

Hydrological analysis has been undertaken using DRAINS to calculate the peak flow rates from the site. The hydrological model used in DRAINS is the Extended Rational Method using ARR87 methods.

Rainfall Intensity-Frequency-Distribution (IFD) data for the site has been obtained from the Bureau of Meteorology (BOM).

5.2 Catchment Summary

Pre- and post-development catchment parameters to be used in DRAINS have been calculated based on existing detailed survey data, aerial image of the site, information provided to us about the proposed development and methods outlined in QUDM.

Times of concentrations have been calculated based on survey contours and methods outlined in QUDM.

Aerial image and detailed survey of the site has been used to calculate the pre-development fraction impervious. Proposed site layout plans have been used to calculate the post-development fraction impervious for the Site.

Refer to **Appendix C** for catchment plans.

Development Area has been divided into three pre- and four post-development catchments (Catchment A, B, C and D) corresponding to the four discharge locations. These catchments have been further subdivided into smaller catchments as per existing site conditions and information on proposed development plans provided by the Client.

Table 1 and Table 2, below, provide a summary of the pre- and post-development catchment characteristics used in DRAINS.

Table 1 – Pre-Development Parameters

Catchment	Area	F.I.	Tc(min)
Catchment A			
A1	0.2748 Ha	30%	7
A2	1.4496 Ha	60%	9
A4	0.2041 Ha	60%	5
A5	0.2035 Ha	40%	5
Ext - A3	0.4242 ha	90%	5
Ext - A6	0.5477 ha	30%	10
Ext - A8	0.6660 ha	60%	9
Ext - A9	0.4098 ha	70%	7
Ext - A10	0.4321 ha	80%	5
Catchment B			
B	0.5302 Ha	95%	5
Catchment C			
C1	0.3132 Ha	75%	6
C2	0.2045 Ha	70%	5

Table 2 - Post-Development Parameters

Catchment	Area	F.I.	Tc(min)
Catchment A			
A1	0.4928 ha	95%	5
A2a	0.9338 ha	90%	7
A2b	0.0819 ha	90%	5
A4	0.1424 ha	80%	5
A5	0.0686 ha	90%	5
A7	0.1068 ha	90%	5
A11	0.0310 ha	90%	5
A12	0.1871 ha	90%	5
A13	0.1880 ha	85%	5
Ext - A3	0.4242 ha	90%	5
Ext - A6	0.5477 ha	30%	10
Ext - A8	0.6660 ha	60%	9
Ext - A9	0.4098 ha	70%	7
Ext - A10	0.4321 ha	80%	5
Catchment B			
B	0.5811 ha	70%	6
Catchment C			
C	0.4785 ha	80%	7
Catchment D			
D	0.1421 ha	70%	5

Developed catchment D discharges towards the south through another stage (Precinct 1 and 2) of the Herston Development. A separate stormwater management report [16-002928-01 (E)] is being prepared for this area by Calibre Groups. The characteristics of catchment D have been coordinated with Calibre Groups to assist them with the preparation of their stormwater management plan.

5.3 Pre- and Post-Development Peak Flow Rates

Table 3, below, provides a summary of the pre-development peak flow rates calculated using DRAINS:

Table 3 - Comparison of Pre- and Post-Development Peak Flow Rates

Catchment	Area	64% AEP (m ³ /s)	39% AEP (m ³ /s)	18% AEP (m ³ /s)	10% AEP (m ³ /s)	5% AEP (m ³ /s)	2% AEP (m ³ /s)	1% AEP (m ³ /s)
Discharge Location A								
Pre-Development	4.6118 ha	0.851	1.170	1.690	2.020	2.460	2.850	3.250
Post-Development	4.7122 ha	0.900	1.240	1.790	2.140	2.610	3.000	3.400
Increase		5.4%	5.6%	5.6%	5.6%	5.7%	5.0%	4.4%
Discharge Location B								
Pre-Development	0.5302 ha	0.123	0.168	0.241	0.288	0.352	0.425	0.475
Post-Development	0.5811 ha	0.119	0.164	0.237	0.284	0.347	0.401	0.454
Increase		-3.4%	-2.4%	-1.7%	-1.4%	-1.4%	-6.0%	-4.6%
Discharge Location C – North-East								
Pre-Development	0.3132 ha	0.065	0.089	0.129	0.155	0.189	0.218	0.247
Post-Development	0.4785 ha	0.097	0.133	0.193	0.231	0.282	0.326	0.369
Increase		33%	33%	33%	33%	33%	33%	33%
Discharge Location C - East								
Pre-Development	0.2045 ha	0.045	0.062	0.089	0.106	0.13	0.158	0.177
Post-Development	0 ha	-	-	-	-	-	-	-

Management of flows to discharge location D flows will be addressed in a separate stormwater management report [16-002928-01 (E)], for Precinct 1 and 3, being prepared by Calibre Group.

Results show that, compared to pre-development peak flow rates, without mitigation, there is an increase in post-development flow rates at Discharge Location A.

However, compared to pre-development peak flow rates, there is a decrease in post-development flow rates at Discharge Location B and C. Therefore, no mitigation measures proposed for flows to these discharge locations.

5.4 Proposed Design

5.4.1 Discharge Locations B and C

Post-development flows from Catchment B will discharge to existing stormwater infrastructure within Discharge Location B un-detained.

Post-development flows from Catchment D will discharge to existing stormwater infrastructure within Central Drive (Discharge Location C) un-detained. Due to existing site constraints (high natural hard rock face), an underground stormwater pipe connection through the rock face and into the existing underground pipe network within Central Drive may not be feasible.

Additional coordination and investigation will be required to confirm the details of how stormwater can be discharged to Central Drive.

5.4.2 Discharge Location A

5.4.2.1 Detention System

An underground detention system under the proposed carpark facility (sub-catchment A1) is proposed.

Post-development flows from sub-catchment A1 and flows in excess of the 10% AEP from Back Road (sub-catchments Ext-A3, A4, A7 and A11) will discharge to the proposed detention tank, while runoff from the remainder of Catchment A will bypass the detention tank.

The following table summarises the proposed detention system characteristics:

Table 4 – Preliminary Catchment A1 Underground Detention Tank Details

Underground Detention Tank	
Tank Surface Area (m ²)	100
Tank Invert Level (m AHD)	5.35
Tank Obvert Level (m AHD)	8.35
1% AEP Storage Level (m AHD)	7.44
Detention Volume at 1% AEP Storage Level (m ³)	209
Low Level Orifice Control	1 x 150mm @ IL 5.35
Mid Level Orifice Control	1 x 225mm @ IL 6.00
High Level Orifice Control	1 x 330mm @ IL 6.65

Refinement of the detention system location, layout, sizing and outlet configuration is expected to be undertaken as part of detailed design of Stage 4 works.

5.4.2.2 Pre- and post-development (with mitigation) peak flow rates comparison

The table below summarises the pre- and post-developed (mitigated) peak flow rates at Discharge Location A.

Table 5- Comparison of Pre- and Post-Development (Mitigated) Peak Flow Rates

Catchment	Area	64% AEP (m ³ /s)	39% AEP (m ³ /s)	18% AEP (m ³ /s)	10% AEP (m ³ /s)	5% AEP (m ³ /s)	2% AEP (m ³ /s)	1% AEP (m ³ /s)
Discharge Location A								
Pre-Development	4.6118 ha	0.851	1.170	1.690	2.020	2.460	2.850	3.250
Mitigated Post-Development	4.7122 ha	0.826	1.130	1.670	2.000	2.400	2.790	3.170
Increase		-3.0%	-3.5%	-1.2%	-1.0%	-2.5%	-2.2%	-2.5%

6 Stormwater Quality Management

6.1 Water Quality Objectives

6.1.1 Construction Phase

- Control measures to be put in place to protect downstream properties from nuisance flows.
- Maximum of 50mg/L of total suspended solids present in run-off discharged from the site during the construction stage, and a pH between 8 and 8.5
- During construction the principle contractor shall be responsible to provide water quality control measures in accordance with BCC guidelines and IECA best practices.

6.1.2 Operational Phase

The proposed development is required to meet or exceed the stormwater management design objectives under the State Planning Policy 2017 (SPP) and Council's planning scheme and guidelines. The following minimum load reduction targets, in mean annual load from unmitigated development, are required to be achieved in the post-developed site's treatment:

- | | |
|---------------------------------------|--------------------------------------|
| ▪ Total Suspended Solids (TSS) | 80% reduction of average annual load |
| ▪ Total Phosphorus (TP) | 60% reduction of average annual load |
| ▪ Total Nitrogen (TN) | 45% reduction of average annual load |
| ▪ Gross pollutants (greater than 5mm) | 90% reduction of average annual load |

In addition to the above, the following permanent stormwater quality best management practices have been identified for the operational phase of the development to assist in the protection of water quality.

- Rubbish Bins provided on site;
- Street sweeping of pavement areas;
- Maintenance of all stormwater quality improvement devices;
- Inspect and clean stormwater system to ensure there is no build-up of silt, leaves, rubbish, debris, etc.

6.2 MUSIC Modelling

6.2.1 Modelling Guidelines

The site is located within a Priority Development Area (PDA) under the authority of Economic Development Queensland (EDQ) and within the Brisbane City Council area.

Water quality parameters and the proposed limits applicable to this site were selected in accordance with Water by Design MUSIC Modelling Guidelines for South East Queensland Version 1.0 (2010) and the consultation draft MUSIC Modelling Guidelines November 2018 Version 3.0 (the Guidelines).

6.2.2 Rainfall Data

MUSIC Modelling Guidelines provide advice on meteorological data for different climatic regions of South East Queensland. Six minutes step rainfall data from Brisbane Regional Office (station 40214) from 1980 to 1989 were adopted for the site

Monthly evapotranspiration values were also obtained from the MUSIC Modelling Guidelines for the same Council/station. The below values were used in the MUSIC model.

Table 6 - Monthly Evapotranspiration

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evapotranspiration (mm)	188	146	146	107	74	63	65	84	111	144	171	192

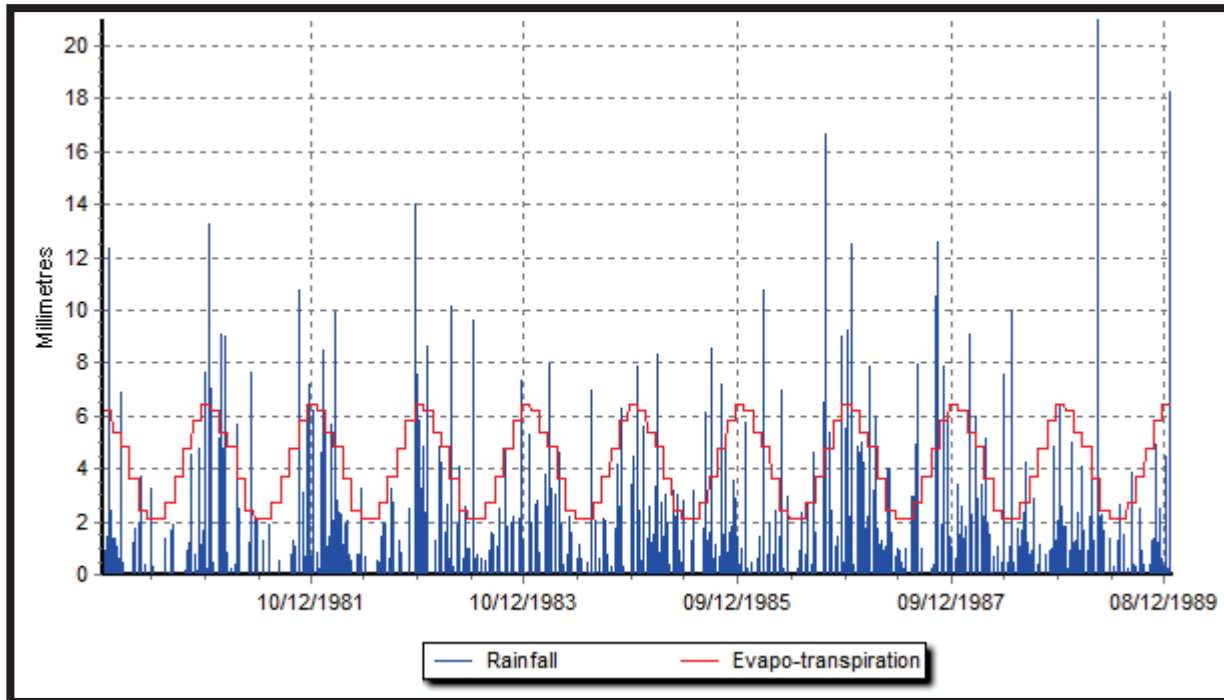


Figure 2 - Rainfall Data

6.2.3 Model Selection, assumption and removal effectiveness

In accordance with the Water By Design MUSIC Modelling Guidelines, split catchment methods were used for the source Nodes utilizing modified % impervious area. Rainfall threshold, soil properties & pollutant concentration input values were also sourced from the Guidelines.

The following table summarises the rainfall runoff parameters (obtained from the Guidelines) used in MUSIC modelling:

Table 7 - MUSIC Developed Case Source Parameters

Source Node Parameters – Sub Catchments		Commercial
Rainfall - Runoff	Rainfall Threshold (mm/day)	1
	Soil Storage Capacity (mm)	18
	Initial Storage (% of Capacity)	10
	Field Capacity	80
	Infiltration Capacity Coefficient - a	243
	Infiltration Capacity Exponent - b	0.60
	Initial Depth (mm)	50
	Daily Recharge Rate (%)	0
	Daily Base flow Rate (%)	31
	Daily Deep Seepage Rate (%)	0

The following table summarises the pollutant export parameters (obtained from the Guidelines) for various split catchments and land use used in MUSIC modelling:

Table 8 - Source Node MUSIC Input Parameters

FLOW TYPE	SURFACE TYPE	TSS log ¹⁰ values		TP log ¹⁰ values		TN log ¹⁰ values	
		Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Baseflow parameters	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Roads	0.780	0.390	-0.600	0.500	0.320	0.300
	Ground	0.780	0.390	-0.600	0.500	0.320	0.300
Stormflow parameters	Roof	1.300	0.380	-0.890	0.340	0.370	0.340
	Roads	2.430	0.38	-0.300	0.340	0.370	0.340
	Ground	2.160	0.380	-0.390	0.340	0.370	0.340

6.2.4 Catchment Areas

Post-development areas have been separated into split catchments with the source node information presented below.

Table 9 - Music Model Source Node

Catchment	Total Area (ha)	Roof (ha) 100% Imp	Road (ha) 80% Imp	Ground (ha)	Open Space (ha)
A1	0.4928	0.4030	0.0000	0.0898 (80% imp.)	0.0000
A2a	0.9338	0.4421	0.1022	0.2045 (80% imp.)	0.1850 (50% imp.)
A2b	0.0819	0.0000	0.0400	0.0000	0.0419 (50% imp.)
A4	0.1514	0.0894	0.0000	0.0000	0.0620 (40% imp.)
A5	0.0686	0.0000	0.0000	0.0000	0.0686 (10% imp.)
A7	0.0948	0.0000	0.0477	0.0000	0.0471 (50% imp.)
A11	0.0285	0.0000	0.0285	0.0000	0.000
A12	0.1871	0.0000	0.0740	0.1131 (50% imp)	0.000
A13	0.1880	0.0000	0.1101	0.0779 (50% imp.)	0.000
B	0.5811	0.1500	0.1500	0.2811 (70% imp.)	0.000
C	0.4785	0.2000	0.0300	0.0000	0.2485 (30% imp.)

6.2.5 Treatment Train

A concept treatment train consisting of proprietary treatment devices from Ocean Protect (previously known as Stormwater 360) is proposed for the site.

The figure below summarises the proposed treatment train for the site.

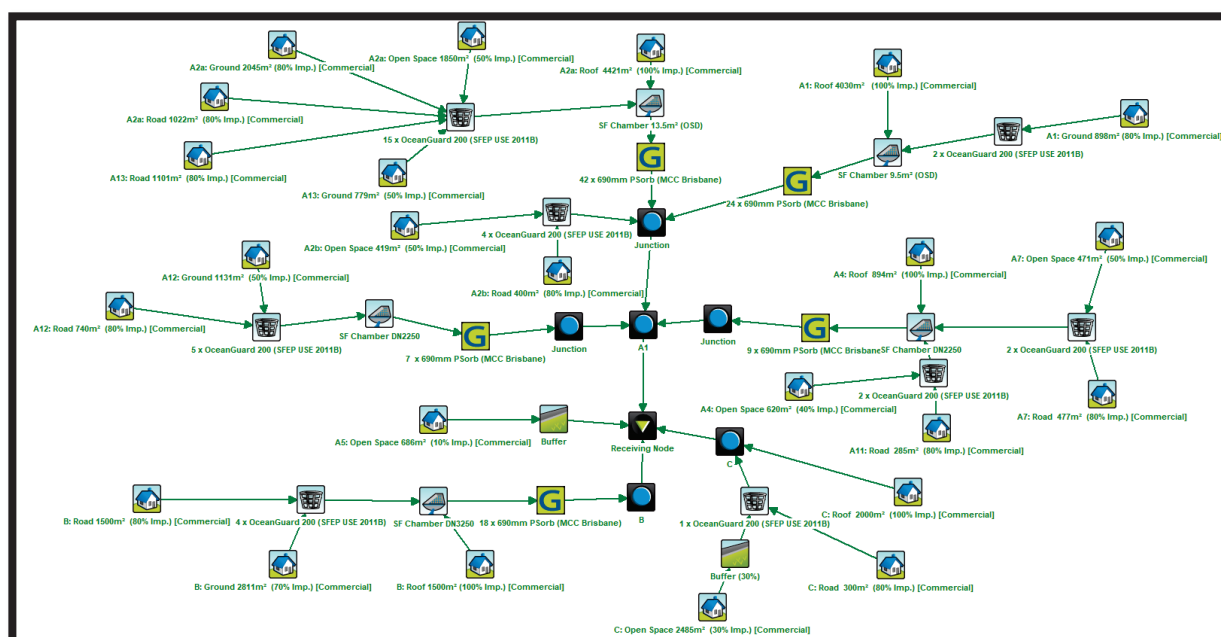


Figure 3 - MUSIC Model Layout

6.2.5.1 Treatment devices

The following proprietary treatment devices from Ocean Protect are proposed for the site.

- Minimum of 35 Ocean Protect OceanGuards. All surface runoff is proposed to be routed through OceanGuards.
 - Minimum 2 OceanGuards within catchment A1
 - Minimum 15 OceanGuards within catchments A2a and A13
 - Minimum 4 OceanGuards within catchment A2b
 - Minimum 2 OceanGuards within catchments A4 and A11
 - Minimum 2 OceanGuards within catchment A7
 - Minimum 5 OceanGuards within catchment A12
 - Minimum 4 OceanGuards within catchment B
 - Minimum 1 OceanGuard within catchment C
- 100 Stormwater 360 690mm PSorb Filter cartridges.
 - 24 x 690mm PSorb cartridges treating catchment A1
 - 42 x 690mm PSorb cartridges treating catchments A2a and A13
 - 9 x 690mm PSorb cartridges treating catchments A4, A7 and A11
 - 7 x 690mm PSorb cartridges treating catchment A12
 - 18 x 690mm PSorb cartridges treating catchment B

Use of alternative equivalent proprietary devices may be investigated during detailed design and construction phase.

6.2.5.2 Treatment train effectiveness

The following table summarises the effectiveness of the proposed treatment train modelled in MUSIC.

Table 10 - MUSIC Modelling Results

Source Pollutants	Inflows (kg/yr)	Outflows (kg/yr)	Achieved Treatment Train Reduction	Targeted Reduction
Total Suspended Solids (kg/yr)	5110	582	88.6	80%
Total Phosphorus (kg/yr)	12.7	4.11	67.7	60%
Total Nitrogen (kg/yr)	98.9	54.5	44.9	45%
Gross Pollutants (kg/yr)	701	54.1	92.3	90%

Results show that the proposed treatment train generally achieves the required pollutant target reduction at three discharge locations (A, B and D).

The proposed development plans result in minimal changes to Catchment C impervious areas. Also, due to existing site constraints, additional treatment devices could not be provided for this catchment. However, the other catchments have been provided with additional treatment to compensate for the expected bypass at Catchment C and, therefore, achieve the objectives for the entire Development Area.

7 Flooding

A Floodwise Property Report has been obtained for the site. Refer to **Appendix D**.

The report advises that a small section of the site may be affected by Creek/Waterway flooding.

The following table summarises the relevant flood levels summarised in the Floodwise Property Report and the required minimum design levels for the Development Area as per Council's Flood Overlay Code

Table 11 - Relevant flood levels

Development Type	DFL (mAHD)	Minimum Design Level (Criteria)	Minimum Design Level (mAHD)
Minimum habitable floor level	5.2	1%AEP Flood Level + 0.5m	5.7m
Minimum non-habitable floor level	5.2	1%AEP Flood Level + 0.3m	5.5m

Review of the proposed plans show that the proposed indicative design levels for the development are higher than the required minimum design levels.

8 Conclusion

A stormwater management plan has been prepared to manage stormwater quantity and quality for the Development Area.

A detention system has been proposed within catchment A to detain the additional flows from the development. No detention system is proposed within catchments B and C. Un-detained flows from Catchment D discharge towards south and into proposed Precinct 1 and 2 and will be managed as per a separate stormwater management plan [16-002928-01 (E)] prepared by Calibre Group.

A treatment train has been developed to achieve the required operation phase water quality objectives for the Development Area. The treatment train consists of Ocean Protect's proprietary OceanGuards and Ocean Protect Filter devices.

The Development Area is may be affected by Creek/Waterway flooding. However, the development plans show that the proposed indicative design levels for the development are higher than the required minimum design levels specified in Council's flood overlay code.

Appendix A - Site Survey



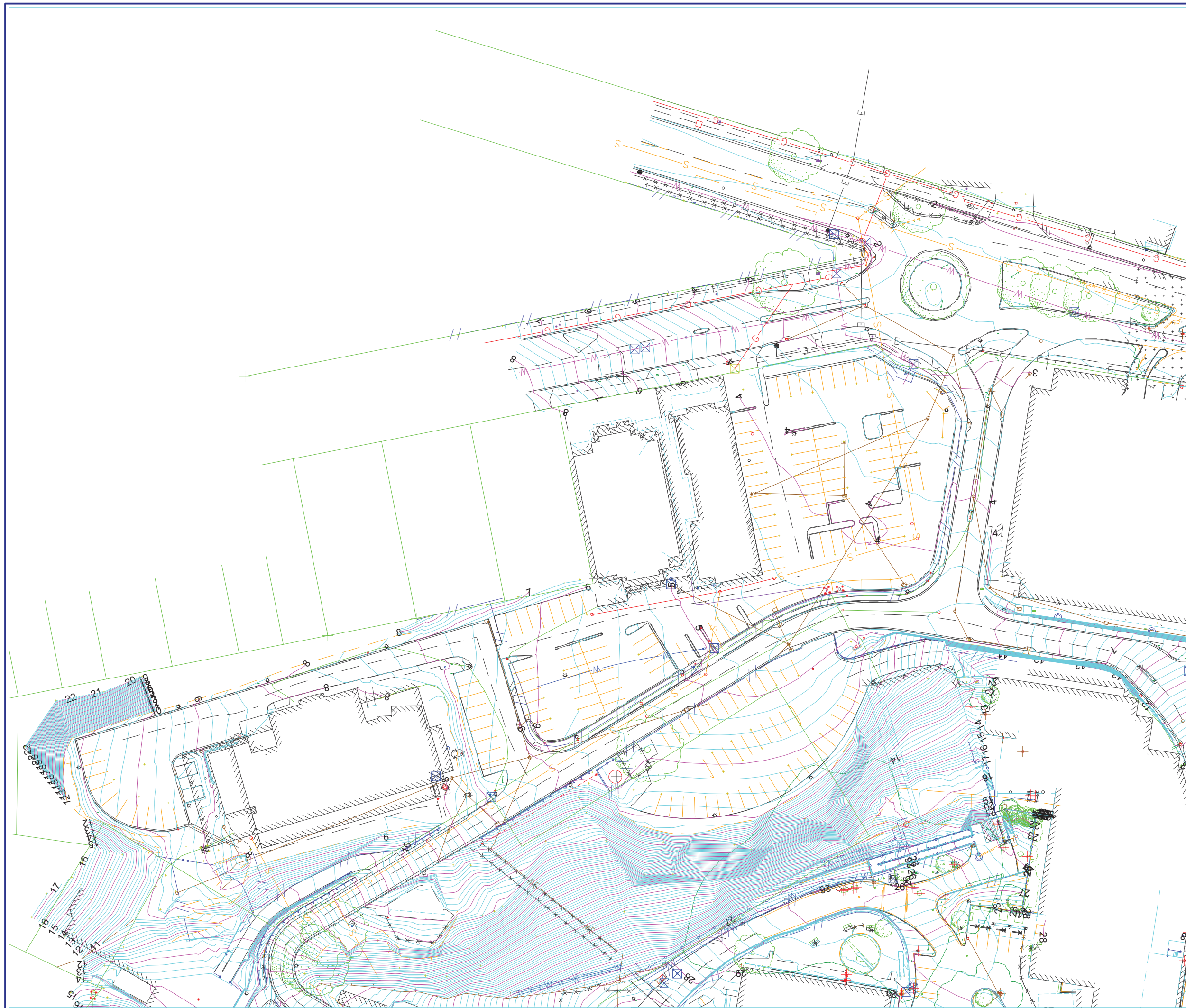
Notes:

Level datum: AHD
Horiz datum: BCSG
Coord Origin: BCSG
Meridian: BCSG

Title:

**Plan Of
Herston Quarter
Verification Plots
Overall**

Client:	Australian Unity
Locality:	Herston
Local Gov:	Brisbane City Council
Surveyed By:	Approved:
Date Created: 10/10/18	Scale: 1:2500
File Ref:	161102
Plan No:	161102_003_DET

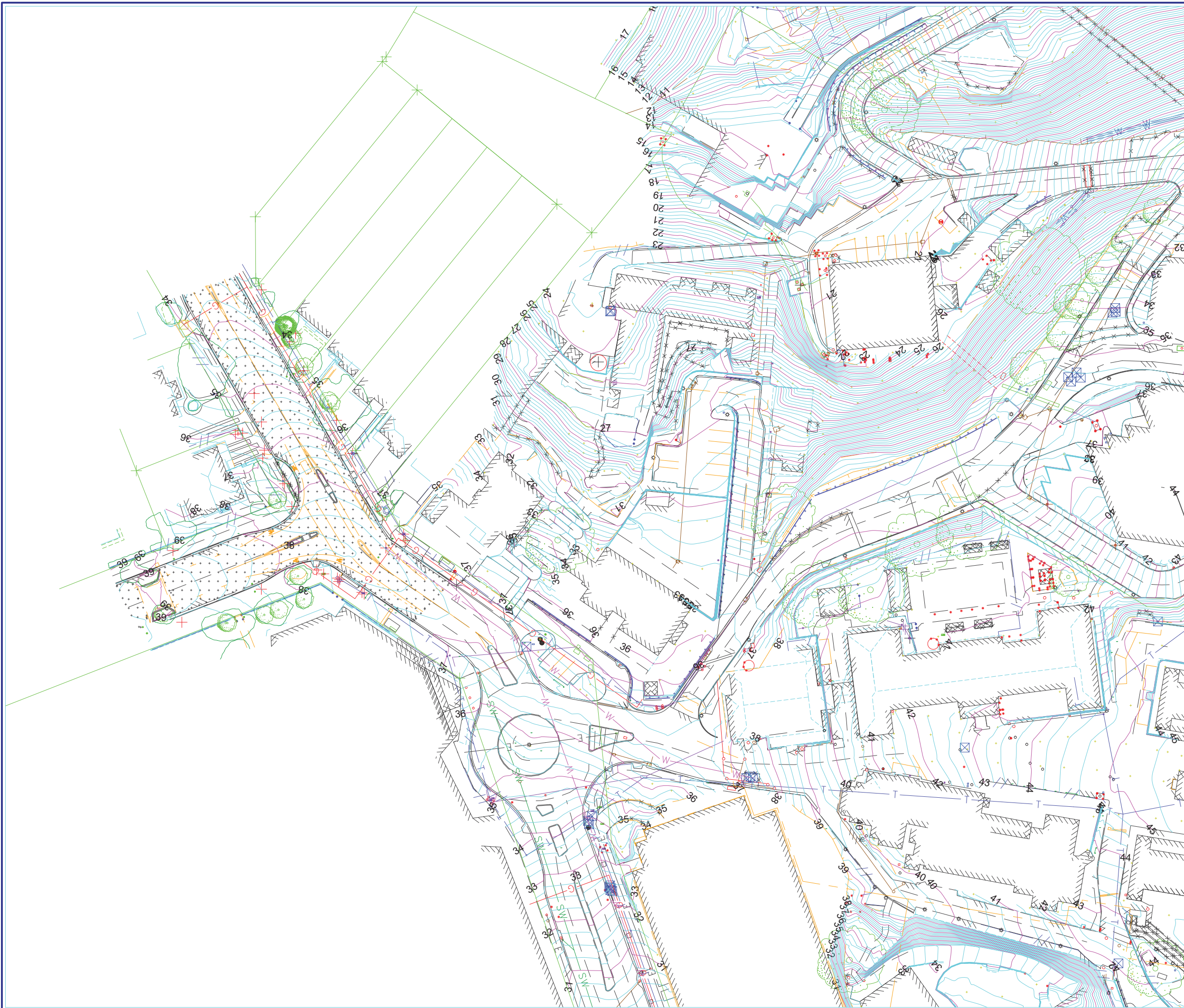


Notes:

Level datum: AHD
Horiz datum: BCSG
Coord Origin: BCSG
Meridian: BCSG

Title:
**Plan Of
Herston Quarter
Verification plots**

Client:	Australian Unity
Locality:	Herston
Local Gov:	Brisbane City Council
Surveyed By:	Approved:
Date Created: 18/12/18	Scale: 1:800
File Ref:	161102
Plan No:	161102_003_DET



Notes:

Level datum: AHD
Horiz datum: BCSG
Coord Origin: BCSG
Meridian: BCSG

Title:
**Plan Of
Herston Quarter
Verification plots**

Client:	Australian Unity
Locality:	Herston
Local Gov:	Brisbane City Council
Surveyed By:	Approved:
Date Created: 18/12/18	Scale: 1:800
File Ref:	161102
Plan No:	161102_003_DET



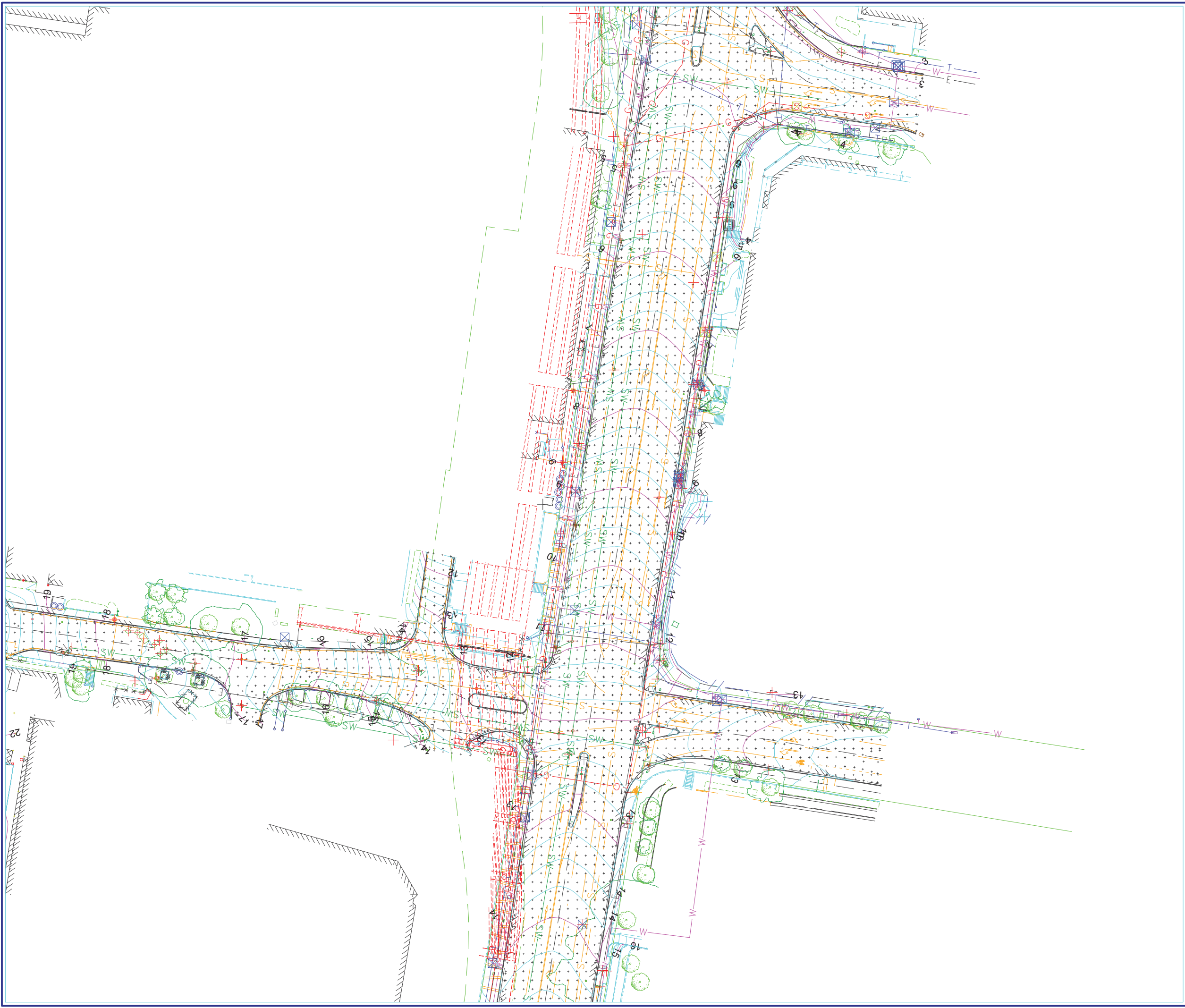
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Level datum: AHD
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 Meridian: BCSG

Title:

**Plan Of
 Herston Quarter
 Verification plots**

Client:	Australian Unity
Locality:	Herston
Local Gov:	Brisbane City Council
Surveyed By:	Approved:
Date Created: 18/12/18	Scale: 1:800
File Ref:	161102
Plan No:	161102_003_DET



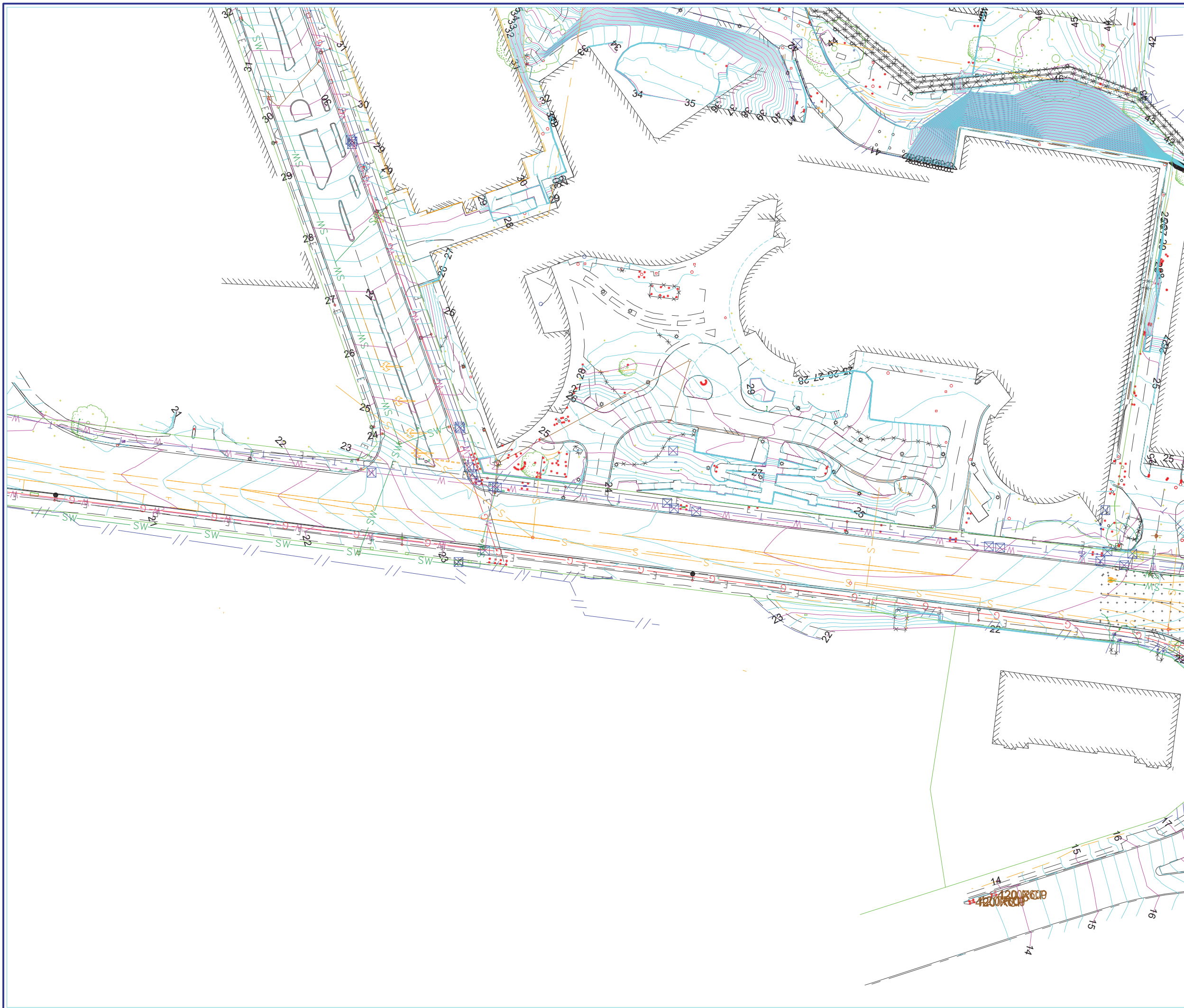
Notes:

Level datum: AHD
 Horiz datum: BCSG
 Coord Origin: BCSG
 Meridian: BCSG

Title:

**Plan Of
 Herston Quarter
 Verification plots**

Client:	Australian Unity
Locality:	Herston
Local Gov:	Brisbane City Council
Surveyed By:	Approved:
Date Created: 18/12/18	Scale: 1:800
File Ref:	161102
Plan No:	161102_003_DET



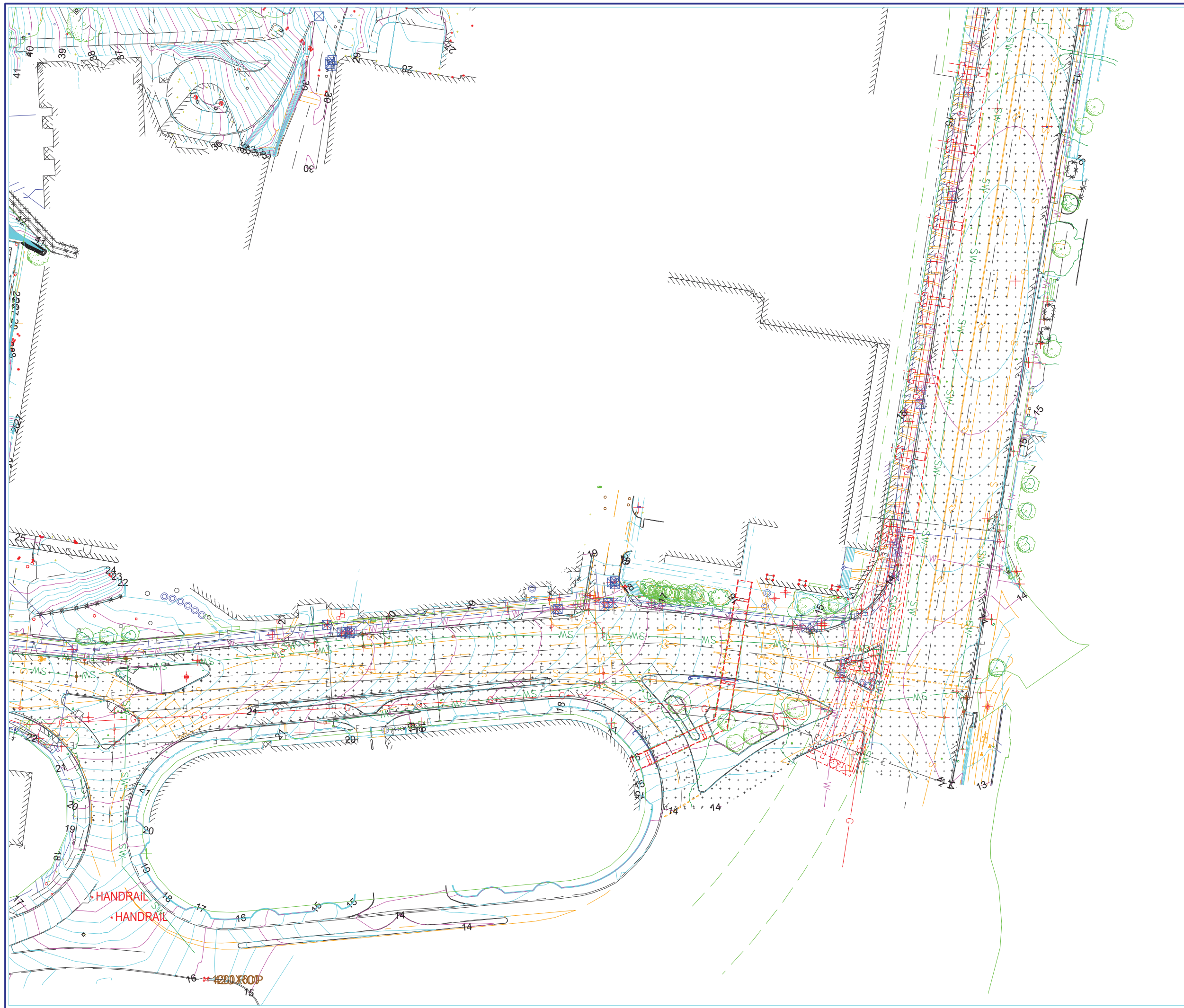
Notes:

Level datum: AHD
 Horiz datum: BCSG
 Coord Origin: BCSG
 Meridian: BCSG

Title:

**Plan Of
 Herston Quarter
 Verification plots**

Client:	Australian Unity
Locality:	Herston
Local Gov:	Brisbane City Council
Surveyed By:	Approved:
Date Created: 18/12/18	Scale: 1:800
File Ref:	161102
Plan No:	161102_003_DET



Notes:

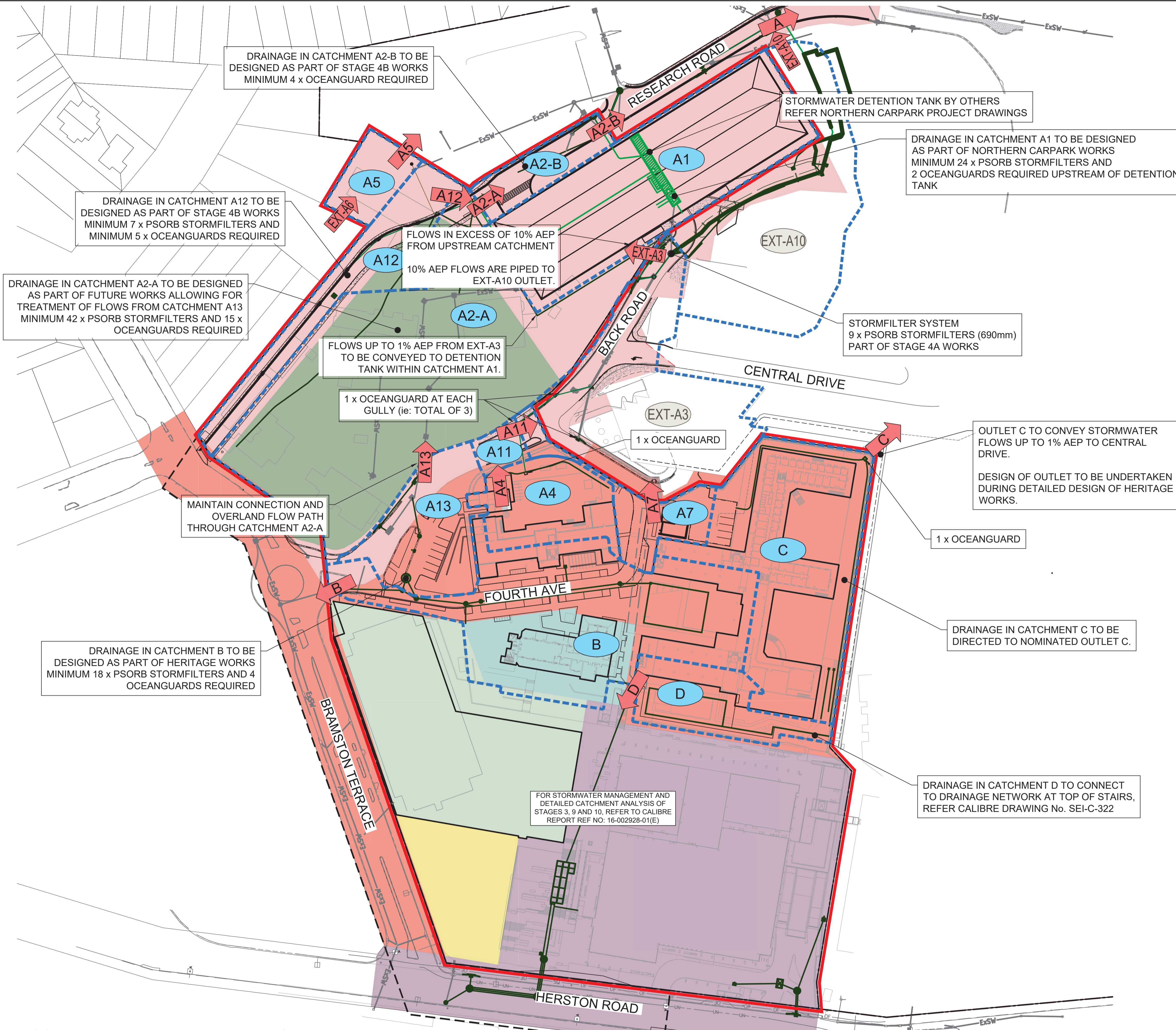
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 Horiz datum: BCSG
 Coord Origin: BCSG
 Meridian: BCSG

Title:

**Plan Of
 Herston Quarter
 Verification plots**

Client:	Australian Unity
Locality:	Herston
Local Gov:	Brisbane City Council
Surveyed By:	Approved:
Date Created: 18/12/18	Scale: 1:800
File Ref:	161102
Plan No:	161102_003_DET

Appendix B - Concept Development and Overall Stormwater Management Plan



LEGEND

- SITE BOUNDARY
- PROPOSED CATCHMENT BOUNDARY
- EXISTING STORMWATER DRAINAGE
- PROPOSED STORMWATER DRAINAGE

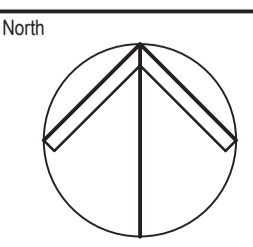
DEVELOPMENT STAGES

- STAGE 3 - SRACC CONSTRUCTION
- STAGE 4 - NORTHERN CARPARK
- STAGE 5&6 - HERITAGE
- STAGE 7 - HERITAGE LADY NORMAN
- STAGE 8 - WELLBEING
- STAGE 9 - PRIVATE HOSPITAL
- STAGE 10 - RESIDENTIAL

NOTE:
STORMWATER DESIGN INFORMATION SHOWN IS INDICATIVE ONLY AND SUBJECT TO FULL DETAILED DESIGN WITHIN THE RELEVANT DEVELOPMENT STAGE.

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Issue	Description	Date	Drawn	Approved
P6	FOR INFORMATION	18/10/19	ND	RK
P5	FOR INFORMATION	27/08/19	KH	MB
P4	FOR INFORMATION	29/01/19	KH	MB
P3	FOR INFORMATION	25/01/19	KH	MB



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Project
HERSTON QUARTER
300 HERSTON ROAD
HERSTON QLD 4006

ENGINEERS | MANAGERS | INFRASTRUCTURE PLANNERS | DEVELOPMENT CONSULTANTS

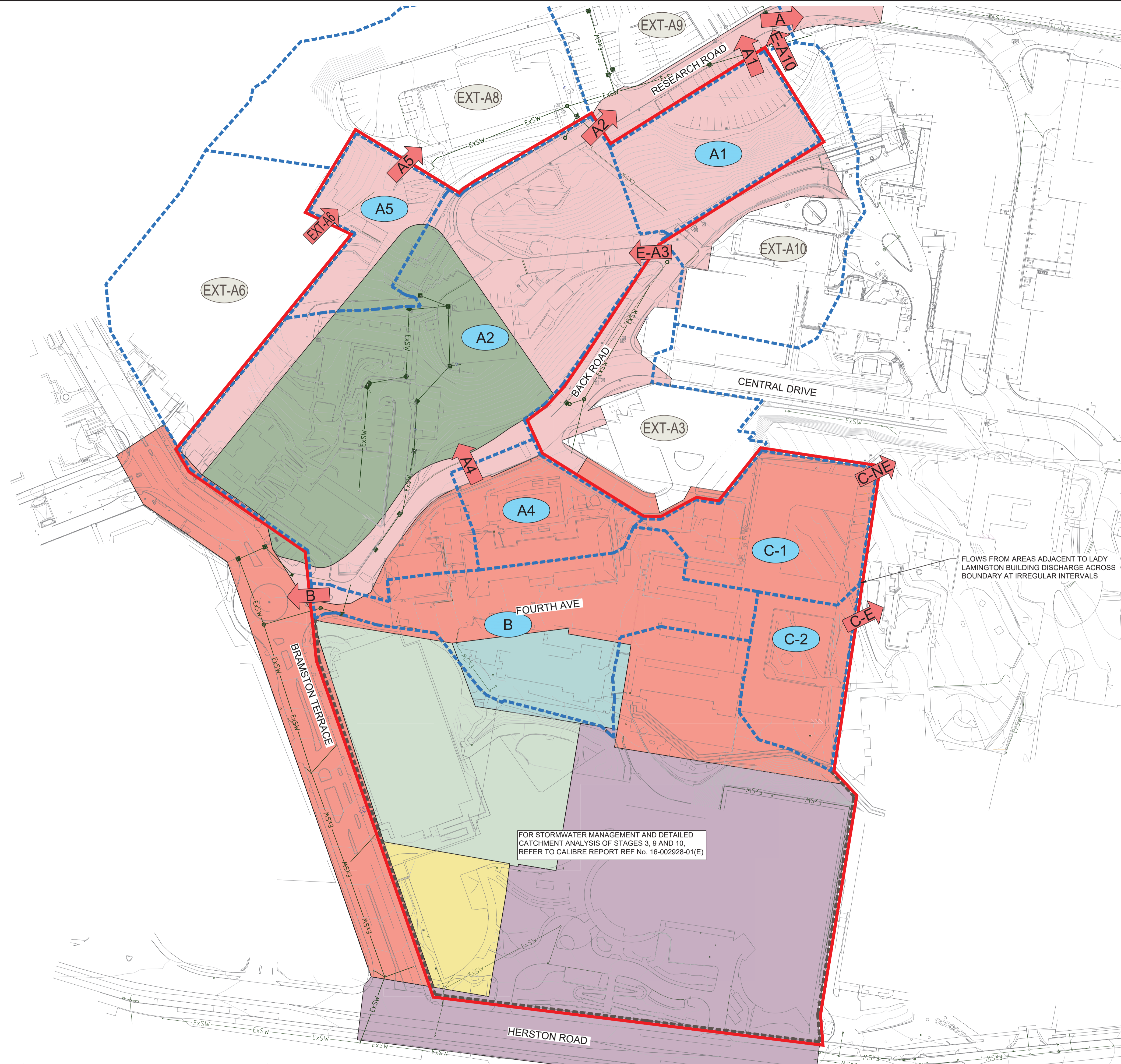
Drawn	Date	Scale	A1	G.A. Check	Date
KH	18/01/19	1:1000		MB	
Designed	Project No.	Dwg. No.			
ND	BR180115				

Issue: SK.23, P6



NOT FOR CONSTRUCTION

Appendix C - Catchment Plans



CATCHMENT TABLE		
CATCHMENT NAME	CATCHMENT AREA (ha)	% IMPERVIOUS
A1	0.2748	30
A2	1.4496	60
A4	0.2041	60
A5	0.2035	40
B	0.5302	95
C-1	0.3132	75
C-2	0.2045	70
EXT-A3	0.4242	90
EXT-A6	0.5477	30
EXT-A8	0.6660	60
EXT-A9	0.4098	70
EXT-A10	0.4321	80

LEGEND

- SITE BOUNDARY
- - - EXISTING CATCHMENT BOUNDARY
- ExSW — EXISTING STORMWATER DRAINAGE

DEVELOPMENT STAGES

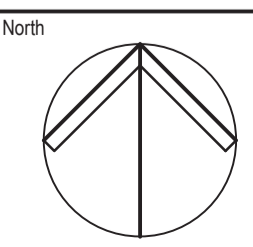
- STAGE 3 - SRACC CONSTRUCTION
- STAGE 4 - NORTHERN CARPARK
- STAGE 5&6 - HERITAGE
- STAGE 7 - HERITAGE LADY NORMAN
- STAGE 8 - WELLBEING
- STAGE 9 - PRIVATE HOSPITAL
- STAGE 10 - RESIDENTIAL

FOR STORMWATER MANAGEMENT AND DETAILED CATCHMENT ANALYSIS OF STAGES 3, 9 AND 10, REFER TO CALIBRE REPORT REF No. 16-002928-01(E)

FLows FROM AREAS ADJACENT TO LADY LAMINGTON BUILDING DISCHARGE ACROSS BOUNDARY AT IRREGULAR INTERVALS

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Issue	Description	Date	Drawn	Approved
P7	FOR INFORMATION	18/10/19	ND	RK
P6	FOR INFORMATION	11/09/19	ND	-
P5	FOR INFORMATION	27/08/19	KH	MB
P4	FOR INFORMATION	29/01/19	KH	MB



Client
AUSTRALIAN UNITY
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BRISBANE QLD 4000
PHONE : 07 3360 3405

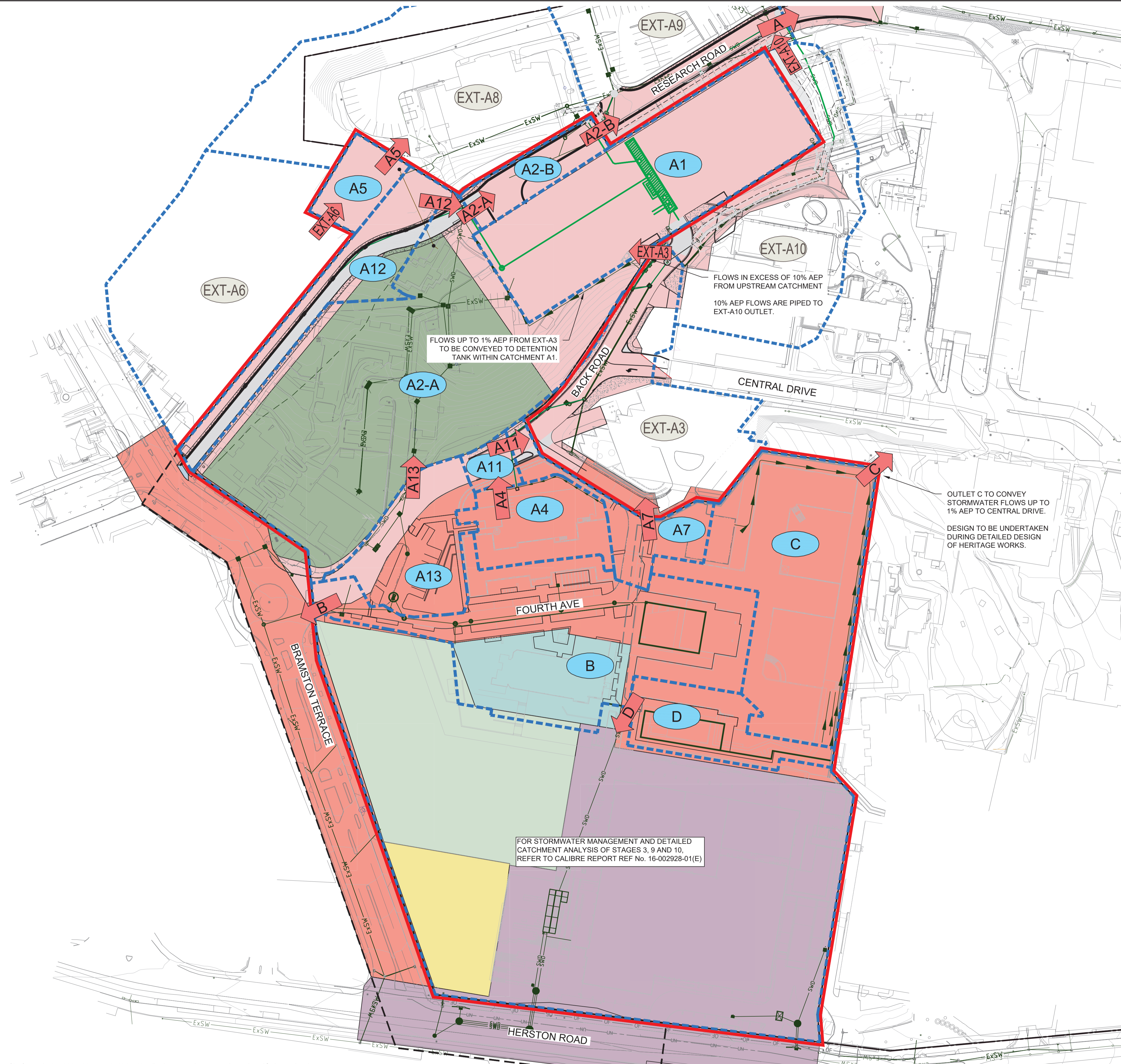


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Project
HERSTON QUARTER
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HERSTON QLD 4006

Drawing Title HERSTON QUARTER EXISTING CATCHMENT PLAN					
Drawn	Date	Scale	A1	G.A. Check	Date
KH	10/01/19	1:750		MB	JAN 2019
Designed	Project No.	Dwg. No.			Issue
	BR180115	SK.19			P7



CATCHMENT TABLE		
CATCHMENT NAME	CATCHMENT AREA (Ha)	% IMPERVIOUS
A1	0.4928	95
A2-A	0.9338	90
A2-B	0.0819	90
A4	0.1424	80
A5	0.0686	90
A7	0.1068	90
A11	0.0310	90
A12	0.1871	90
A13	0.1880	85
B	0.5811	70
C	0.4785	80
D	0.1421	70
EXT-A3	0.4242	90
EXT-A6	0.5477	30
EXT-A8	0.6660	60
EXT-A9	0.4098	70
EXT-A10	0.4321	80

NOTE:
CATCHMENTS LABELLED WITH A PREFIX OF 'EXT-' HAVE NOT BEEN INCLUDED WITHIN THE STORMWATER QUALITY ASSESSMENT. HOWEVER, THESE CATCHMENTS HAVE BEEN CONSIDERED IN THE STORMWATER QUANTITY ASSESSMENT WHERE THEIR FLOWS ARE BELIEVED IMPACT THE INTERNAL CATCHMENTS.

LEGEND

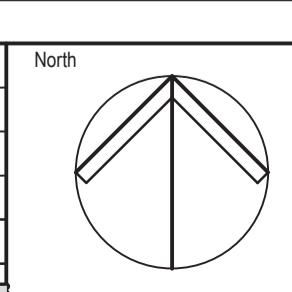
- SITE BOUNDARY
- PROPOSED CATCHMENT BOUNDARY
- ExSW - EXISTING STORMWATER DRAINAGE
- Swd - PROPOSED STORMWATER DRAINAGE

DEVELOPMENT STAGES

- STAGE 3 - SRACC CONSTRUCTION
- STAGE 4 - NORTHERN CARPARK
- STAGE 5&6 - HERITAGE
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Issue	Description	Date	Drawn	Approved
P7	FOR INFORMATION	18/10/19	ND	RK
P6	FOR INFORMATION	11/09/19	ND	-
P5	FOR INFORMATION	27/08/19	KH	MB
P4	FOR INFORMATION	29/01/19	KH	MB



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Project
HERSTON QUARTER
300 HERSTON ROAD
HERSTON QLD 4006

Drawing Title
**HERSTON QUARTER
DEVELOPED CATCHMENT PLAN**

Drawn	Date	Scale	A1	G.A. Check	Date
KH	10/01/19	1:750		MB	JAN 2019
Designed	Project No.	Dwg. No.			Issue
	BR180115			SK.20	P7

Appendix D - Floodwise Property Report



Brisbane City Council FloodWise Property Report

Report Reference

1546994203753

09/01/2019 10:36:43

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THIS REPORT IS FOR BUILDING AND DEVELOPMENT PURPOSES ONLY

The FloodWise Property Report provides property or lot-based flood information for building and development requirements. This report provides information on estimated flood levels, habitable floor level requirements and more technical information on the four sources of flooding: river, creek / waterway, storm tide and overland flow. Refer to the Useful Definitions section for a glossary of terms.

To find out more about how the contents of this report may affect building or development on this property, please visit www.brisbane.qld.gov.au/planning-building. For more general information about understanding your flood risk and how to prepare your property, family or business for potential flooding visit www.brisbane.qld.gov.au/beprepared

THIS IS A REPORT FOR:

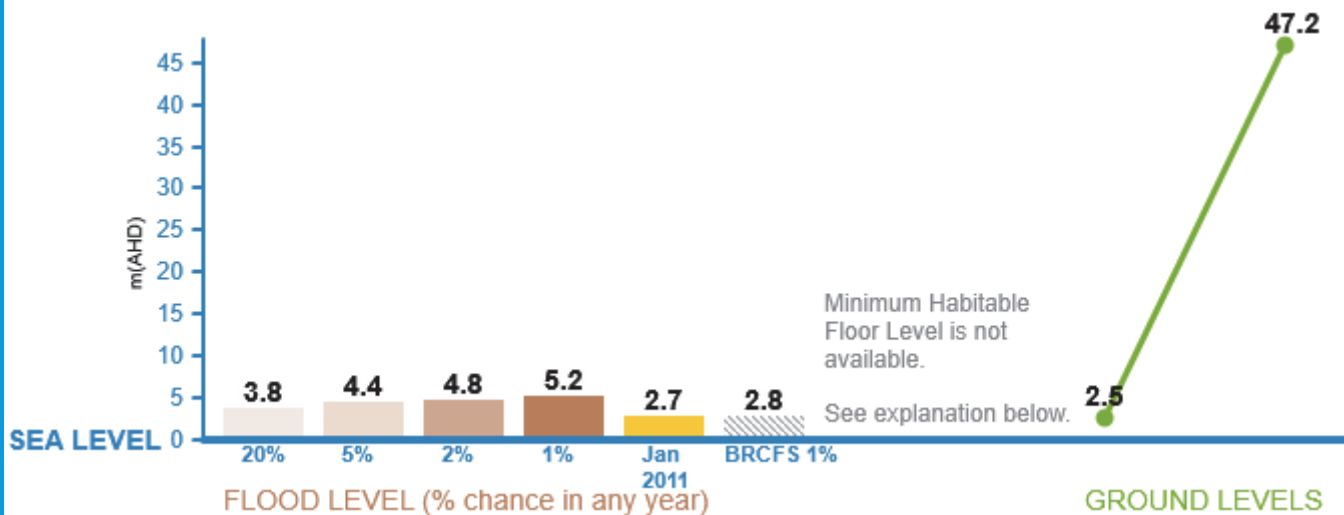
Rateable Address: 40 BOWEN BRIDGE RD, HERSTON QLD 4006

Lot Details: L.545 SP.289113, L.546 SP.289113

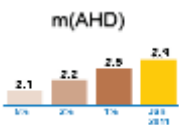
Multiple Lot warning

The Property being reported on contains multiple lots. This report is a summary for the entire Property. To obtain a Lot specific report, please use the search tool to search for the specific Lot you wish to report on.

FLOOD LEVEL INFORMATION



EXPLANATION



m(AHD) - Metres Australia Height Datum. The level of 0.0m AHD is approximately mean sea level.

Flood Levels - The Flood level bar chart above shows the possible flooding level and percentage chance of that level being reached or exceeded in any year. If an orange bar shows, it is the calculated January 2011 flood level at this address or lot. If a hatched bar shows, it is the 1% AEP flood level from the 2017 Brisbane River Catchment Flood Study (BRCFS). Refer to 'Useful Definitions' for further information.

Minimum Habitable Floor Level - Applies to residential development only. Please refer to Council's planning scheme to learn how this may affect you. If a property is in an overland flow path, or a large allotment, a minimum habitable floor level cannot be provided. Refer flood and planning development flags below.

Ground Levels - The green line above shows this property's approximate lowest and highest ground levels based on latest available information (2014 airborne laser survey) to Council. If you are building, please confirm with a surveyor.

For further information and definitions please refer to the Useful Definitions page

FLOOD AND PLANNING DEVELOPMENT FLAGS

**DEVELOPMENT
FLAG(S)**

This property may also be affected by one or more flood or property development overlays or flags. These include: LARGE ALLOTMENT

Please review the technical summary over page and refer to Council's planning scheme for further information.



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TECHNICAL SUMMARY

This section of the FloodWise Property Report contains more detailed flood information for this property so surveyors, builders, certifiers, architects and engineers can plan and build in accordance with Council's planning scheme. For more information about building and development in Brisbane please visit www.brisbane.qld.gov.au/planning-building or talk to a Development Assessment Planning Information Officer via Council's Contact Centre on (07) 3403 8888.

THIS IS A REPORT FOR:

Rateable Address: 40 BOWEN BRIDGE RD, HERSTON QLD 4006

Lot Details: L.545 SP.289113, L.546 SP.289113

Multiple Lot warning

The Property being reported on contains multiple lots. This report is a summary for the entire Property. To obtain a Lot specific report, please use the search tool to search for the specific Lot you wish to report on.

PROPERTY INFORMATION (Summary)

The following table provides a summary of flood information for this property. More detailed flood level information is provided in the following sections of this report.

PROPERTY SUMMARY	LEVEL (mAHD)
Minimum Ground Level	2.5
Maximum Ground Level	47.2
Min Habitable Floor Level	Contact Council
Defined Flood Level (DFL)	5.2
Defined Flood Level Source	CREEK/WATERWAY
Source of Highest Flooding	CREEK/WATERWAY
Flooding may also occur from	STORMTIDE,RIVER,CREEK/WATERWAY

ESTIMATED PEAK FLOODING LEVELS

The table below displays the peak estimated flood levels by probability for this property. Estimated flood level data should be used in conjunction with applicable planning scheme requirements - Refer to Flood Planning Development Information.

Note that the overland flow flooding level maybe higher than the levels below from other sources.

DESCRIPTION	LEVEL (mAHD)	SOURCE
20% AEP	3.8	CREEK/WATERWAY
5% AEP	4.4	CREEK/WATERWAY
2% AEP	4.8	CREEK/WATERWAY
1% AEP	5.2	CREEK/WATERWAY
January 2011	2.7	RIVER
DFL	5.2	CREEK/WATERWAY
2017 BRCFS 1% AEP**	2.8	RIVER

** This is the 1% AEP flood level from the 2017 Brisbane River Catchment Flood Study (BRCFS). The new flood study data is yet to be adopted for application in planning schemes and is for information purposes only.

FLOOD PLANNING DEVELOPMENT INFORMATION

This section of the FloodWise Property Report contains information about Council's planning scheme overlays. Overlays identify areas within the planning scheme that reflect distinct themes that may include constrained land and/or areas sensitive to the effects of development.

FLOOD OVERLAY CODE

The Flood overlay code of Council's planning scheme uses the following information to provide guidelines when developing properties. The table below summarises the Flood Planning Areas (FPAs) that apply to this property. Development guidelines for the FPAs are explained in Council's planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

FLOOD PLANNING AREAS (FPA)		
RIVER	CREEK/WATERWAY	OVERLAND FLOW
	FPA2	Not Applicable
	FPA3	
FPA4	FPA4	
FPA5	FPA5	

COASTAL HAZARD OVERLAY CODE

The coastal hazard overlay code of Council's planning scheme uses the following information to provide guidelines when conducting new development. The table below summarises the coastal hazard categories that apply to this property. Development guidelines for the following coastal hazard overlay sub-categories are explained in the planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

COASTAL HAZARD OVERLAY SUB-CATEGORIES

Medium Storm Tide Inundation Area

NOTE: Where land is identified within one or more flood planning area on the Flood Overlay, or is identified within a Storm Tide Inundation area on the Coastal Hazard Overlay, the assessment criteria that provide the highest level of protection from any source of flooding applies.

PROPERTY DEVELOPMENT FLAGS

Large Allotment - This property is either a Large Allotment of over 1000 square metres or is located within a Large Allotment. Flood levels may vary significantly across allotments of this size. Further investigations may be warranted in determining the variation in flood levels and the minimum habitable floor level across the site. For more information or advice, it is recommended you engage a Registered Professional Engineer of Queensland.



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Useful Definitions

Australian Height Datum (AHD) - The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Annual Exceedance Probability (AEP) - The probability of a flood event of a given size occurring in any one year, usually expressed as a percentage annual chance.

Defined Flood Level (DFL) - The DFL for Brisbane River flooding is a level of 3.7m AHD at the Brisbane City Gauge based on a flow of 6,800 m³/s.

Maximum and Minimum Ground Level - Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum Habitable Floor Level - The minimum level in metres AHD at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.

Council's Planning Scheme - The City Plan (planning scheme) has been prepared in accordance with the Sustainable Planning Act as a framework for managing development in a way that advances the purpose of the Act. In seeking to achieve this purpose, the planning scheme sets out the Council's intention for future development in the planning scheme area, over the next 20 years.

Residential Flood Level (RFL) - Residential flood level (RFL) for Brisbane River flooding equates to the flood level applicable to the extent of January 2011 floods as depicted by mapping on the Queensland Reconstruction Authority website or the Council's defined flood level (DFL) for the Brisbane River, whichever is higher.

Rateable Address - A Lot or Property may have more than one street address. The address shown on this report is the address used by Council for the Lot or property selected.

Property - A property will contain 1 or more lots. The *Multiple Lot Warning* is shown if you have selected a property that contains multiple lots.

2017 Brisbane River Catchment Flood Study (BRCFS) - The BRCFS is a project led by the Queensland Government. The flood study was released in 2017. The 1% AEP flood levels from the flood study is yet to be adopted for application in planning schemes and is for information only. Other % AEPs will be updated with new information from the flood study as part of any relevant changes to City Plan 2014 as soon as is practicable.

Brisbane City Council's Online Flood Tools

Council provides a number of online flood tools:

- to guide planning and development
- to help residents and businesses understand their flood risk and prepare for flooding.

Planning and Development Online Flood Tools

Council's online flood tools for planning and development purposes include:

- FloodWise Property Report
- Flood Overlay Code

For more information on Council's planning scheme and online flood tools for planning and development:

- phone 07 3403 8888 to talk to a Development Assessment Customer Liaison Officer
- visit www.brisbane.qld.gov.au/planning-building
- visit a Regional Business Centre.

Helping residents and businesses be prepared for flooding

Council has a range of free tools and information to help residents and businesses understand potential flood risks and how to be prepared. This includes:

- Flood Awareness Maps
- Flooding in Brisbane - A Guide for Residents
- Flooding in Brisbane - A Guide for Business
- Early Warning Alert Service. Visit www.brisbane.qld.gov.au/earlywarning to register for email, home phone or SMS severe weather alert updates.

Note: The Flood Awareness Maps show four levels of flood likelihood from high likelihood (flooding is very likely to occur) through to very low likelihood (very rare and extreme flood events).

For more information on Council's online flood tools for residents and business:

- Visit www.brisbane.qld.gov.au/beprepared
- Phone (07) 3403 8888.



Brisbane City Council FloodWise Property Report

Report Reference

1546994203753

09/01/2019 10:36:43

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Disclaimer

1. Defined Flood Levels and Residential Flood Levels, and the Minimum Habitable Floor Levels are determined from the best available information to Council at the date of issue. These flood levels, for a particular property, may change if more detailed information becomes available or changes are made in the method of calculating flood levels.
2. Council makes no warranty or representation regarding the accuracy or completeness of a FloodWise Property report. Council disclaims any responsibility or liability in relation to the use or reliance by any person on a FloodWise Property Report.



Planning to build or renovate?

For information, guidelines, tools and resources to help you track, plan or apply for your development visit www.brisbane.qld.gov.au/planning-building

You can also find the Brisbane City Plan 2014 and Neighbourhood Plans as well as other information and training videos to help with your building and development plans.