Drainage Catchment Study

City of Cockburn

CW988000

Prepared for
City of Cockburn

5 July 2017

Cardno
Shaping the Future

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Executive Summary

The Drainage Catchment Study has been prepared by Cardno on behalf of the City of Cockburn to:

> Undertake a review of the existing 2009 Plan and the delivery of its recommendations;

> Review any relevant structure plans in developing areas so that new sub-division developments provide appropriate stormwater management and required infrastructure;

> Review of the most recent customer requests related flooding issues received since 2009;

> Review present condition of the Council's Drainage Assets to identify weaknesses in the City's drainage system and action plan for implementation of the Drainage Management Strategy (DMS);

> Identify the reasons why existing drainage assets fail/deteriorate and therefore do not meet current performance standards and community expectations; and

> Identify and establish the priority order in which any modifications and/or new works are to be installed, so that a clear direction is provided to the Council.

Cardno systematically modelled over 350 sumps results show that only 3% of the sumps are deemed to pose a risk to building infrastructure, 4% is deemed to impact on private lots and 10% will flood onto the road or POS.

Sumps deemed to impact on building infrastructure form part of the recommended capital works program detailed in Section 5 which sets an program of works over a five year period.

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1 Introduction

1.1 Background

A Drainage Catchment Study (DCS) was completed by Shawmac in 2009 on behalf of the City of Cockburn. The DCS identified system deficiencies and provided a prioritized list of upgrade projects that could be undertaken to improve the aesthetics, performance and efficiency of stormwater disposal.

Since that time, numerous projects identified in the 2009 DCS have been completed by the City. The City has also continued to experience considerable growth and land development, which necessitated a review and replacement of the existing 2009 Plan with a new Drainage Catchment Study.

1.2 Scope of Works

The City of Cockburn (CoC) engaged Cardno to complete a new Drainage Catchment Study by undertaking an assessment of the drainage catchments within their local government area.

The Scope of Works required Cardno to:

> Undertake a review of the existing 2009 Plan and the delivery of its recommendations;

> Review any relevant structure plans in developing areas so that new sub-division developments provide appropriate stormwater management and required infrastructure;

> Review of the most recent customer requests related flooding issues received since 2009;

> Review present condition of the Council's Drainage Assets to identify weaknesses in the City's drainage system and action plan for implementation of the Drainage Management Strategy (DMS);

> Identify the reasons why existing drainage assets fail/deteriorate and therefore do not meet current performance standards and community expectations; and

> Identify and establish the priority order in which any modifications and/or new works are to be installed, so that a clear direction is provided to the Council.

1.3 Previous Drainage Catchment Study

Shawmac DCS was required to undertake a review of drainage catchments within the City in order to:

> Identify system deficiencies and provide a prioritised list of upgrade projects that could be undertaken to improve the aesthetics, performance and efficiency of stormwater disposal;

> Identify opportunities to rationalise and combine drainage disposal structures, in particular to free excess land for other purposes;

> Identify opportunities to reduce and adjust the size of disposal structures for improve disposal efficiency;

> Identify surface flow paths in extreme rainfall conditions that are likely to provide a real potential for substantial property damage and financial loss due to the incapacity of the disposal structure; and

As a result of Shawmac's analysis, a program of drainage infrastructure upgrades was provided for the City to incorporate into their capital works program with 24 projects completed since 2009.

1.3.1 Changes to the DCS

To build on from Shawmacs report and meet the project objectives, Cardno:

> Updated the DCS to be in line with the recently released Australian Rainfall & Runoff (Geoscience Australia, 2016).

> Utilised the 1% AEP event, which was seen as the biggest flood risk to property, as the critical event;

> Reviewed all sumps and generated a stage-storage relationships (using Lidar data and 12D software) for each sump.

> Reduced the blanket 90% impervious assumption by undertaking catchment specific impervious characteristics.

> Utilised an infiltration rate of 5m/d and site specific infiltration data where available.

As a result of the changes the City of Cockburn received a refined hydraulic model with a refined basin model providing flows as well as top water levels, and extents of inundation. The results provide significant benefit to understanding total POS volumes, basin volumes, and 1% AEP event top water levels to provide the City understanding of land utilization.

2 Site Context

The City of Cockburn contains long established suburbs and is located approximately 15 km from the Perth city centre consisting of a total land area of 170 square kilometres shown in Figure 1. It is bounded in the north by the Cities of Fremantle, Melville, and Canning, in the east by the City of Armadale, in the south by the City of Kwinana and in the west by the Indian Ocean.

2.1 Land Use

A comparison between 2009 and 2016 cadastres highlights areas of infil and new Local Structure Plan areas which have been developed in the City since 2009 as shown in Figure 2.

The most significant change was found to occur in Treeby (prior to 2016, Treeby was formerly part of the locality of Banjup), Hammond Park, Aubin Grove, Spearwood, North Coogee, Beeliar, Munster and Bibra Lake. New housing developments have also been built in the southern part of Hammond Park.

2.2 Climate

The Cockburn area is characterised by a Mediterranean climate with warm dry summers and cool wet winters.

The long-term average annual rainfall from the Bureau of Meteorology's Jandakot Aero station (Site No. 009172) is 823mm/yr (1973-2016). This average has decreased between 2006 to present to an average annual rainfall of 716 mm/yr, reflecting a 13% reduction compared to the long term average (BoM, 2016).

As part of the analysis, Cardno utilised the 2016 IFD's from Bureau of Meteorology. 1% AEP design rainfall intensities are provided in Table 2-1.

Table 2-1 1% AEP Rainfall Intensities

	Duration								
	30 min	1 hour	2 hour	3 hour	6 hour	12 hour	24 hour	48 hour	72 hour
Intensity (mm/hr)	68.2	44.2	29.1	22.9	15.2	9.82	5.92	3.32	2.34

There has been significant drying over southwest Western Australia, particularly between May and July where rainfall has decrease by approximately 19% since 1970 (BoM and CSIRO, 2016). An increase in mean sea level pressure in southern Australia is associated with a shift in large-scale weather patterns, observing a reduction in the number of cold fronts impacting the southwest.

2.3 Topography

The topography varies throughout the city (Figure 3) with two bands of low lying regions extending north to south on the western extents and the central region of the city. These low lying areas form various lakes and wetlands.

The western band of low-lying land has an average elevation of 4 m AHD, with low points of 0 m AHD at the lakes and wetlands. The region is separated from the ocean by a coastal ridge with an average elevation of 27 m AHD.

The central band of low-lying land, forming the majority of the City's lakes and wetlands, has an average elevation of 15 m AHD and is separated from the western band by a ridge with an average elevation of 46 m AHD.

The eastern portion of the city is generally flat with a few scattered high points and no major low points. The average elevation of the region is 30 m AHD.

2.4 Surface Geology & Hydrogeology

Surface Geology mapping by Gozzard (1983a) is shown on Figure 4.

The western half of the City is primarily underlain by Tamala Limestone (Ls1, S7) overlain by Safety Bay Sand (S13) along the coast and pockets of silt (M6) in wetland areas. The Tamala Limestone is described as "pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin" Gozzard (1983a). Safety Bay Sand is described as "white, medium-grained, rounded quartz and shell debris, well sorted, of eolian origin" Gozzard (1983a).

The eastern half of the City is underlain by Bassendean Sands (S8) and thin veneers of Bassendean Sands overlying clays of the Guildford Formation (S10) with pockets of sandy silt (Ms5), peaty sand (Sp1) and peaty clay (Cps) in wetland areas. The Bassendean Sands are characterised as "very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin" (Gozzard, 1983a). The Guildford formation consists of pale-grey, blue, but predominantly brown silty and slightly sandy clay (Davidson, 1995).

2.4.1 Hydraulic Conductivity

The City's varying geology leads the way for differences in hydraulic conductivity across City. Table 2-2 presents ranging hydraulic conductivities based on lithology and grain size which can be experienced across the City adapted from those reported in Davidson (1995)

Table 2-2 Average Hydraulic Conductivity's

Lithology	Hydraulic Conductivity (m/d)
Sand	
very coarse	200
coarse	70
medium	15
fine	5
very fine	1
Silty	0.5
Clay	0 to 0.4
Limestone and Calcarenite	0 to >1000

2.4.2 Superficial Aquifer

The superficial aquifer in this region is referred to as the Jandakot Mound, and extends approximately 522 km^2. The aquifer has a maximum thickness of 40 m and includes three formations which are, in order of increasing depth: Bassendean Sand, Gnangara Sand and Ascot Formation. Aquifer transmissivities range between 200 to 1000 m^2/d (Davidson, 1995).

Recharge in this flow area is estimated at approximately 15% of rainfall (Davidson, 1995). Depending on the specific yield of the local soils, fluctuations in the regional water table may be 0.6 to 1 m seasonally (Davidson, 1995).

Perth Groundwater Atlas (DoW, 2004) indicates a minimum groundwater level in the City to range from 0 mAHD at the western end to 26 mAHD at the eastern end. Historical maximum groundwater levels (DoW, 1997) for the City range from 1 mAHD at the western boundary to 28 mAHD at the eastern boundary.

Maximum groundwater contour mapping and depth to groundwater is presented in Figure 5.

2.5 Wetlands

The Department of Parks and Wildlife (DPaW) Geomorphic Wetland Mapping of the Swan Coastal Plain indicates there are a number of wetlands located within the City shown in Figure 6.

A series of lakes exist in the central portion of the City classified as Conservation and Resource Enhancement Wetlands. The largest of these is Thomsons Lake, classified as a Conservation Lake, and Bibra Lake, classified as a Resource Enhancement Lake.

Between Cockburn Rd and Stock Rd/Rockingham Rd exists a series of wetlands mostly located within Munster and Henderson. Lake Coogee in Munster is classified as a Conservation Lake and the Beeliar Regional Park in Henderson is classified as a Conservation Sumpland.

Banjup and Atwell are mostly located on wetlands classified as Multiple Use and Resource Enhancement.

2.6 Surface Water Hydrology

The City of Cockburn has a number of connected drainage systems and regional drains throughout the eastern and central catchments where hydraulic conductivities and depth to groundwater are lowest as shown in Figure 7.

A series of interconnected basins and swales connecting to the chain of wetlands traversing the central part of the City provides stormwater drainage for Yangebup, Cockburn Central and South Lake where depth to groundwater and clayey soils inhibit infiltration of stormwater.

2.6.1 Atwell Drain

The Atwell Drain is the main drain in the eastern catchments draining upstream of Harper Road. At tapper Road, the open drain is culverted as it drains through the suburb of Atwell. The Atwell Drain consists of combination of open drain sections and culverts as it conveys stormwater through Success and Beeliar.

The Atwell Drain traverses through a number of Resource Enhancement sumplands and damplands and a multiple use dampland at Bratram Rd, prior to discharging to Thomson's Lake, a Conservation Category Wetland.

The drain is approximately 7km long and varies between grassed open channel flow, balancing basins ad large diameter box/pipe culverts. The drainage system is subject to groundwater inflow during the winter months.

2.7 Summary

The site context establishes the setting for the varying environmental opportunities and constraints associated within the drainage within the City.

Key concerns with respect to this study is the infiltration performance of basins in areas of varying geology's. The City has high hydraulic capabilities capable of infiltrating significant quantities of stormwater associated with Bassendean Sands and Tamala Limestone and areas of no or very low hydraulic conductivities (Guildford Formation and silty sands) which prohibit infiltration and alternate stormwater considerations are needed. This is evident through the arterial drainage systems prevalent linking the eastern to the central catchments.

The City has areas of greater than 30m to groundwater and other locations where it is expressed at the surface associated with its vast network of wetlands. The depth to groundwater impacts on the ability of the basin to infiltrate stormwater and can also impacts on the liveability associated with sumps and other drainage storages holding water.

The City capitalises on its natural resources by utilising wetlands to capture stormwater and provide storage for rainfall events, typically greater than the 20% AEP.

3 Data Review

3.1 City Strategies

The City has implemented a series of plans to provide guidance for the City's direction and strategic aspirations.

The Strategic Community Plan, Integrated Transport Plan. Long-term Financial Plan as well as Natural Area Management Strategy, Sustainability Strategy to name a few, are relied on to provide growth, economic, social and environmental responsibility and community, lifestyle and security for residents.

The City has also implemented a Drainage Management and Maintenance Strategy to provide an understanding of the issues of urban stormwater and waterway management, and to provide Council with a comprehensive list of actions required to achieve appropriate stormwater management throughout the City.

The Drainage Catchment Study forms part of the Strategy and aims to enhance the strategies put into place by the City by:

> Reducing risk to residents property and persons;

> Improving liveability;

> Minimising impacts on the environment; and

> Improve the appearance of streetscapes.

In line with the Drainage Management and Maintenance Strategy this DCS:

> Reviews and Updates the 2009 Drainage and Catchment Study;

> Reviews Local Structure Plans Local Water Management Strategies;

> Identifies deficiencies and completes a list of projects that can be undertaken;

> Identifies surface flow paths that have the potential for property damage and financial loss; and

> Feeds into capital works programs.

3.2 Directions 2031

Directions 2031 released by the Department of Planning in 2010 sets out targets for infill residential developments which impact on the City of Cockburn. The infill targets are:

> A 50 per cent improvement on current infill residential development trends of 30 and 35 per cent; and, has set a target of 47 per cent or 154,000 of the required 328,000 dwellings as infill development.

> A 50 per cent increase in the current average residential density 10 dwellings per gross urban zoned hectare; and, has set a target of 15 dwellings per gross urban zoned hectare of land in new development areas.

When considering reducing the size or modifying a sump within the City, future planning needs to be considered to ensure that the drainage requirements of future infill is not prohibited.

3.3 Structure Plans

Cardno completed a literature review of the documents below at the request of the City. It should be noted that the documents provided are Local Water Management Strategies and any comments may have been addressed in the subsequent Urban Water Management Plans (UWMP) and/or detailed engineering design.

3.3.1 Lots 22 & 51 Mayor Road and Lots 18, 19 & 25 Rockingham Road, Munster LWMS – Emerge Associates (2016);

The Local Water Management Strategy was prepared for R & M Garbin, D Tomasich and M Tomasich residential development.

The key drainage strategy principles and criteria adopted for the document were:

> Lots to contain the first 15mm of rainfall on site;

> Pipe network sized to convey the 5yr ARI rainfall event;

> Subsurface storage (Stormtech Cells) to hold road runoff for upto the 5yr event prior to discharging to the nearby wetland;

> Subsurface storage to have a 500mm clearance to site adopted maximum groundwater levels;

> Post-development peak discharge rates to the wetland are below the pre-development flow rates; and

> An infiltration rate of 4.32 m/d for Lots 22 and 51 and 8.64 m/d for Lots 18, 19 and 25 have been utilized for subsurface storages. A 50% clogging factor was applied.

Commentary:

> Modelling discussed in the main report suggests the entire front yard of residential lots (assumed 20% of lot) contributes to road runoff. Appendix D stipulates 50% of the front yard will be pavement and the other pervious garden with a portion of the runoff infiltrated prior to reaching the road network.

> The main reports stipulates lots will hold the first 15mm of rainfall. Appendix D stipulates the 10yr ARI event. Appendix F stipulates 15.8 mm. Soakwell sizing to be confirmed.

> Inverts of subsurface storages not provided to confirm if sufficient clearance to groundwater levels is provided.

3.3.2 Lot 41 Frankland Avenue, Hammond Park LWMS – Development Engineering Consultants (2017)

The LWMS was prepared to support the Local Structure Plan for Lot 41 Frankland Avenue, Hammond Park.

The key drainage strategy principles and criteria adopted for the document were:

> Provide treatment and soakage at source for the 1yr 1hr ARI storm event;

> Ensure surface water is routed to the detention basin and retained onsite;

> Lots to be >1.5 m above the Controlled Groundwater Level (CGL);

> Pipe network sized to convey the 5yr ARI rainfall event; and

> Lot drainage to cater for the 1 in 5yr ARI Storm.

Commentary:

> Unsure as to how residential soakwells sized to the 1 in 5yr ARI storm has been implemented as it is not in line with City policy. Confirmation needed from building services. Potential for swale to be undersized if lots did not provided sufficient capacity.

3.3.3 Lot 21 Rockingham Road, Munster LWMS – Bioscience, 2016

The LWMS was prepared on behalf of Harley Dykstra to support the Local Structure Plan for Lot 21 Rockingham Road, Munster.

The key drainage strategy principles and criteria adopted for the document were:

> Residential soakwells to be sized to the 20 yr 5min ARI storm event as per the City's guidelines;

> A minimum of 0.5 m from soakwell base to Maximum Groundwater Level;

> Roads to infiltrate the 100yr event at source via side entry pits and Stormtech Cells;

> Limestone pinnacles were identified underneath the eastern road reserve which is to be removed prior to installation of soakwells;

> Storage sizing based on 5 m/d infiltration; and

> Invert levels of subsurface storages are confirmed to be 500mm above Maximum Groundwater Level.

Commentary:

- In-situ infiltration rates in the geotechnical report were reported as 101.9 mm/hr (2.5 m/d) and 198.1 mm/hr (4.75 m/d). 5 m/d infiltration was used for sizing of drainage infrastructure. A 50% clogging factor should be applied to in-situ results (as with the neighbouring development). Potential for infrastructure to be undersized.
- The LWMS does not identify the extent or depth of limestone removal required in order to utilise on-site disposal. Limestone can prohibit infiltration of stormwater. It is recommend this is investigated further to ensure infrastructure is sized appropriately.

3.3.4 Lot 2 Lyon Road, Aubin Grove LWMS – Emerge Associates (2011);

The Local Water Management Strategy was prepared for Q & B Pty Ltd to support the Local Structure Plan for Lot 2 Lyon Rd, Aubin Grove:

The key drainage strategy principles and criteria adopted for the document were:

- Residential soakwells to be sized to the 20 yr 5min ARI storm event as per the City's guidelines;
- Invert of the storage basin is >4.0 m to groundwater levels therefore no subsoil control is proposed;
- Site infiltration rates assumed 8.64 m/d for storage basin; and
- Soakwells and Ecoaid underground storage assumed to infiltrate 1yr ARI event but not included in overall modelling of basin storage.

Commentary:

- On site infiltration rates to be confirmed through geotechnical report and sizing of infrastructure sized accordingly.
- Providing soakwells and Ecoaid underground storage and not including it within stormwater calculations means infrastructure may be oversized.

3.3.5 Lot 2 Fanstone Ave, Beeliar LWMS – Hyd2o (2016);

The Local Water Management Strategy was prepared for Rowe Group on behalf of Adelaide Brighton Ltd to support the Local Structure Plan for Lot 2 Fanstone Ave, Beeliar:

The key drainage strategy principles and criteria adopted for the document were:

- Groundwater > 23 mBGL;
- Pipe network sized to convey the 5yr ARI rainfall event;
- 1yr 1hr storm event to be retained on lots;
- Stormtech Cells sized to infiltrate the 2yr ARI Storm event;
- Infiltration rates on site recorded between 0.5 m/d (limestone) up to 13.3 m/d (sand); and
- A permeability of 2 m/d assumed for modelling purposes taking into account deep ripping would be required of any underlying limestone.

Commentary:

- No commentary

3.3.6 Latitude 32: Planning Area 2 LWMS – RPS, 2012

The LWMS was prepared to support the Latitude 32 Local Structure Plan.

The key drainage strategy principles and criteria adopted for the document were:

- Runoff within lots to cater for the 10 yr critical ARI storm event;
- Pipe network and road sized swales sized to convey the 10yr ARI rainfall event;
- Minimum lot clearance of >1.5m to AAMGL;
- Infiltration assumed to be 1.5m/d;

> Central catchment to discharge to Mt Brown Lake in events >10yr ARI at pre-development flow rates;

> Basin inverts >0.3m above MGL.

Commentary:

> Onsite infiltration testing to be carried out and utilised to finalise drainage infrastructure sizing to minimise basin sizes.

> Modelling software capable of given consideration to shallow groundwater tables should be used when refining basin sizes during subdivision.

3.3.7 Hammond Park LWMS and UWMP – Cardno, 2008

The LWMS was prepared on behalf of the Hammond Park Development Company Pty Ltd to support the Local Structure Plan for Lot Lots 36 & 37 Gaeblar Rd, Lot 45 Frankland Ave and lot 101 Barfield Road, Hammond Park. .

The key drainage strategy principles and criteria adopted for the document were:

> Infiltration rate of >50m/d recorded in the geotechnical Investigation;

> Infiltration rates for basin sizing assumed to be 1m/d to account for potential accumulation of sediment forming an impervious layer;

> Pipe network sized to convey the 5yr ARI rainfall event;

> All runoff up to and including the 100yr ARI retained and infiltrated on site;

> Finished lot levels >3m to CGL; and

> Mandatory construction of appropriately sized soak wells on all lots.

Commentary:

> Infiltration rate utilised for modelling considered very conservative. Consideration to be given by the City for future developments to remodel basins and potentially use as storage if appropriate.

> Unsure as to the sizing of the mandatory sized soakwells on all lots. Confirmation needed to ensure sized in accordance with the City's guidelines.

3.3.8 Robb Jetty LWMS – GHD, 2014

The LWMS was prepared on behalf of Landcorp to support the Robb Jetty Local Structure Plan.

The key drainage strategy principles and criteria adopted for the document were:

> Groundwater >6mBGL;

> Infiltrate the first 16mm at source;

> Residential soakwells to be sized to the 20 yr 24 hour (?) ARI storm event;

> Commercial, industrial and mixed use lots are required to infiltrate all events up to and including the 100yr 24 hr ARI event (?).

> All runoff up to and including the 100yr ARI retained and infiltrated on site; and

> Infiltration rate of 1 m/d utilized to size storages.

Commentary:

> Infiltration rate utilised for modelling considered very conservative. Onsite infiltration testing should be carried out to confirm onsite infiltration rates and an appropriate rate utilised to size infrastructure.

> Unsure of reference to residential soakwells sized to the 20yr 24hr ARI storm event and commercial 100yr 24hr ARI storm event. If alternate holding capacities are proposed and are not inline with City policies, a mechanism of enforcement needs to be identified.

3.3.9 Calleya Redevlopment LWMS – PDC, 2015

The LWMS was prepared on behalf of Stockland for the redevelopment of the old Banjup Quarry site and support the Local Structure Plan.

The key drainage strategy principles and criteria adopted for the document were:

> Flows for events up to 1 year 1 hour ARI will be retained in bioretention swales located in public open spaces,

> Infiltration (other than of roof runoff at lot level) will be inhibited in Water Protection Zone to protect the drinking water source. In the rest of the site, road runoff will be treated through WSUD methods prior to infiltration,

> Provide storage in POS to attenuate post development flows up to the critical 5 year ARI event

> Provide overflows from POS storage areas for events exceeding the critical 5 year ARI event, which will discharge to an arterial drainage system, namely the Atwell drain.

> POS basins are to have a minimum of 0.5 m clearance to maximum groundwater level

> Pipe network sized to convey the 5yr ARI rainfall event;

> Residential soakwells to be sized to the 20 yr 5min ARI storm event as per the City's guidelines;

Commentary:

> Basin E on Figure 5.3 has incorrect basin invert. The basin invert is actually >0.5m to MGL as per the adopted criteria confirmed within the UWMP

> Infiltration rates utilised to size the 5yr basins are not provided. Confirmed from the UWMP as 5m/d.

3.4 Complaint Register

As part of the investigation, Cardno reviewed residents' complaints received by the City since 2009. Over the period, 513 complaints were received. The complaints can be broken down into the following areas:

- Maintenance issues: 267
- Drainage infrastructure: 220
- Non-drainage related: 26

The complaints which have been considered in this report which are related to the drainage infrastructure. A large proportion of the complaints are as a result of poorly designed crossovers and drainage after road works have been completed. Of these complaints 7 are in relation to sumps which have overflowed. The remainder are in relation to insufficient drainage inlets being provided and cross over issues (typically after roadworks have been completed).

Other notes of interest:

- Complaints were received when drainage was redirected to POS and water was observed in the previously dry parks;
- Large proportion of complaints relating blocked drains also mention newly mulched areas; and
- This report considered the 7 issues reported regarding sump overflows which have been discussed in Section 5.

3.5 Drainage Data Received

The current drainage network and catchments were established through liaison with the City. The drainage network is primarily serviced by a system of drainage pipes and some open channels which carry stormwater:

A summary of the data received utilised for the modelling process is presented in Table 3-1. Current drainage infrastructure owned by the City is shown in Figure 7.

Table 3-1 Data Received

Data Received	Source
Drainage Catchments	City of Cockburn
Drainage Pipes	
Drainage Sumps	
2009 and 2016 Cadastre	
LiDAR Topography	Department of Water

4 Assessment Methodology

4.1 Design Storm Events

Modelling was undertaken for the 1% AEP storm event to determine maximum runoff volume generated and to identify any deficient sumps requiring further detailed investigation. Durations modelled ranged from 30 minutes to 72 hours.

4.2 Runoff Coefficient

Areas of contributing catchments were confined to road reserves only. Catchments were classified as one of two road types; residential or major road. Using aerial photography, the catchment was divided into impervious and pervious surfaces as per the examples presented in Figure 8. Each catchment was allocated a runoff coefficient based on the percentage of impervious surface. The range in runoff coefficients for each type of catchment are presented in Table 4-1**Error! Reference source not found.**.

Table 4-1 Runoff Coefficient Values

Catchment Type	Runoff Coefficient
Residential	0.5 - 0.7
Major Road	0.7 – 0.9

4.3 Sumps

Most sumps in the City's Catchments are typically fenced with 1 in 2 side slopes and are around 1m –2m deep with little vegetation. The effectiveness of the sump is mainly dependent on:

> Frequency of maintenance and removal of sedimentation build up (clogging layer).

> Sump invert clearance to the groundwater table. The lower the clearance the greater the adverse impact on the infiltration capacity of the sump.

> Underlying soil type.

> Degree of saturation of the underlying soil.

Sumps are typically designed using a simple infiltration rate model where the sump infiltration capacity is a direct function of sump base area and design infiltration rate however this does not take into account all of the above conditions particularly depth to groundwater which reduces the effective infiltration rate considerably where clearances are low.

The sumps design capacity is generally more dependent on the total catchment runoff volume rather than the short term peak inflow. The critical design storm duration is a function of total catchment runoff and sump infiltration capacity, typically this is between 24 and 72 hours (as shown by Cardno modelling results) where the latter is typical for areas with higher groundwater levels or in areas with lower permeability's.

4.3.1 Permeability

The City currently has infiltration data available for a number of sumps in Hamilton Hill, Munster and Spearwood presented in Table 4-2. Sump DSU_000152 had an infiltration rate of 0 m/day (Table 4-2) as it was found to be overlying limestone. A cone penetrometer test indicated limestone up to a depth of 7.0 m.

For the initial round of modelling Cardno assumed 5 m/d based on the average result and DoW recommendation for sandy soils (DoW, 2004). This parameter aligned well with tested data provided by the City of Cockburn provided in Table 4-2 and 4-3 with averages being 5.7 and 7.2 m/d (noting that the rates provided by the City of Cockburn were moderated using a clogging factor).

Table 4-2 Available Infiltration Data

Sump ID	Address	Infiltration Rate (m/day)[1]
DSU_000165	19A Chesham Way, Hamilton Hill	5.5
DSU_000152	Hurford St, Hamilton Hill	0.0
DSU_000310	48212r Riverina Parade, Munster	4.0
DSU_000396	4 Albion Avenue, Munster	4.5
DSU_000208	29 Lintott Way, Spearwood	3.0
DSU_000419	Wilkes Street, Spearwood	7.0
DSU_000418	Wilkes Street, Spearwood	7.5
DSU_000416	Arthur Road, Spearwood	8.0
DSU_000417	Arthur Road, Spearwood	8.0

1- Assumed as tested infiltration rate

Following the initial assessment by Cardno, critical sumps identified had infiltration testing undertaken by the City in May 2017. Two tests were conducted within each sump with the average infiltration rate used in the model. The infiltration rates utilised are presented in Table 4-3.

Table 4-3 May 2017 Infiltration Test Results

Sump ID	Address	Infiltration Rate (m/day)
DSU_000142	Corner of Redmond Road & Healy Road, Hamilton Hill	5.3
DSU_000146	27 Clara Road, Hamilton Hill	7.25
DSU_000147	391 Carrington Street, Hamilton Hill	1.4
DSU_000151	60 Healy Road, Hamilton Hill	4.05
DSU_000251	19B Jean Street, Hamilton Hill	5.46
DSU_000120	19-23 Simons Street, Coolbelup	6.95
DSU_000123	33 Coolbelup Avenue, Coolbelup	12.0
DSU_000137	Cordelia Avenue, Coolbelup	9.25
DSU_000246	Rinaldo Place, Coolbelup	3.15
DSU_000181	15 Scroop Way, Spearwood	4.8
DSU_000203	273 Spearwood Ave, Spearwood	2.3
DSU_000205	86 Edeline Street, Spearwood	8.0
DSU_000206	14B Scales Way, Spearwood	7.15
DSU_000230	111 Plover Drive, Yangebup	2.15
DSU_001021	868 Armadale Road, Banjup	0.39

Sumps located within areas of high groundwater table or above the Guildford Formation were still modelled with an infiltration rate of 5 m/d, while in reality, this may not be the case as most would have low infiltration rates but have an outlet pipe. Sumps in these locations are typically part of the arterial drainage network. Modelling of the arterial drainage was not within the scope of works, but given no complaints were received regarding flooding, this was not perceived as a risk to be addressed with the 2017/2018 capital works program.

4.4 Existing Infrastructure and Catchments

The City's drainage infrastructure network is made up of the following main elements:

> Series of pits and pipes;

> Drainage sumps;

> Wetland Storages; and

> Arterial Drainage

4.5 Modelling Assumptions

The following assumptions were used in the model:

> For all sumps with no current infiltration data (Section 4.3) an assumed infiltration rate of 5 m/day based on the saturated hydraulic conductivity of sandy soils (DoW, 2004) was used;

> Additional sumps were identified through aerial photographs, drainage outlet locations and LiDAR converted into a Digital Elevation Model (DWM) provided by the Department of Water;

> Surface area and volumes for sumps with no as constructed drawings were calculated using the DEM;

> Additional catchments were drawn according to the City's drainage network; and

> No storage within the piped system was factored.

4.6 Categories

Prior to commencement of the Study, Cardno discussed the level of service to be addressed within the modelling and results. It was agreed the level of service to be consider was the 1% AP (100yr ARI) to ensure protection of property and community safety from flooding.

Sumps where modelling indicated overflow would occur were assigned one of the following categories:

> Category 1: Roads and public open space (POS) impacted;

> Category 2: Lots (but not building infrastructure) impacted;

> Category 3: Building infrastructure impacted.

Categories were assigned by identifying the surface flow path using the DEM and potential to reach properties.

4.7 Presentation of Results

Results provided in Section 5 are presented consistent with Table 4-4.

Table 4-4 Example Results Table

Sump Name	Address
Sump Image	**Storage Volume Deficit:** Volume sump under capacity **Average Permeability Recorded:** CoC provided permeability if available **Comments:** General comments **Recommendation:** Recommendation of works **Costing:** • Costings of capital works

5 Results

A summary of the results of the modelling is presented in Table 5-1 with category 3 sumps forming part of the capital works program detailed in the proceeding sections. Calculation sheets are provided in Appendix A and drainage catchments and sump locations provided in Appendix B.

Table 5-1 Sump Analysis Summary

Suburb	No Overflow/Impact	Category 1 Roads and POS	Category 2 Lots	Category 3 Buildings	Missing Sump Data	Total Sumps
Atwell	9	2	0	0	1	12
Aubin Grove	12	2	0	0	7	21
Banjup	0	0	0	1	0	1
Beeliar	11	1	0	0	8	20
Bibra Lake	38	2	2	0	1	43
Cockburn Central	5	0	0	0	5	10
Coogee	7	3	0	0	3	13
Coolbelup	11	4	4	3	4	26
Hamilton Hill	22	6	7	5	3	43
Hammond Park	10	0	0	0	11	21
Henderson	26	2	0	0	0	28
Jandakot	23	5	0	0	1	29
Munster	23	1	0	0	6	30
North Coogee	11	1	0	0	6	18
North Lake	5	0	0	0	0	5
South Lake	15	1	1	0	0	17
Spearwood	28	3	2	3	4	40
Success	24	6	0	0	6	36
Treeby	7	0	0	0	0	7
Wattleup	4	0	0	0	0	4
Yangebup	15	5	1	1	0	22
Total	**306**	**44**	**17**	**13**	**66**	**446**
Total (%)	**69%**	**10%**	**4%**	**3%**	**15%**	**100%**

The results show that only 3% of the sumps are deemed to pose a risk to building infrastructure, 4% is deemed to impact on private lots and 10% will flood onto the road or POS.

5.1 Works Program

Works proposed in the following section are indicative only and have not been subjected to detailed investigations. It is critical that prior to completing works, hydraulic analysis, catchment assessment, constraints mapping and detailed design need to be completed by suitably qualified professionals in order to assess each sump on a case by case basis.

Recommendations provided herein are based on a high level overview and may ultimately not provide the most suitable outcome. The City's engineering department will need to assess each sump on a case by case basis.

Costings assume that engineering drawings are a mark-up or are simplified drawings and not suitable for tender. Contingency provided is assumed to be 30% of catchment and engineering design and capital costs.

5.1.1 Short Term Capital Works

The short term capital works program are for projects which are deemed to be of the most risk to residents property and should, subject to budget, be completed within the 2017/2018 financial year. Further to Cardno's assessment, four additional locations identified by the City; Jakovich Park, Tolley Road, Russell Rd and Lot 2792 Hartley St have also been included as they were identified as areas of concern.

DSU_000146	27 Clara Rd, Hamilton Hill

Storage Volume Deficit: 1025 m^3
Average Permeability Recorded: 7.25 m/d
Comments: February 2015 basin works were carried out to change basin design. Assumed moved to back lot to sell front lot for house.
Recommendation:
Detailed catchment drainage assessment to be completed to ensure sump is adequately sized.
Costing:

- $3,500 for catchment drainage assessment
- $6,000 for engineering design
- $120,000 for local shaping and earthworks
- $38,850 contingency

Total cost: $168,350

DSU_000251	19B Jean St, Hamilton Hill

Storage Volume Deficit: 870 m^3
Average Permeability Recorded: 5.46 m/d
Comments: Limited opportunity to increase sump size within lot. Water level has been reported up above the toe of the fence.
Recommendation:

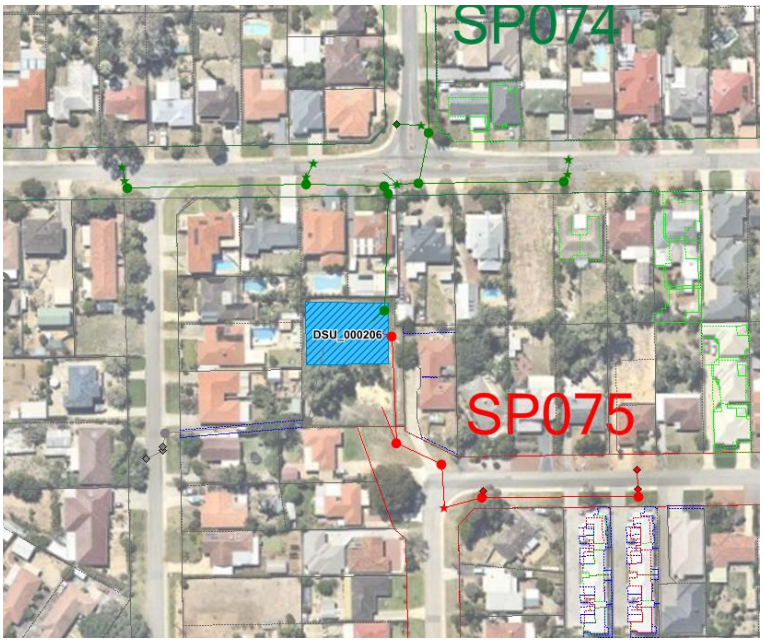
- Capture a portion within PAW in upper catchment (approx. 400m^3). Sewer pipe in PAW however.
- Install leaky pipe system, underground storage in upper catchment and or tree pits within road reserves

Costing:

- $6,000 for catchment drainage assessment
- $20,000 for engineering design
- $200,000 for capital works
- $67,800 contingency

Total cost: $293,800

DSU_000206	14B Scales Wy, Spearwood



Storage Volume Deficit: 1637 m^3
Average Permeability Recorded: 7.15 m/d
Comment: Used to be a much bigger sump but was reduced in size.
Recommendation:

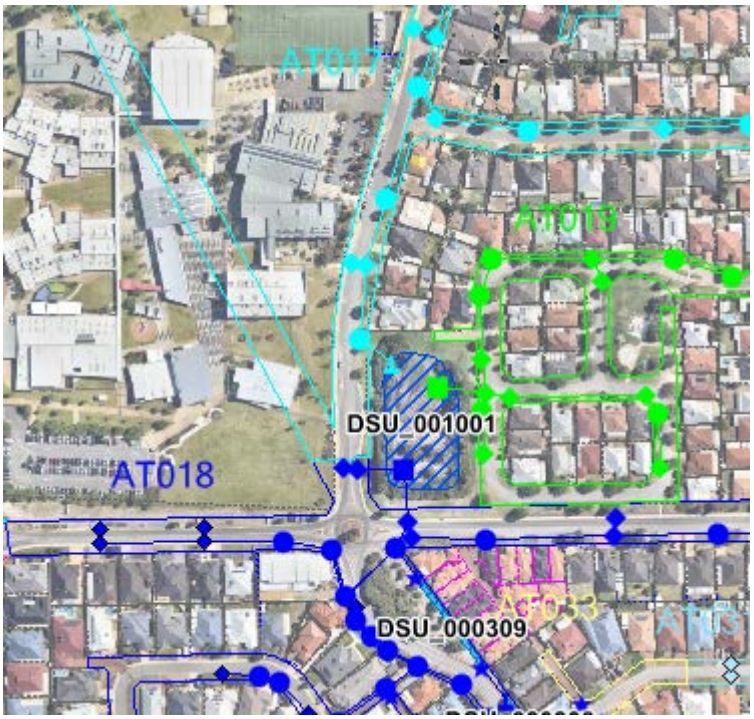
- Further excavate the sump.

Costing:

- $3,500 for catchment drainage assessment
- $6,000 for engineering design
- $90,000 for local shaping and earthworks
- $29,850 contingency

Total cost: $129,350

DSU_001001	Cornet Bartram Road and Brenchley Drive, Atwell



Storage Volume Deficit: N/A
Comment: Park is unsightly and 50% of the year cannot be mowed as it is underwater or ground too soft. Pipe blockages. Most likely high groundwater table
Recommendation:

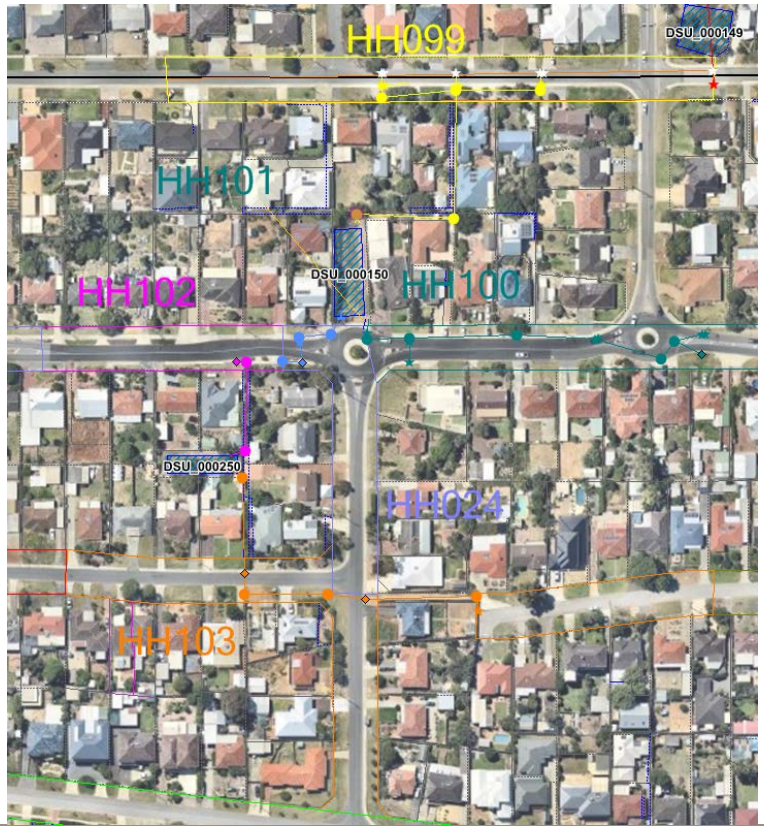
- Look to raise basin invert
- Maintain swales connecting inlets and outlets
- Avoid planting in front of outlets.

Costing:

- $10,000 for engineering design and assessment
- $120,000 for capital works
- $39,000 contingency

Total cost: $169,000

DSU_000250	Between 157 Clontarf Road and 52 Tolley Court, Hamilton Hill



Storage Volume Deficit: 279 m^3
Comment: investigate possibility of removing sump and disposing the stormwater from contributing catchments into other existing sumps or via underground storage.
Recommendation:

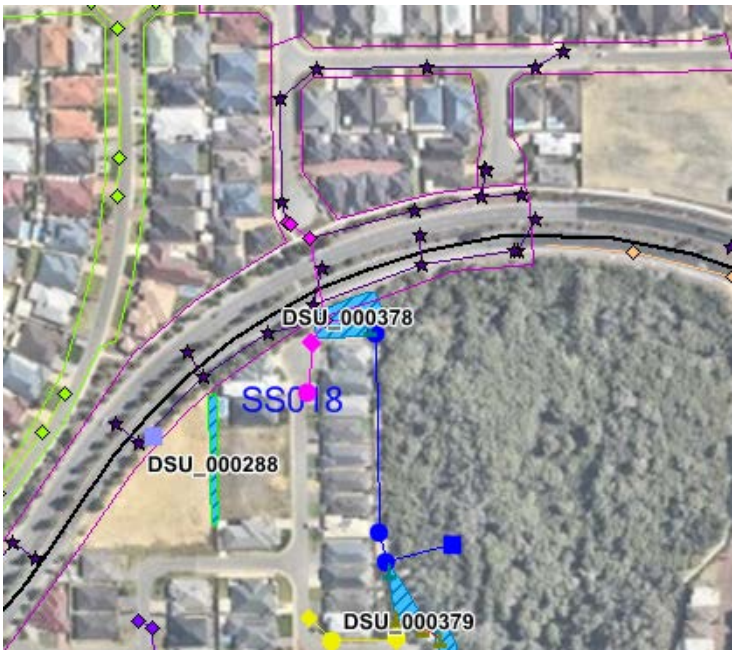
- Look to redirect catchment to DSU_000150
- Potential to increase size of DSU_000150.
- Complete infiltration testing on DSU_000150
-

Costing:

- $10,000 for catchment drainage assessment and engineering design
- $300,000 for capital works
- $93,000 contingency

Total cost: $403,000

DSU_000378	Russell Road, Hammond Park



Storage Volume Deficit: 1165 m^3; discharges into Baler Reserve
Comment: Flooding of 2/18 Crossville Way, Success.
Recommendation:

- Lower outlet to Baler Reserve to ensure overflow occurs before Crossville Way floods.

Costing:

- $5,500 for engineering design and assessment
- $80,000 for capital works
- $25,650 contingency

Total cost: $111,150

DSU_000330	27 Guidace Way, Yangebup

Storage Volume Deficit: 249 $m^{3.}$, overflow to outlet underneath Spearwood Ave.
Comment: Possibility of removing sump and disposing the stormwater from contributing catchments into other existing sumps.
Recommendation:

- Pipe connection to pipe discharging underneath Spearwood Ave to the north of sump.

Costing:

- $10,000 for catchment drainage assessment
- $200,000 for capital works
- $63,000 contingency

Total cost: $273,000

DSU_000121	18 Hartley Street, Coolbellup

Storage Volume Deficit: N/A
Average Permeability Recorded: N/A
Comment: Possibility of removing sump and disposing the stormwater from contributing catchments into median.
Recommendation:

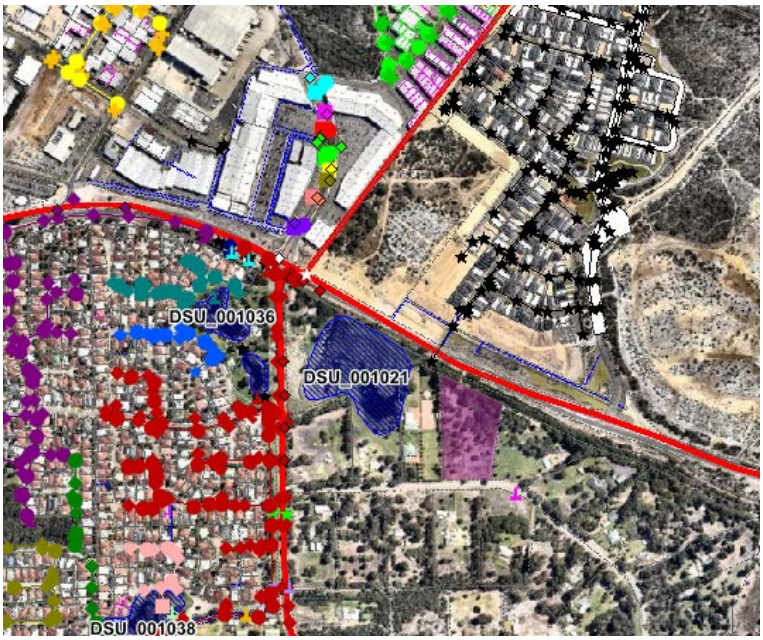
- Infiltration testing
- Construction of underground storage in large median strip on Hartley Street.

Costing:

- $10,000 for engineering design and assessment
- $200,000 for capital works
- $63,000 contingency

Total cost: $273,000

DSU_001021	868 Armadale Rd, Banjup



Storage Volume Deficit: N/A
Average Permeability Recorded: N/A
Comment: No infiltration. District storage basin connecting to Atwell Drain. Existing vegetation adding to flood risk.
Recommendation:

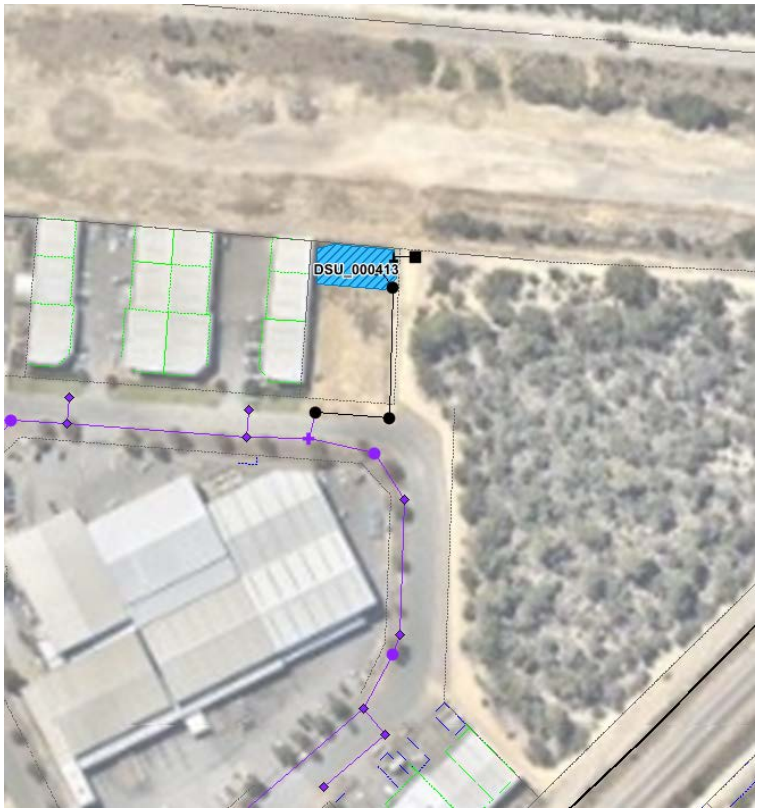
- Clear Atwell Drain
- Conduct wetland maintenance

Costing:

- $50,000 for capital works.
- On-going maintenance to ensure drain remains clear as per section 6.4 and 6.5.
- $15,000 contingency

Total cost: $65,000

DSU_000413	Cascara Cnr, Bibra Lake



Storage Volume Deficit: 2645 m^3
Average Permeability Recorded: N/A
Comments: 2012 basin works were carried out to change basin design. A preliminary assessment of the design undertaken has identified potential design flaws.
Recommendation:
Infiltration testing and detailed catchment assessment to be carried out urgently as land owned by a developer.
Costing:

- $6,500 for catchment drainage assessment
- $6,000 for engineering design
- $120,000 capital works
- $39,750 contingency

Total cost: $172,250

5.1.2 Medium Term Capital Works

The medium term capital works program are for projects which are deemed to be of risk to residents property and through discussions with the City, have been identified as needing to have works completed by the end of the 2019/2020 financial year.

DSU_000137 Address: Cordelia Ave, Coolbelup

Storage Volume Deficit: 375m^3
Average Permeability Recorded: 9.25 m/d
Comment: Complaint received
Recommendation:

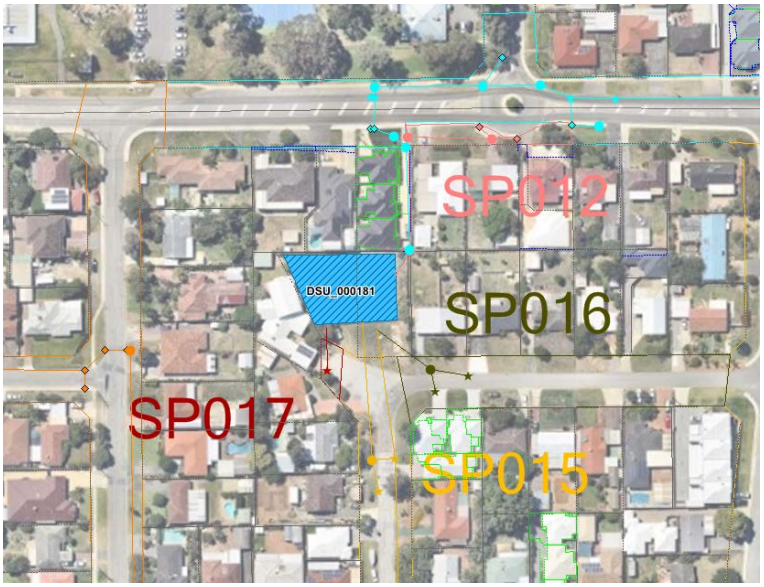
- Infiltration testing
- Use verges for infiltration, disconnect drainage on Sebastian and Cordelia.
- Underground storage in upper catchment and or tree pits up within road reserves.

Costing:

- $4,000 for catchment drainage assessment
- $6,000 for engineering design
- $140,000 for capital works
- $45,000 contingency

Total cost: $195,000

DSU_000181 15 Scroop Wy, Spearwood



Storage Volume Deficit: 528m^3
Average Permeability Recorded: 4.8 m/d
Recommendation:

- Excavate sump further to increase volume

Costing:

- $5,000 for drainage assessment and engineering design
- $120,000 for capital works
- $37,500 contingency

Total cost: $162,500

DSU_000203	273 Spearwood Ave, Spearwood

Storage Volume Deficit: 1129m^3
Average Permeability Recorded: 2.3 m/d
Comment: Complaint received.
Recommendation:

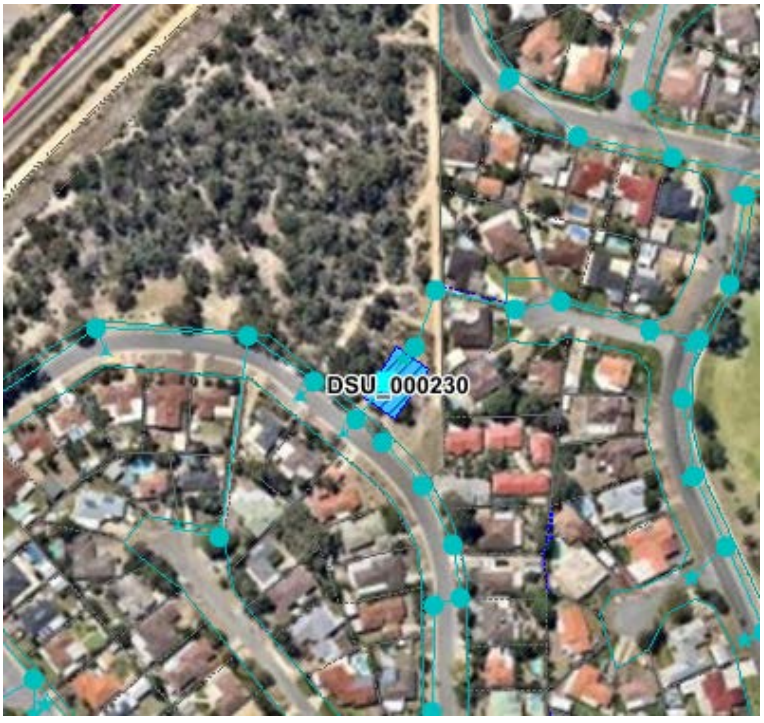
- Excavate sump further to increase volume
- Incorporate storage in Spearwood Ave median.

Costing:

- $8,000 for catchment drainage assessment
- $20,000 for engineering design
- $300,000 for capital works
- $98,400 contingency

Total cost: $426,400

DSU_000230	111 Plover Dr, Yangebup



Storage Volume Deficit: 2442 m$^{3.}$
Average Permeability Recorded: 2.15 m/d
Recommendation:

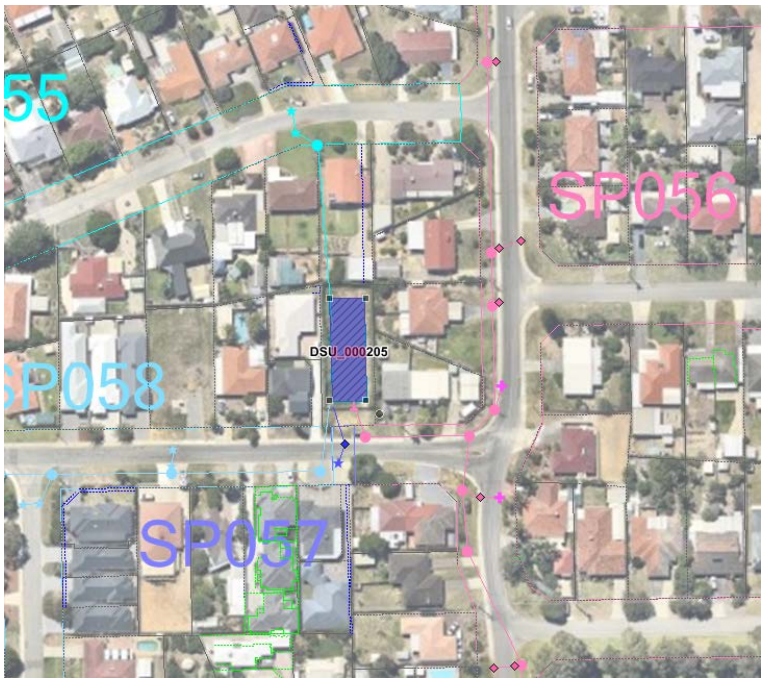
- Infiltration testing
- Potential to increase sump size in reserve.
- Underground storage in upper catchment and or tree pits up within road reserves

Costing:

- $3,000 site survey
- $6,000 for catchment drainage assessment
- $20,000 engineering design
- $220,000 for capital works
- $74,700 contingency

Total cost: $323,700

DSU_000205	86 Edeline St, Spearwood



Storage Volume Deficit: 1599m^3
Average Permeability Recorded: 8.0 m/d
Recommendation:

- Room to further excavate sump to increase volume.
- Look to redirect portion of the catchment to POS in the south.

Costing:

- $8,000 for catchment drainage assessment
- $15,000 for engineering design
- $320,000 for capital works
- $102,900 contingency

Total cost: $445,900

5.1.3 Long Term Capital Works

The long term capital works program are for projects which are deemed to be of risk to residents property and through discussions with the City, have been identified as needing to have works completed by the end of the 2021/2022 financial year

DSU_000142	Corner of Redmond Rd and Healy Rd, Hamilton Hill

Storage Volume Deficit: 1430m^3
Average Permeability Recorded: 5.3 m/d
Comment: Complaint received. Limited opportunity to increase sump size.
Recommendation:

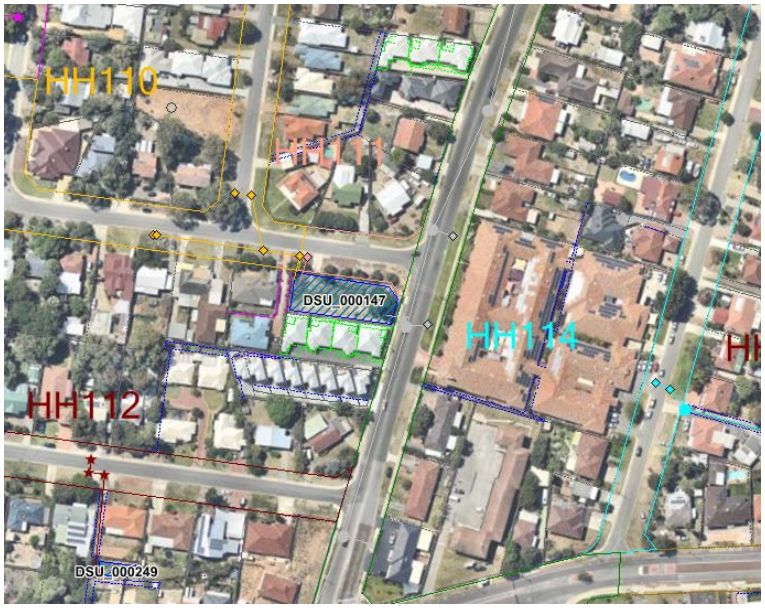
- Underground storage in upper catchment and or tree pits within road reserve

Costing:

- $10,000 for catchment drainage assessment
- $20,000 for engineering design
- $500,000 for capital works
- $159,000 contingency

Total cost: $689,000

DSU_000147	391 Carrington St, Hamilton Hill



Storage Volume Deficit: 3963m^3
Average Permeability Recorded: 1.4 m/d
Comment: Complaint received. Limited opportunity to increase sump size.
Recommendation:

- Underground storage in upper catchment and or tree pits within road reserve

Costing:

- $10,000 for catchment drainage assessment
- $20,000 for engineering design
- $500,000 for capital works
- $159,000 contingency

Total cost: $689,000

DSU_000151	60 Healy Rd, Hamilton Hill

Storage Volume Deficit: 625m^3
Average Permeability Recorded: 4.05 m/d
Comment: Limited opportunity to increase sump size.
Recommendation:

- Potential for underground storage within sump
- Underground storage in upper catchment and or tree pits within road reserve

Costing:

- $6,000 for catchment drainage assessment
- $10,000 for engineering design
- $200,000 for capital works
- $64,800 contingency

Total cost: $280,800

DSU_000246	Rinaldo Pl, Coolbelup

Storage Volume Deficit: 625m^3
Average Permeability Recorded: 3.15 m/d
Recommendation:

- Over excavate basin in sump

Costing:

- $10,000 for 12D earthworks and landscaping design
- $250,000 for capital works earthworks and landscaping.
- $78,000 contingency

Total cost: $338,000

5.1.4 Sumps to be Re-developed

Cardno identified sumps which could be re-developed, integrated with Public Open Space or combined with other drainage infrastructure to provide reduce the land take of drainage sumps.

Please note, sumps suggested for re-development need to have a detailed investigation completed in the first instance to ensure no detrimental impacts are experienced.

Sumps to be re-developed also need to be considered in context of future infill as part of Directions 2031. Consideration needs to be given to ensure retrofication works or reduction in sump size will not impact on future infill.

DSU_000375	L'Aquila Cir, Beelair

Total Storage: 1090m^3
Total Available: 779m^3
Recommendation:

- Infiltration testing
- Confirm catchments
- Reduce basin size and sell additional land

Costing:

- $5,000 for catchment drainage assessment
- $20,000 for engineering design
- $5,000 for planning
- $140,000 for capital works
- $51,000 contingency

Total cost: $221,000

Land to sell: 500m^2

DSU_000074	22 Maritime Tce, Coogee

Total Storage: 1445m^3
Total Available: 981m^3
Recommendation:

- Infiltration testing
- Confirm catchments
- Reduce basin size and sell additional land

Costing:

- $5,000 for catchment drainage assessment
- $20,000 for engineering design
- $5,000 for planning
- $140,000 for capital works
- $51,000 contingency

Total cost: $221,000

Land to sell: 500m^2

DSU_000144	Joyce Ave, Hamilton Hill

Total Storage: 1608m^3
Total Available: 925m^3
Recommendation:

- Infiltration testing
- Confirm catchments
- Reduce basin size and sell additional land

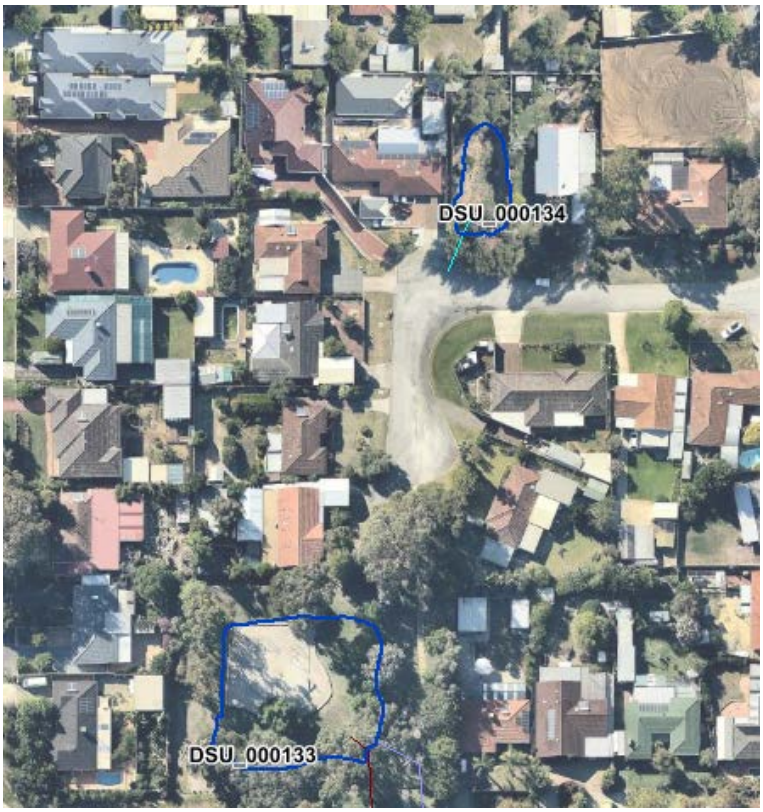
Costing:

- $5,000 for catchment drainage assessment
- $20,000 for engineering design
- $5,000 for planning
- $140,000 for capital works
- $51,000 contingency

Total cost: $221,000

Land to sell: 600m^2

DSU_000134 Varna Place, Coolbellup



Total Storage: 271m^3
Total Available: 223 m^3
Recommendation:

- Infiltration testing
- Confirm catchments
- Look to connect to DSU_000133. Will most likely need some rework to reach capacity.

Costing:

- $5,000 for catchment drainage assessment
- $20,000 for engineering design
- $5,000 for planning
- $180,000 for capital works
- $63,000 contingency

Total cost: $268,000

Land to sell: 450m^2

DSU_000048 Allendale Entrance, North Lake

Total Storage: 1937m^3
Total Available: 1310 m^3
Recommendation:

- Infiltration testing
- Confirm catchments
- Look to resize or negotiate drainage on neighboring land.

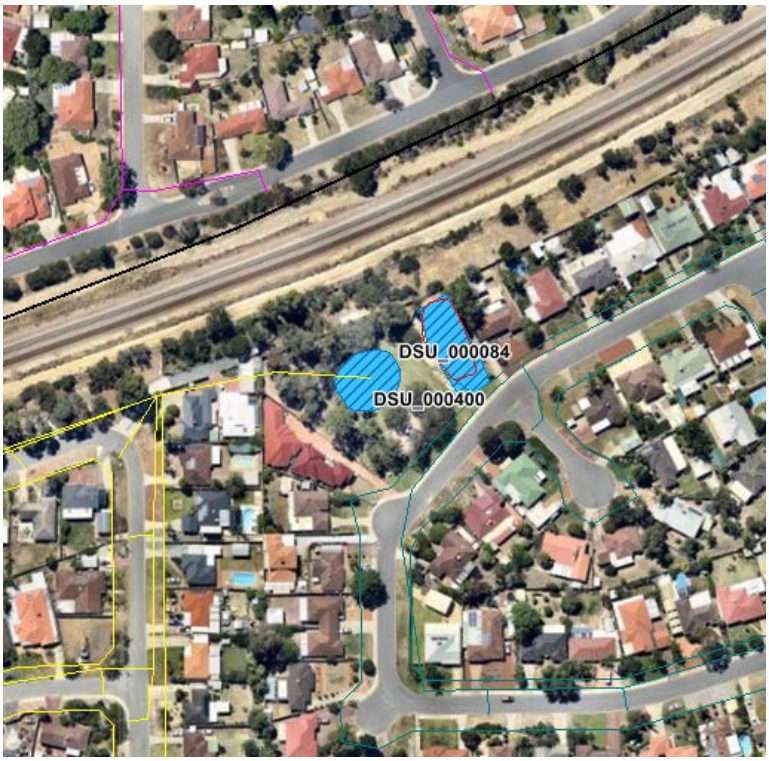
Costing:

- $4,500 for catchment drainage assessment
- $20,000 for engineering design
- $10,000 for planning
- $160,000 for capital works
- $58,350 contingency

Total cost: $252,850

Land to sell: 450m^2

DSU_000084 and DSU_000400	Allamanda Dve, South Lake



Total Storage: N/A
Total Available: N/A
Recommendation:

- Infiltration testing
- Confirm catchments
- Combine basins into integrate POS and create a lot.

Costing:

- $10,000 for 12D earthworks and landscaping design
- $2,000 for planning
- $250,000 for capital works earthworks and landscaping.
- $78,600 contingency

Total cost: $340,600

Land to sell: 800m^2

DSU_000284 and DSU_000285	Makjanich Place, Success

Total Storage: N/A
Total Available: N/A
Recommendation:

- Infiltration testing
- Confirm catchments
- Combine basins into once basin.
- Provide overland flow path from DSU_000287 to DSU_000285 via footpath
- Reshape DSU_000285 to generate extra storage.

Costing:

- $5,500 for catchment drainage assessment
- $20,000 for engineering design
- $5,000 for planning
- $190,000 for capital works
- $66,150 contingency

Total cost: $286,650

Land to sell: 400m^2

DSU_000159	Rodd Place, Hamilton Hill

Total Storage: N/A
Total Available: N/A
Recommendation:

- Infiltration testing
- Confirm catchments
- Integrate basin with POS
- Create lot

Costing:

- $3,500 for catchment drainage assessment
- $10,000 for 12D earthworks and landscaping design
- $5,000 for planning
- $160,000 for earthworks and landscaping
- $53,550 contingency

Total cost: $232,050

Land to sell: 750m^2

DSU_000057	101 Mills St, Coogee

Total Storage: N/A
Total Available: N/A
Recommendation:

- Infiltration testing
- Confirm catchments
- Integrate basin with POS
- Create lot

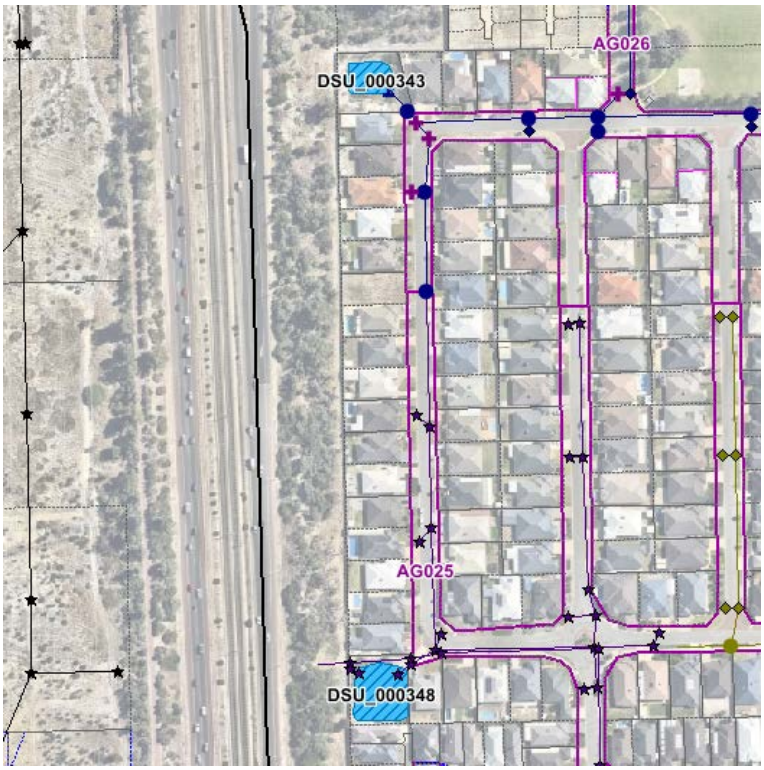
Costing:

- $5,000 for catchment drainage assessment
- $10,000 for 12D earthworks and landscaping design
- $5,000 for planning
- $190,000 for earthworks and landscaping
- $63,000 contingency

Total cost: $273,000

Land to sell: 450m^2

DSU_000343 and DSU_000348	Princeton Circuit, Aubin grove



Total Storage: N/A
Total Available: N/A
Recommendation:

- Infiltration testing
- Review groundwater levels
- Combine both basins into one.
- Create lot

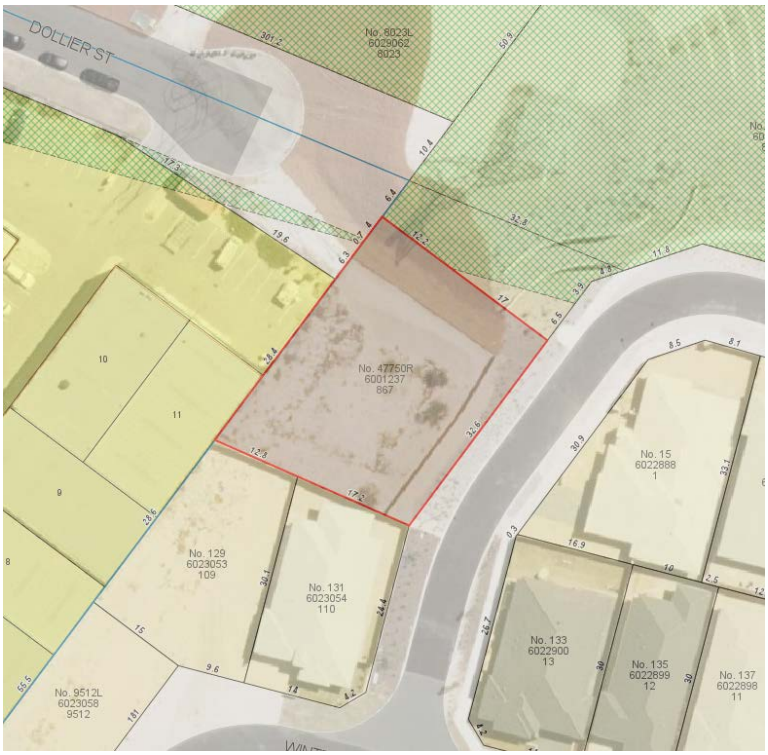
Costing:

- $8,000 for catchment drainage assessment
- $5,000 for planning
- $15,000 for engineering design
- $160,000 for capital works
- $56,400 contingency

Total cost: $244,400

Land to sell: 1000m^2

N/A	Basil Loop, Banjup



Total Storage: N/A
Total Available: N/A
Recommendation:

- No longer provides drainage function. To be removed.

Costing:

- $2,000 for planning
- $40,000 for capital works
- $12,600 contingency

Total cost: $54,600

Land to sell: 1050m^2

DSU_001009	Lot 8003 Selkis Road Bibra Lake

Total Storage: 4681m^3
Total Available: 2798m^3
Recommendation:

- Infiltration testing
- Confirm catchments
- Reduce basin size and sell additional land

Costing:

- $6,000 for catchment drainage assessment
- $20,000 for engineering design
- $120,000 for capital works
- $43,800 contingency

Total cost: $189,800

Land to sell: 3500m^2

5.2 Capital Works Program Summary

The total costing for short, medium and long term projects are provided in Table 5-2 to 5-4. This is an engineering estimate only and is not based on detailed design.

Table 5-2 Engineering Costing's Short Term Projects 2017/2018

Study Location	Total (exc GST)
DSU_000146	$168,350.00
DSU_000251	$293,800.00
DSU_000206	$129,350.00
DSU_001001	$169,000.00
DSU_000250	$403,000.00
DSU_000378	$111,150.00
DSU_000330	$273,000.00
DSU_000121	$273,000.00
DSU_001021	$ 65,000.00
DSU_000413	$172,250.00
Total	$2,057,900.00

Table 5-3 Engineering Costing's Medium Term Projects 2018/2019

Study Location	Total (exc GST)
DSU_000137	$195,000.00
DSU_000181	$162,500.00
DSU_000203	$426,400.00
DSU_000230	$323,700.00
DSU_000205	$445,900.00
Total	$1,553,500.00

Table 5-4 Engineering Costing's Long Term Projects 2019/2020 to 2021/2022

Study Location	Total (exc GST)
DSU_000142	$689,000.00
DSU_000147	$689,000.00
DSU_000151	$280,800.00
DSU_000246	$338,000.00
Total	$1,996,800.00

Table 5-5 provides engineering costs to re-develop sumps which, subject to further detailed studies, be reduced in size.

Table 5-5 Engineering Costing's Re-Developed Sumps

Study Location	Total (exc GST)
DSU_000375	$221,000.00
DSU_000074	$221,000.00
DSU_000144	$221,000.00
DSU_000134	$268,000.00
DSU_000048	$252,850.00
DSU_000084 & DSU_000400	$340,600.00
DSU_000284 & DSU_000285	$286,650.00
DSU_000159	$232,050.00
DSU_000057	$273,000.00
DSU_000343 & DSU_000348	$244,440.00
Basil Loop	$ 54,600.00
DSU_001009	$189,800.00
Total	$2,804,990.00

It is estimated by Cardno that in total 10,450m^2 of land could be made available to landscape/sell after reducing the size of the sumps in Table 5-5. It should be noted, much of these lands may not be applicable for re-development due to other reasons not consider as part of the initial assessment including:

> Planning;

> Sewer;

> Servicing; and

> Community expectations.

These and other reasons will need to be considered as part of a detailed assessment.

6 Discussion

6.1 Drainage Problems & Solutions

The review of the complaints received by the City highlighted a large portion of drainage issues in the City related to poorly designed cross overs and drainage infrastructure after road works had been completed. The following information should be considered by the City to help alleviate problems occurring.

6.1.1 Road Profiles and Crossovers

The maintenance of flood protection to low side lots is largely dependent on the profile of the verge and more importantly that of the down slope lot cross-over. It is commonly observed in the City and has come across in the complaints register where cross-overs provide very little flood protection by grading away into the lot too early and providing as little as 50mm to 100mm of flood protection (Plate 8). This severely impacts on the carriage way conveyance and storage capacity. Gutter flow widths and depths should be assessed inline with an appropriate road design level of service to ensure appropriate flood protection for lots.

Plate 8 Poor Flood Protection Profile

It is recommended Development Application Conditions require all proposed cross-overs to be approved by a City Engineer.

6.1.2 Maintenance

Regular maintenance is inherent to basins and other drainage infrastructure performance in retaining and detaining stormwater safely and efficiently. Although the removal of vegetation may seem like a simple process, a couple of key factors have to be considered for the maintenance plan. Basin and channel management should ideally involve active monitoring of hydraulic efficiency upstream and downstream, water quality and erosion.

Although basin and channel vegetation overgrowth can severely impact storage and conveyance, the ecosystem within the basin or channel can play an important role channel stability, erosion control, sediment control, water quality improvement and scour protection.

An adaptive approach to maintenance needs to be taken whereby by ongoing, broad scale application of herbicide and/or the excavation of vegetation and sediment within the root zone is only done where deemed necessary after active monitoring.

The addition of litter and sediment traps also need to be considered in order to minimise long term maintenance costs and improve hydraulic performance and water quality of both basins and underground storages.

6.1.3 Maintenance Schedule

To ensure that adequate flood protection is provided, scheduled preventative maintenance and regular inspections should be conducted. While vegetation growth within drains and channels can provide nutrient uptake, it also restricts the storage and flow and should be removed periodically to prevent flows being impeded.

Upon installation, inspections of underground storages should occur on a regular basis until sedimentation rates and rubbish collection is known to ensure a suitable maintenance schedule is implemented.

6.1.4 Drainage Pits

Where bubble-up or bubble-in pits are installed, Cardno recommend that the City consider enforcing dumped rather than grouted rock protection so that undermining of infrastructure is minimised. Dumped rock pitching allows rock to fall into areas where undermining might start occurring and can be readily repaired simply by dumping further rock to fill the void.

6.1.5 Sumps

To ensure drainage sumps are installed in accordance with design, it is recommended the City request 3D as-constructed earthworks data for drainage sumps, swales and basins.

6.2 Water Sensitive Urban Design

Water Sensitive Urban Design (WSUD) is an approach to water quantity and quality management through the implementation of sustainable 'soft' engineering measures which improve water quality while also enhancing the landscape and providing amenity to the local community. WSUD systems are primarily used to tackle non-flood management issues, in particular improving stormwater quality and reducing mains water use.

The choice, scale and design of a WSUD system will ultimately be dependent on case and site specific factors which need to be established and assessed before a conceptual design is drawn up. Factors which might need to be assessed include site conditions, runoff management requirements and characteristics of the existing environment, catchment area and the desired end-quality of water, among many others.

Incorporating WSUD within the City's existing drainage system may offer a variety of means of minimising pollution and mitigating the environmental impact on the City's watercourses, valuable wildlife areas and wetlands.

With proper implementation into new and existing infrastructure, WSUD systems can have far reaching benefits not only on environmental and social levels, but also on economic ones. From cutting down on capital costs of a new developments through the reduction in the size of pipe work and stormwater infrastructure, to the improvement in market value of existing developments, the implementation of WSUD systems can prove to be a cost-effective measure to the City's overall water management strategy.

Most WSUD measures, as are proposed within this report, can be retrofitted (in the most cost effective manner) into the existing drainage systems where capacity issues are noted. The merits of retrofitting WSUD over upsizing existing infrastructure is:

> More cost effective than upsizing sumps and pipes;

> Avoids deep excavations;

> Can be fit into existing verges; and

> Contributes to the enhancing biodiversity.

6.2.1 Reduction Targets

A reduction in pollutant loads according to national or regional best practice guidelines should be aimed for in the performance assessment of any proposed treatment system, with the results from this study used as baseline pollutant load. Recommended pollutant load reduction targets, compared to traditional urban drainage where storm water is not treated, are as follows:

> 80% reduction in total suspended solids.

> 65% reduction in total phosphorus.

> 40% reduction in total nitrogen.

> 90% reduction in gross pollutants.

Meeting these reduction criteria through the use of treatment systems is to be done according to best practice principles. Control measure hierarchy for improving water quality is as follows, with the recommendation of using natural systems where possible:

> Source control at allotment level.

> Conveyance control during the transit phase.

> Discharge control at the estate or catchment level before stormwater enters watercourses.

Current best practice approach is to utilise treatment measures at two or more of the above levels, thereby forming a 'treatment train' along the stormwater flow stream. The advantages of a treatment train include minimising the size and cost of treatment measures further downstream of the flow and preventing total system failure should one of the treatment measures fail.

6.2.2 Constraints

Cost and location constraints will play a major role in the ultimate selection of treatment systems. Some of the constraints specific to Cockburn's locality may include:

> Topography and hydraulic considerations such as arterial drainage and wetlands;

> Soil properties (particularly permeability);

> Groundwater levels;

> Costs associated with excavations adjacent to traffic and live services;

> Limited lands available for drainage;

> Potential acid sulphate soils; and

> Budget.

A lifecycle analysis of proposed WSUD measures should also be carried out in order to determine the cost effectiveness of potential solutions.

The following sections describe the most widely used large-scale WSUD systems.

6.2.3 Bioretention Systems

Bioretention systems are one of the most commonly used WSUD measures in Australia. They are deigned to treat stormwater by allowing it to pass through a vegetated filter media, before being exfiltrated into the local soil and/or entering an underlying perforated pipe and being conveyed down the drainage system. This allows the removal of pollutant through gravity-induced filtration, while the overlying vegetation metabolises pollutants, filters some of the gross pollutants and prevents erosion of the filter medium. The benefits of utilizing bioretention systems are many and include the following:

> Fine and soluble pollutant removal;

> Lower cost relative to tradition treatment systems (particularly in a retrofit scenario;

> Reduction in impervious area

> Versatility

> Plants provide habitat for wildlife

> Aesthetics

Bioretention systems are usually implemented in-transit and as end-of-line measures and are typically in the form of bioretention swales and basins. These are described in the sections below.

The focus of bioretention design for Cockburn should be on sustaining vegetation throughout the summer, managing first flush events and coarse sediment, as well as the overall aesthetics of the system.

6.2.3.1 Bioretention Swales

Bioretention swales are swales that have a bioretention system installed in the base and therefore provide both treatment and conveyance functions. The vegetated swale component provides conveyance (and retardation of flow) and pre-treatment of the stormwater through the removal of coarse to medium sediments as the flow passes through the vegetation. The bioretention system, often placed at the end of the swale, removes finer particulates and associated contaminants through fine filtration, extended detention treatment and some biological uptake. Bioretention swales are limited to flows that are not excessive as this will result in scouring of the filter media.

A typical layout of a bioretention swale is shown in Plate 1 below:

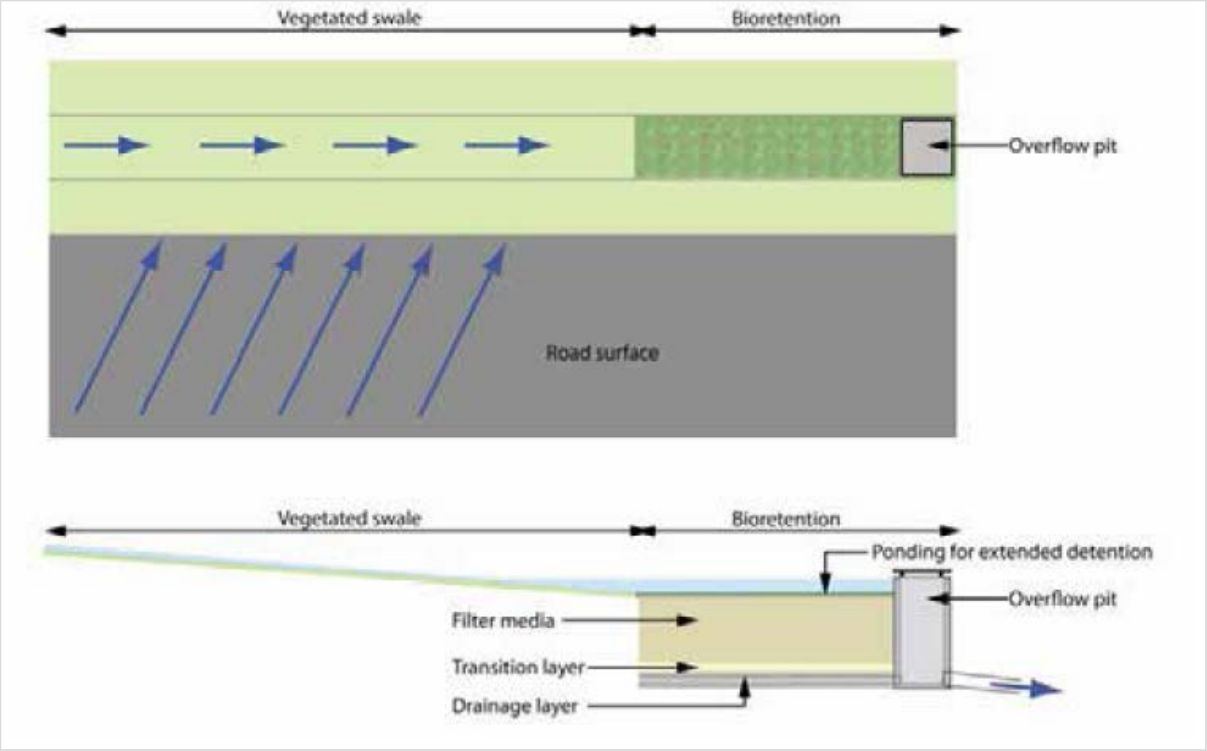


Plate 1 Typical Bioretention Swale Layout

6.2.3.2 Bioretention Basins

Bioretention basins are vegetated basins where runoff is allowed to filter through a densely plated surface before percolating and being filtered through a media layer and subsequently being collected by an underlying perforated drain, conveying it back into the drainage system. This process treats the stormwater through retention, where pollutants are filtered, adsorbed and experience some biological uptake. The vegetation in a bioretention system is a vital element of the system, providing a substrate for biofilm growth within the upper layer of the filter media. The vegetation also facilitates the transport of oxygen to the soil and enhances microbial communities that enhances biological transformation of the pollutants.

Unlike typical bioretention swales, bioretention basins are usually designed with a high-flow bypass, ensuring the filter media is protected from scouring by high velocity flows during larger rainfall events.

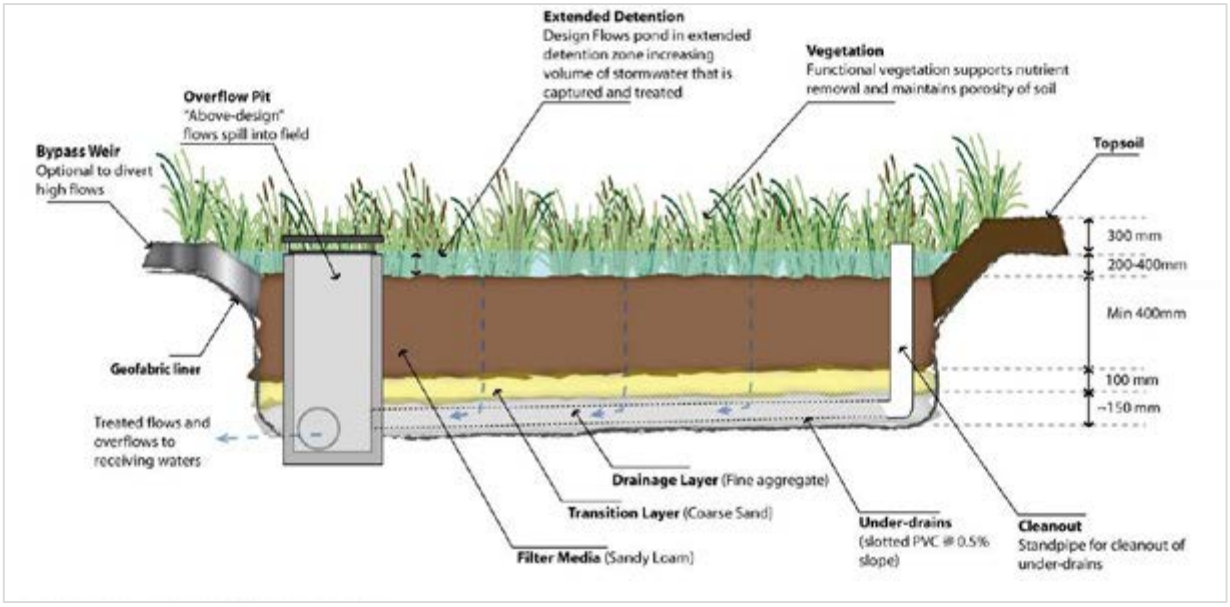


Plate 2 Typical Bioretention Basin Layout

6.2.3.3 Constructed Wetlands

Constructed stormwater wetlands are complex shallow water environments that are densely populated with vegetation. Constructed wetland systems use enhanced sedimentation, fine filtration and biological uptake to treat the stormwater. During a design rainfall event, water level within the constructed wetland will rise and slowly be released over a period of a few days, until the water levels reaches dry-weather levels. Constructed wetlands can greatly enhance biodiversity, and provide amenity to the local community.

The design of constructed wetland usually consists of a sedimentation basin at the inlet to remove coarse sediments, marsh zone to remove fine particulates and soluble pollutants, deep pools to sustain the vegetation during dry periods and a high flow bypass channel. The key elements of a constructed wetland are illustrated below:

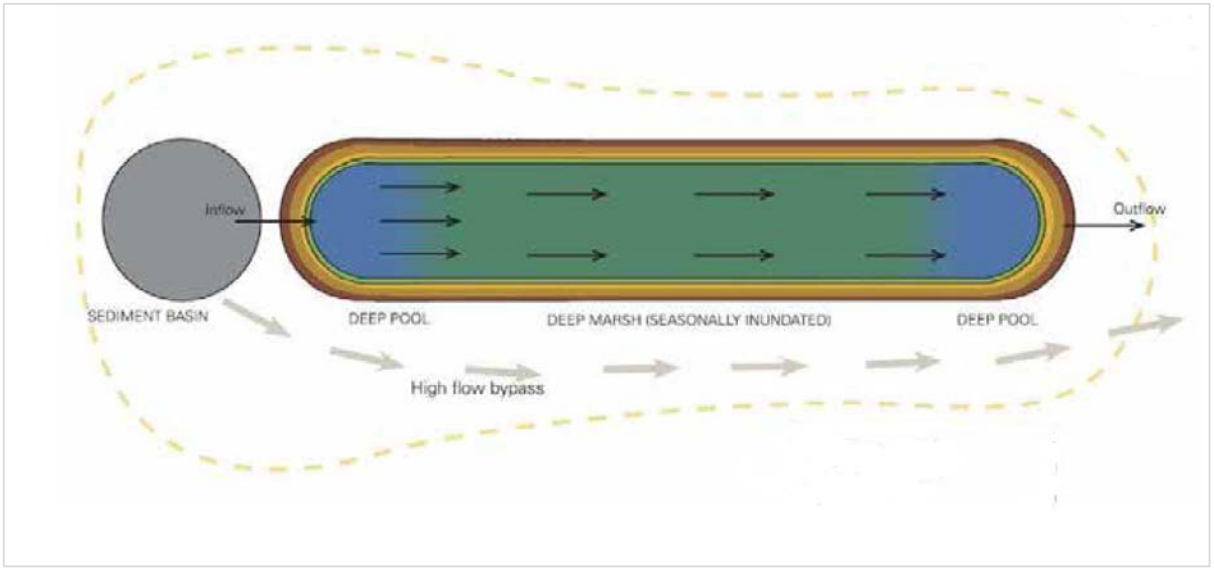


Plate 3 Typical Constructed Wetland Layout

As the stormwater enters the wetland, the flow is slowed down and coarse sediments are allowed to settle in the inlet basin. The flow is then released to the macrophyte zone where is passes horizontally through dense vegetation which removed pollutants by sorption to biofilms on plant stems. The macrophytes also treat water by treating pollutants held within the wetland sediment, uptake of nutrients and heavy metals, physical filtration, inhibiting algal synthesis by providing shade. The vegetation also reduces erosion to the wetland and provides a basis for wetland food chains and supplied shelter for mosquito predators.

6.2.4 At Source Solutions

Various source control options are available for treating stormwater before it enters or soon after it enters the drainage system. Most of these can be retrofitted to the existing system with no major works involved. Due to Cockburn's relatively high permeability of the local soil, source control measures involving infiltration (example permeable paving, soakwells) are suitable for implementation. The following are some examples of source control that can be incorporated to form the upstream part of a treatment train.

> **Infiltration Systems**

Infiltration systems typically consist of excavated soakaways, trenches and basins, all of which are used to detain runoff thereby allowing it to infiltrate into the surrounding soil. Infiltration systems consist of a storage space which is usually constructed out of gravel or similar man-made structures. It is typically wrapped in geotextile fabric through which the water is allowed to infiltrate into the soil.

Infiltration systems are primarily used to detain flows. The runoff usually requires some form of upstream pre-treatment before it reaches the infiltration system.

While infiltration systems may provide a positive impact on the flooding in urbanised catchments they also change the way flow enters the receiving waters. Any large scale infiltration system design option should be reviewed to ensure the change in water supply to receiving waters will not have a detrimental effect on the environment.

Below-ground storage tanks or detention systems such as precast concrete, arch or modular systems (Plate 4) capture and infiltrate stormwater, thereby reducing flow into downstream basins. Any underground infiltration system needs to factor in design considerations for Cockburn as detailed in Section 6.2.5 with each needing to be considered on its own merit for each situation.

Plate 4 Below ground detention systems include pre-cast concrete (above), arch systems (top right) and modular systems (right)

> **Tree Pits**

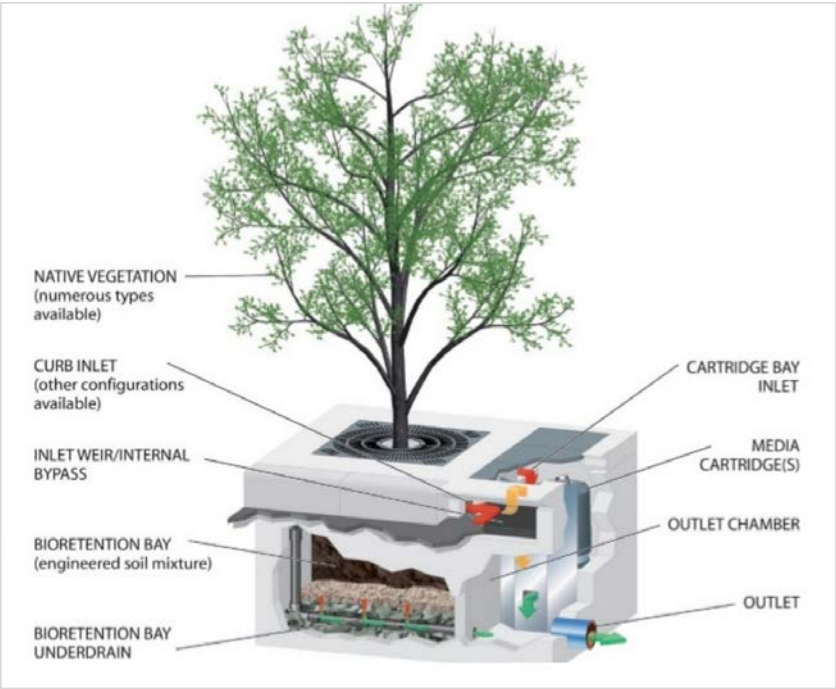
The tree pit system is similar to a regular bio-retention in its function and applications. Its small footprint allows it to be used on highly developed sites such as landscaped areas, parking lots and streetscapes.

Stormwater runoff enters the tree through a kerb-inlet opening and flows into the tree pit filter media. There are several different suppliers and variations on the filter media and flow interception approach for tree pits.

The filter media captures pollutants; those pollutants are then decomposed and incorporated into the biomass of the tree. Stormwater runoff flows through the media and either into an underdrain system or infiltrated into the surrounding soil. These systems can also be coupled with larger detention and infiltration systems, increasing their potential as a flood mitigation system.

This option, provides the benefit of requiring a small financial outlay per system and can be coupled with routine maintenance and upgrade of the drainage network.

Tree pit systems such as UrbanGreen BioFilter™ provide infiltration at the source level. These pits act on the same principles as larger bioretention systems, treating water through bioretention and media filtration.



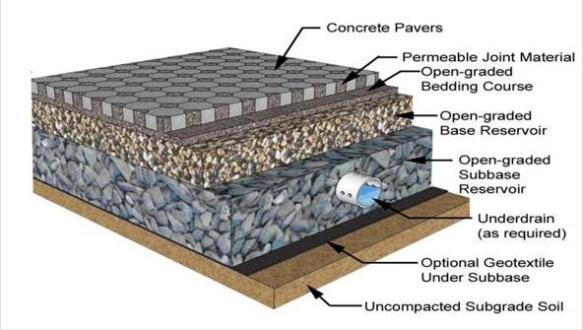
(Source: Stormwater 360)

Plate 5 UrbanGreen BioFilter™ System

Systems of this nature are highly suited to urbanised environments, their small footprint and ability to achieve multiple water cycle objectives (quality and quantity) make the systems increasingly desirable.

> **Pervious Paving**

Pervious paving at existing or new developments to treat water through media filtration while reducing peak flow rates further down the drainage system. This can be considered/mandated in strata developments to address increased impervious runoff associated with infill development targets set out in Directions 2031.

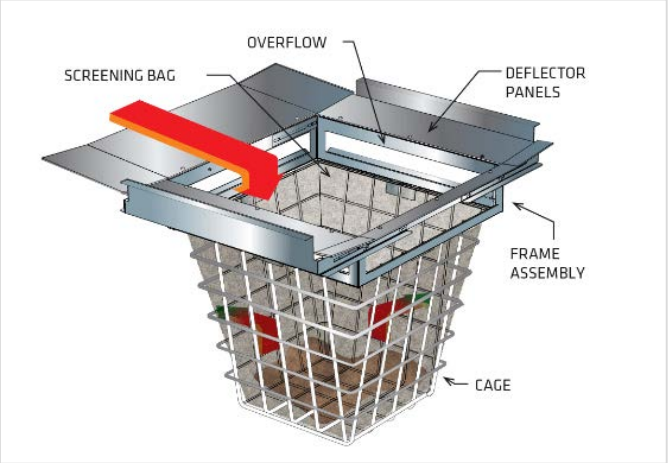


(Source: Virginia Tech)

Plate 6 Typical Pervious Paving Layout

> **Litter Devices**

Catch pit inserts such as the EnviroPod® can be retrofitted to existing curb inlets to capture litter, debris and other pollutants such as oils for systems which require pre-treatment .



(Source: Stormwater 360)

Plate 7 EnviroPod® Insert

6.2.4.1 City of Cockburn Guidelines

When considering retrofitting existing systems with at source solutions, the City guidelines for installation of underground chambers within new subdivisions should also be applied. This includes:

> The base of the chambers to be at least 0.5m above maximum groundwater level (MGL);

> Manhole with sand baffles to be installed prior connecting stormwater pipes to the underground chambers;

> Underground chambers to be constructed in accordance to manufacturer's design and specifications;

> Trapped drainage pits with soakage to be installed as standard drainage pits, pits also to have trash racks;

> Underground chambers are preferred to be installed upstream in the catchment; and

> Underground chambers to be installed within the verge area.

6.2.5 Design Considerations for Cockburn

The following outlines key design considerations for WSUD to be implemented within the City of Cockburn:

> **At Source**: Given a large proportion of City of Cockburn lies on sandy soils, at source treatment and infiltration should be given greatest priority. At source controls reduce the burden on the downstream receiving environment helping to reduce risk to the public (i.e. depth of ponded water) and infrastructure (i.e. trapped low points overflowing and impacting on property).

- **Maintenance**: Design of at source solutions (with special consideration given to underground storages) need to consider maintenance requirements. During detailed design, maintenance and ease of accessibility need to be given top priority.
- **Landscape and Community Acceptance:** WSUD structures should provide public amenity and enhance the aesthetic character of the location. The vegetation should integrate into the environment and the basin should be a landscape feature of interest to the community. This usually requires collaboration between various stakeholders including engineers, landscape architects, urban designers and the local community.
- **Hydraulic Design:** The hydraulic design of the basin should ensure effective treatment while minimizing damage from stormwater flows. The following aspects should be considered:
    - The filter media surface must be flat to ensure even flow dispersion and prevent scour and damage to the media.
    - Temporary ponding (up to 0.3 m depth) within the basin can help in reducing flow velocities and improve the treatment capability of the system.
    - An overflow pit or bypass channel should be located at the inflow zone to prevent high flows damaging the filter media.
- **Filter Media:** The choice of filter media should reflect the overall requirements of the design and will be influenced by site-specific factors. These may include:
    - The depth of extended detention.
    - Surface Area of filter media.
    - Suitability as a growing media required to sustain vegetation during dry periods.
- **Saturated Zone:** The saturated zone in the basin has two main purposes. It provides the moisture needed by the vegetation during dry periods and enhances nitrate removal of the system. The saturated zone should be composed of medium to coarse sand, gravel and small rock, with no fine soils present.
- **Vegetation:** The vegetation in the basin should cover whole surface of the filter media. The vegetation should serve the purpose of preventing scour and the re-suspension of sediments, preventing clogging of the filter media through agitation from root growth and wind, while being able to withstand the design flows. Additionally, the vegetation acts as a treatment measure itself through biological uptake and by providing a substrate for biofilm growth.

7 Recommendations

While the information provided is sufficient to make educated decisions regarding potential drainage upgrades and feasible mitigation options, there are still data gaps that exist which may enable more effective utilisation of drainage upgrade budgets.

The following section discusses potential additional studies that can be undertaken to further improve the councils understanding of the drainage network and the impacts it presents on the community.

7.1 Further Modelling

As noted in Section 2, the City has arterial drainage connecting multiple storage basins. The capacity of such systems were not modelled as part of this study. The City should give consideration to undertake 2D flood modelling of arterial drainage routes and associated basins to identify any shortfalls or opportunities, similar to the approach utilised within this report.

It should be noted that no complaints were received regarding flooding or under capacity arterial drains. Complaints received were mainly in relation to water standing for long periods after rainfall events. Modelling of systems may allow channel profiles and basin storages to be maximised to minimise land take and the associated flooding footprint.

7.2 Combined Asset Condition and Capacity Review

The assessment undertaken as part of this report was to determine areas within the catchment that are currently poorly serviced by the existing drainage network. This assessment is based only on the hydraulic capacity of the network and does not consider other critical elements of the network, such as age of the system or the effectiveness compared to the surrounding network.

It is recommended that a combined capacity – condition assessment is undertaken for the catchment. This assessment will highlight the areas which are likely to require replacement in the near future due to the age of the asset as well as determine the current capacity of the asset relative to the surrounding network. This will enable a more focussed maintenance and upgrade plan to be developed, enabling more effective use of available funds.

7.3 Cost Benefit Analysis

The assessment undertaken to prioritise mitigation options has been based upon the hydraulic model results. At this stage the assessment is based purely on the depth and extent of flooding experienced rather than a quantifiable impact on infrastructure and the community.

The costs associated with the impacts of flooding in the catchment can be established using previous information. This analysis utilises data gathered during previous flood events to quantify the monetary impact of flooding on properties within the catchment.

By undertaking this assessment the value of potential mitigation options can be quantified. This analysis will provide more confidence in the effectiveness of the mitigation options and ensure potentially expensive options are prioritised.

7.4 Community Consultation, Participation

While the drainage assessment provides information relevant to council, upgrade works and works undertaken in public open space can often result in community enquires into the works. By providing community consultation prior to the works being undertaken, the Council can ensure the upgrade works consider all potential community benefits / impacts. The community consultation process can be invaluable in the development of drainage options, particularly options which will visually alter the neighbourhood or result in inconvenience for residents during the construction process.

The community consultation process can also be a useful tool in determining the communities understanding of flooding in their area. The process may highlight issues not previously identified or inform council that the community as a whole has a strong (or weak) understanding of flood risks in their surrounds.

7.5 Monitoring

It is recommended that continuous rainfall data and catchment sump water level data is collected following storm events to help calibrate runoff coefficients for the sub-catchment and sump infiltration rates which will be invaluable for future sump upgrade design work. Valuable measurements would be:

> Max sump water level mark for a large storm event. This could be obtained from adjacent lot owner observation or by installing a simple plastic ball and clear tube system with a one way valve.

> Rate of infiltration, measurement of sump water level within 24hours of a known event. A graduated staff in the sump would allow accurate reading from a distance.

This information would optimise upgrade designs and assist in identifying the likely service limitation of the system.

8 References

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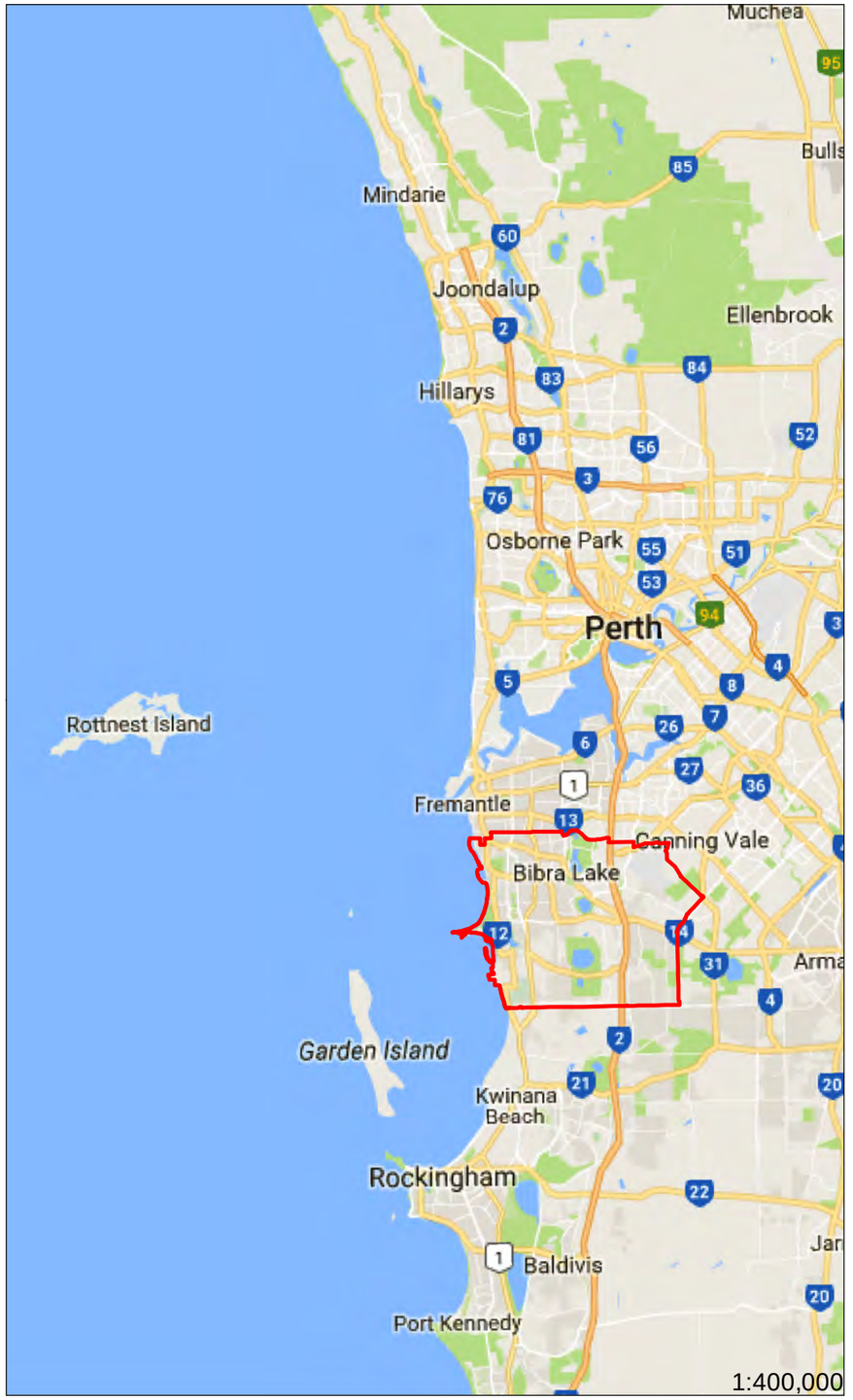
City of Cockburn

FIGURES

Cardno
Shaping the Future



Legend

Study Area

Data Source: Nearmap (2017)

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24/05/2017

Size
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Scale
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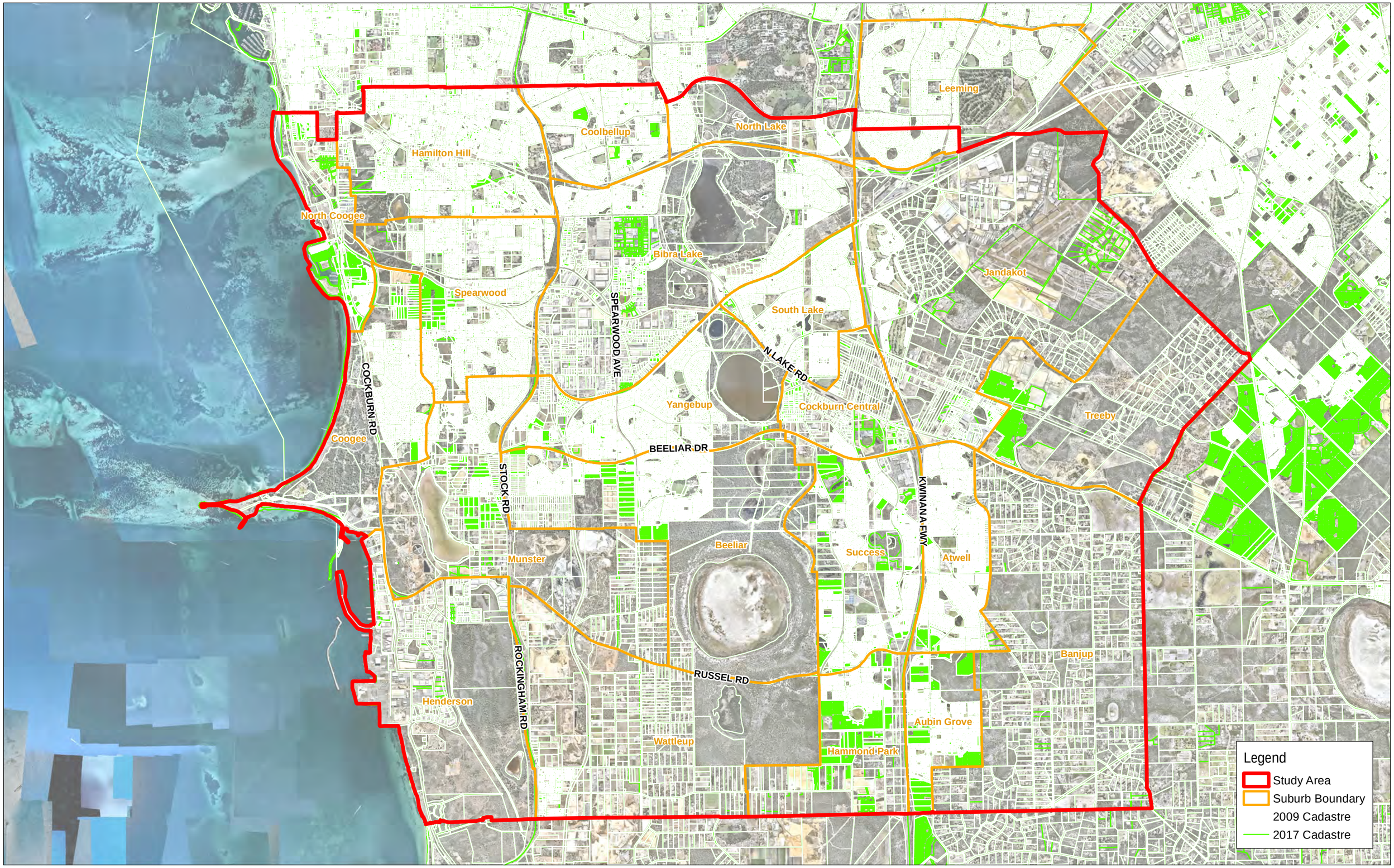
Kilometers

FIGURE 1: LOCATION PLAN

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY



Data Source: City of Cockburn (2009), City of Cokburn (2017), Nearmap (2017)

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Size
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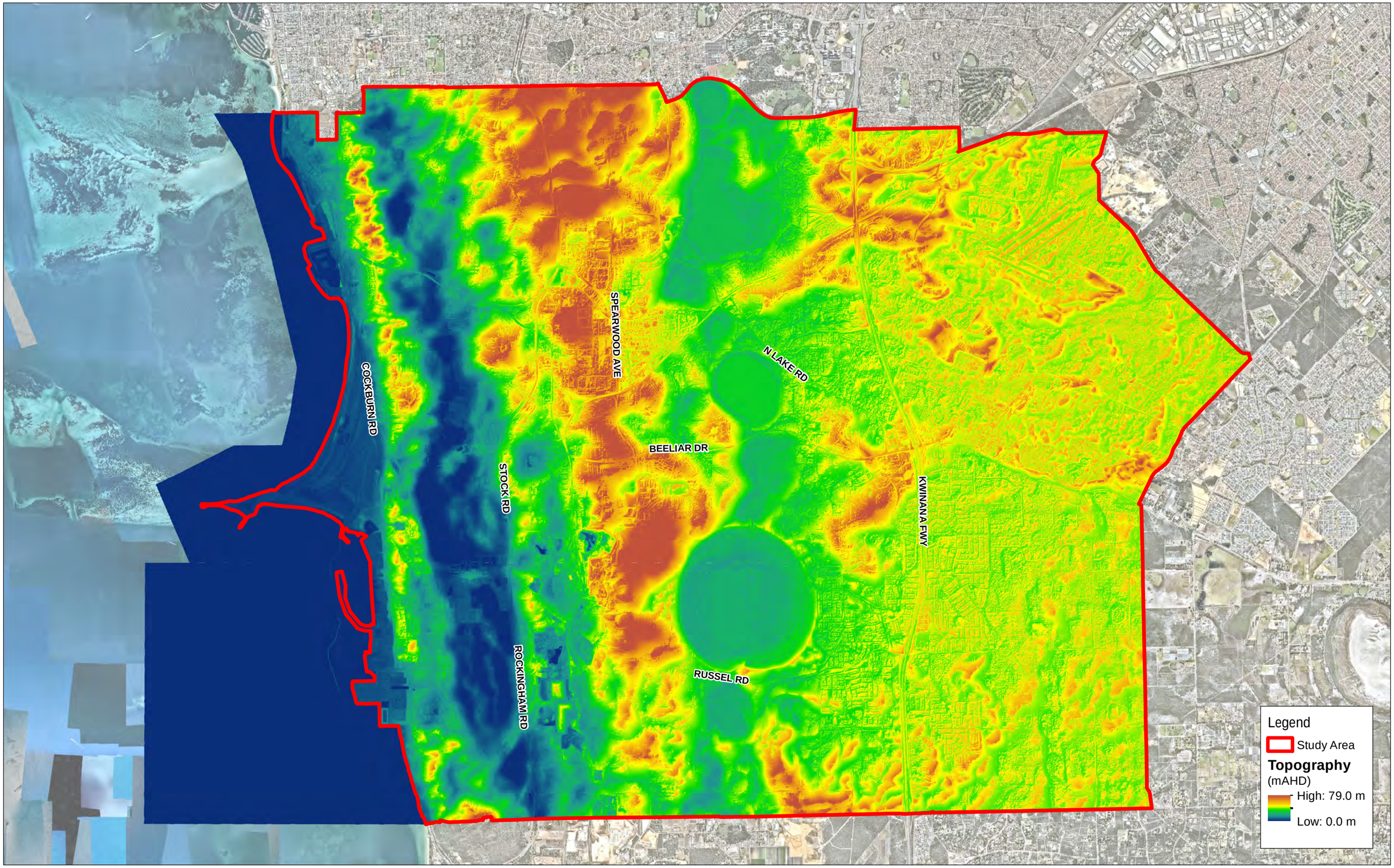
FIGURE 2: LAND USE CHANGE

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY



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<Office Location> Tel. <xx xxxx xxxx>

Date
24/05/2017

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Scale
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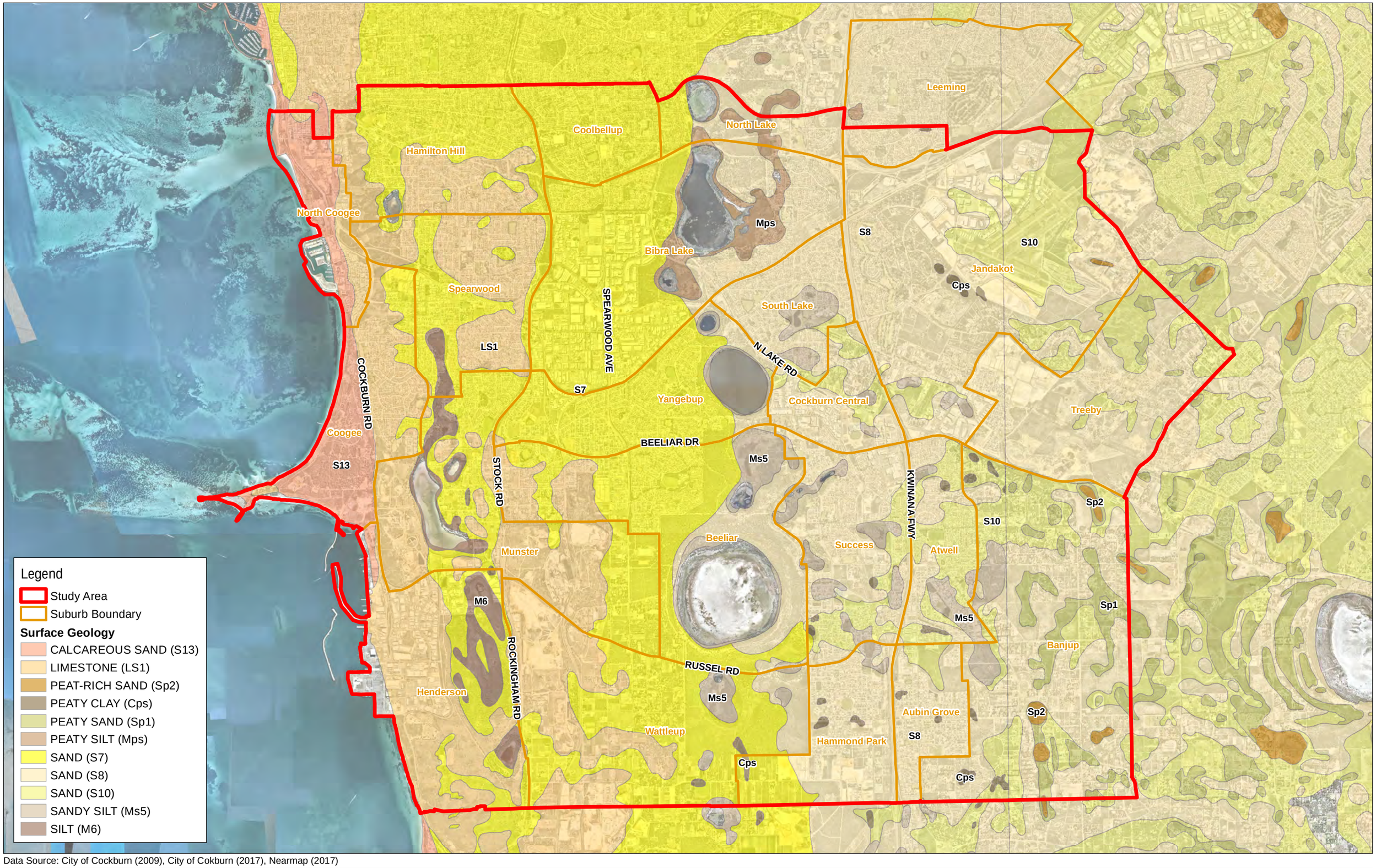
Kilometers

FIGURE 3: TOPOGRAPHY

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY



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Shaping the Future

<Office Location> Tel. <xx xxxx xxxx>

Date
24/05/2017

Size
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Scale
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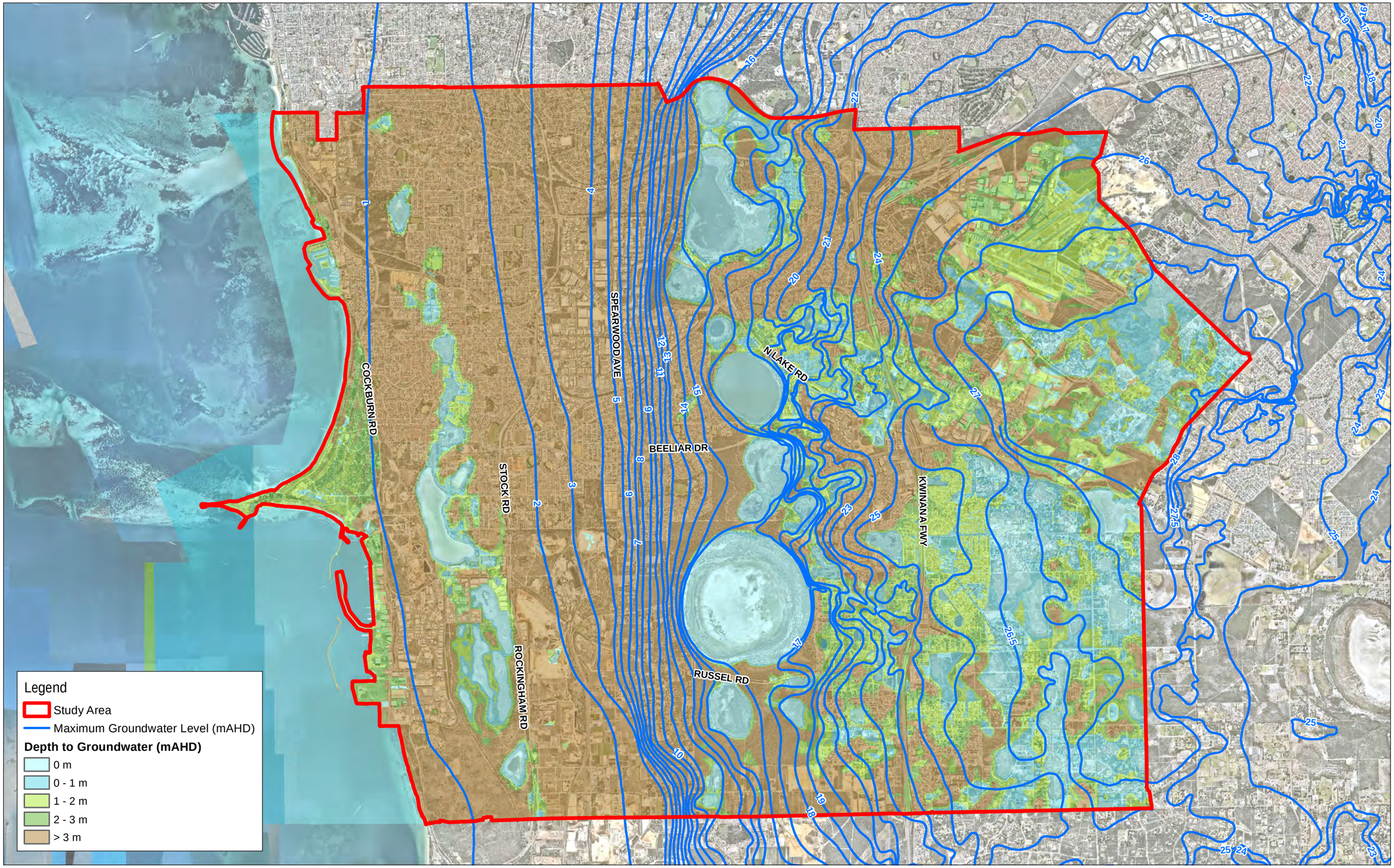
0 0.5 1 2 3
Kilometers

FIGURE 4: SURFACE GEOLOGY

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY



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Shaping the Future

<Office Location> Tel. <xx xxxx xxxx>

Date
26/05/2017

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Scale
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Kilometers

FIGURE 5: GROUNDWATER MAPPING

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY

Data Source: DPaW (2016), Nearmap (2017)

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24/05/2017

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Scale
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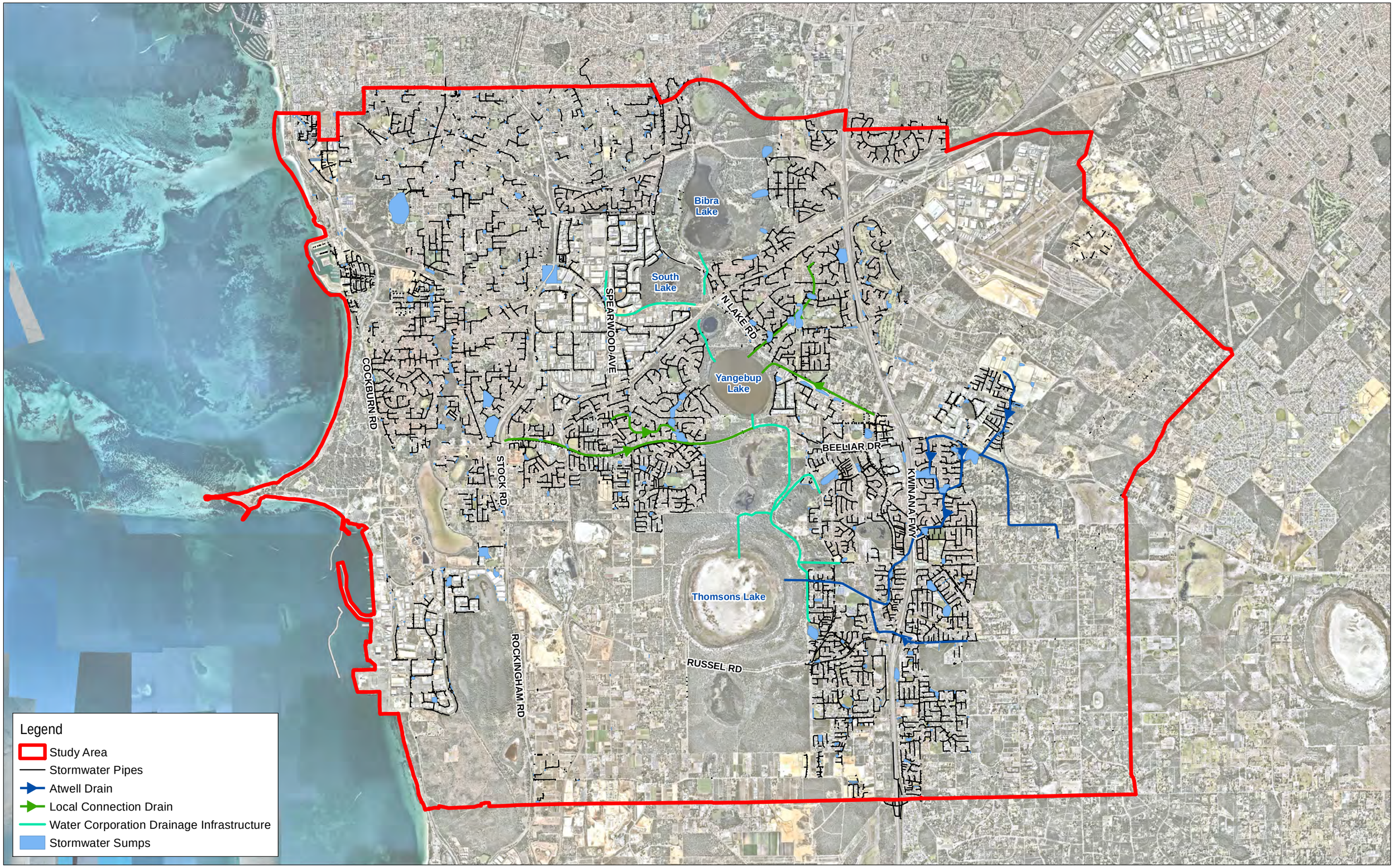
Kilometers

FIGURE 6: WETLANDS

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY



Data Source: DoW (2004), Nearmap (2017)

DATE PLOTTED:24/05/2017 4:01:16 PM BY: ANIN.DHARMA
FILE: U:\Projects\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_TechnicalWater\Drawings\GIS_Figures\Figure_7.mxd

Cardno
Shaping the Future

<Office Location> Tel. <xx xxxx xxxx>

Date
24/05/2017

Size
A3

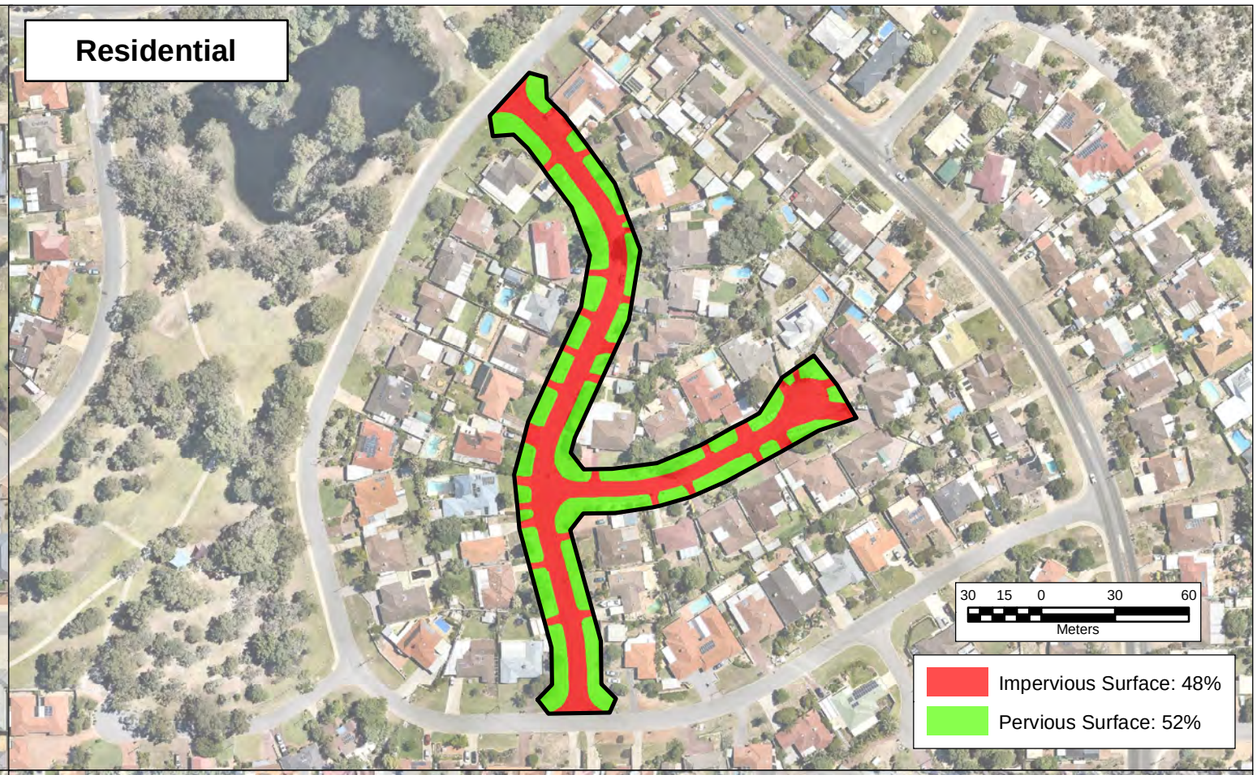
Scale
1:56,170

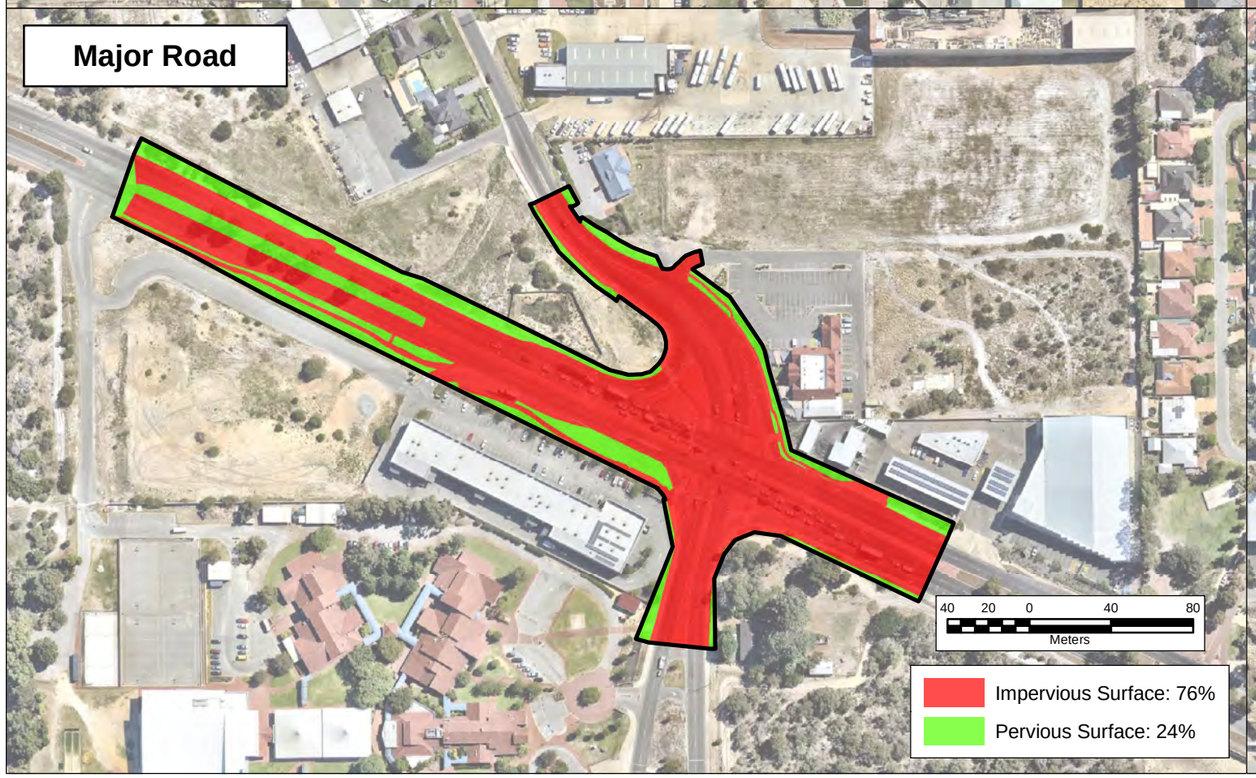
0 0.5 1 2 3 Kilometers

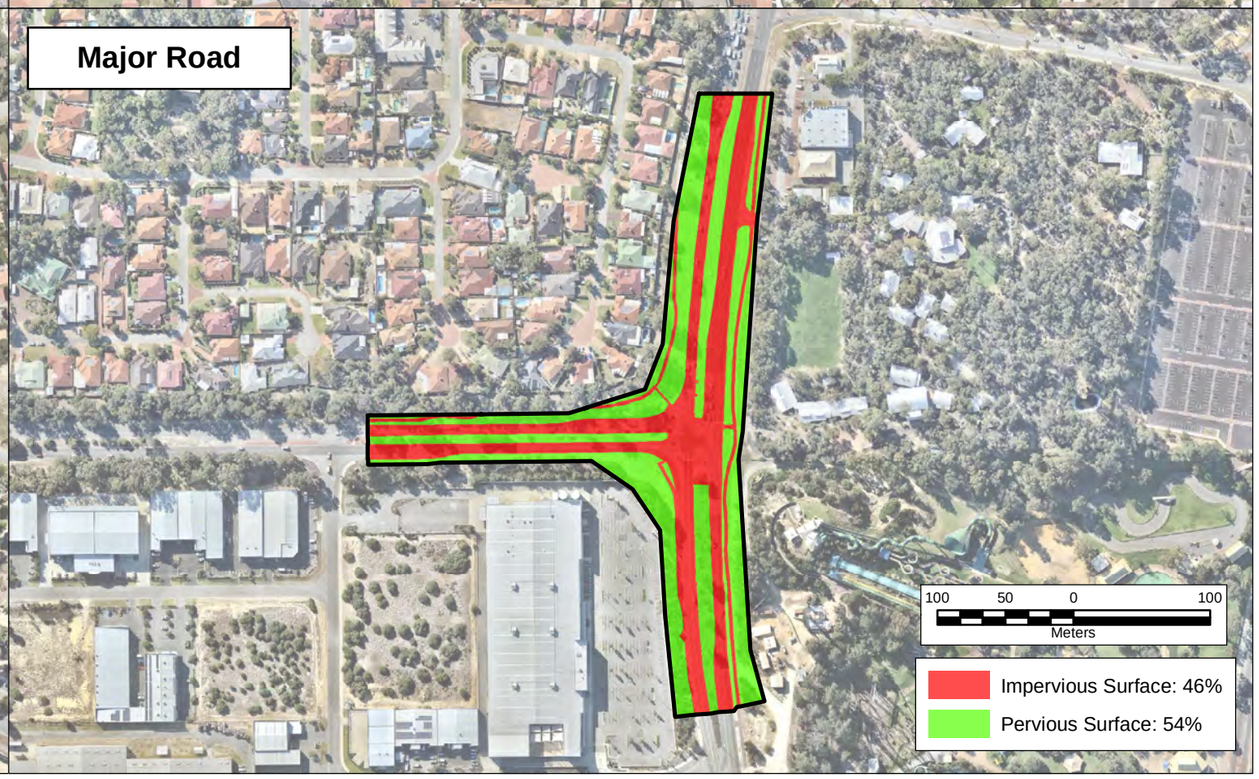
FIGURE 7: DRAINAGE INFRASTRUCTURE

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY







Data Source: Nearmap (2017)

DATE PLOTTED:24/05/2017 3:04:09 PM BY: ANIN.DHARMA
FILE: U:\Projects\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_TechnicalWater\Drawings\GIS_Figures\Figure_8.mxd

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<Office Location> Tel. <xx xxxx xxxx>

Date
24/05/2017

Size
A3

Scale
1:2,000

FIGURE 8: RUNOFF COEFFIECIENTS

CITY OF COCKBURN

DRAINAGE CATCHMENT STUDY

City of Cockburn

APPENDIX A

CALCULATION SHEETS

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ATWELL

Sump	Runoff						Basin									Comments	Available Data	Action Required	Risk Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m^3)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000091_DSU_000092	32968	0.50	16484	3	22.9	1133	938	28.8	746	5	1133.4	387.6	192	28.8	1.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000313	171878	0.53	87638	0.5	68.2	2991	39521	27	12146		2990.8		27375	26.2	0.8	Flood volume from UWMP.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000351	11825	0.65	7751	12	9.82	914	119	27.7	665	5	914.0	248.7	-546	27.8	1.4	Overflow likely to spill onto undeveloped land surrounding the basin and may spill onto Gibbs Rd.	COMPLETE	NONE	NO	NO	YES	1
DSU_000382	6152	0.60	3691	72	2.34	622	0	0	622	5	622.4	0.0	-622	#N/A	#N/A	Infiltration area approaching 3000 m2, unlikely to represent flood risk.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	TBC	TBC
DSU_001001	143912	0.57	84643	6	15.2	7726	4453	26.7	4349	5	7725.6	3376.6	104	26.7	1.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001036	17981	0.55	9702	0.5	68.2	331	6278	25.5	2296		331.1		3982	24.6	1.1	Flood volume from UWMP.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001037	42085	0.60	25251	2	29.1	1471	3211	25.6	1939		1470.8		1272	25.1	1.5	Flood volume from UWMP.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001038	134334	0.60	80600	72	2.34	13590	19316	27	6407		13590.4		12909	26.1	0.9	Flood volume from UWMP.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001039	195361	0.60	117217	72	2.34	19764	8041	26	5997				2044	25.8	1.2	Flood volume from UWMP.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000294	131005	0.60	78603	72	2.34	13254	29159	27.1	13254	0	13253.6	0.0	15905	26.2	1.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000218	151058	0.60	90635	72	2.34	15282	23510	27.3	15282	0	15282.4	0.0	8228	27.0	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000256	70917	0.60	42550	72	2.34	7175	1442	25.8	7175	0	7174.6	0.0	-5732	25.9	0.6	Overflow spilsl onto Kurrajong Park.	COMPLETE	NONE	NO	NO	YES	1

AUBIN GROVE

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000318	35833	0.60	21500	12	9.82	2536	674	26.3	1490	5	2535.6	1045.1	-816	26.4	1.6	Overflow spills onto Tangle Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_000329	41143	0.55	21837	1	44.2	966	2058	26.8	583	5	966.0	382.9	1475	26.4	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000343	20525	0.60	12315	3	22.9	847	1757	26.5	497	5	846.7	349.8	1260	24.9	1.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000348	26903	0.60	16142	3	22.9	1110	1519	25.3	741	5	1109.8	368.4	777	24.4	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000349	12150	0.60	7290	2	29.1	425	305	26.1	267	5	424.6	158.1	38	26.1	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000350	66880	0.60	40128	24	5.92	5706	250	24.9	4173	5	5705.9	1532.8	-3923	25.0	0.8	Overflow spills onto Balboa Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_000352	104100	0.60	62460	24	5.92	8881	209	25.6	6114	5	8881.4	2767.0	-5905	25.7	0.4	Overflow spills onto Jandakot Regional Park.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000353	28272	0.60	16963	6	15.2	1548	323	25.8	946	5	1548.3	602.5	-622	25.9	0.7	Overflow spills onto Jandakot Regional Park.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000369	5070	0.60	3042	72	2.34	513	0	0	513	5	512.9	0.0	-513	#N/A	#N/A	Relatively small runoff volume. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000370	9732	0.60	5839	72	2.34	985	0	0	985	5	984.6	0.0	-985	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000405	24180	0.60	14508	72	2.34	2446	0	0	2446	5	2446.3	0.0	-2446	#N/A	#N/A	Relatvely large park area. Unlikely to overflow.	NO		NO	NO	YES	TBC
DSU_000407	42018	0.60	25211	2	29.1	1468	1653	26.1	938	5	1468.4	530.5	715	25.8	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000448	11200	0.50	5600	72	2.34	944	0	0	944	5	944.2	0.0	-944	#N/A	#N/A	Relatvely large area. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data				TBC
DSU_001015	11058	0.60	6635	0.5	68.2	226	1663	26.3	-26	5	226.4	252.9	1689	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001016	23330	0.60	13998	72	2.34	2360	0	0	2360	5	2360.3	0.0	-2360	#N/A	#N/A	Large basin area. If overflow were to occur, it would likely spill onto adjacent park.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	YES	TBC
DSU_001017	0	#DIV/0!	0	0.5	68.2	0	26151	26.5	-620	5	0.0	619.7	26770	#N/A	#N/A	Very large storage within this basin. Unlikely to overflow.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000323_DSU_000324	65762	0.60	39457	0.5	68.2	1347	9762	26.4	711	5	1346.6	636.0	9052	25.2	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000393	17250	0.60	10350	6	15.2	945	605	30.69	628	5	944.7	316.3	-23	30.8	2.6	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	YES	NO	No Overflow
DSU_001018	5418	0.60	3251	72	2.34	548	0	0	548	5	548.1	0.0	-548	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001019	24580	0.60	14748	72	2.34	2487	0	0	2487	5	2486.7	0.0	-2487	#N/A	#N/A	Overflow likely to spill onto adjacent bushland.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001020	16046	0.60	9628	1	44.2	426	166	25.9	250	5	425.9	176.3	-84	26.0	0.3	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow

BANJUP

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m^3)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_001021	42085	0.60	25251				21263		56267	0		613.1	-35004	26.1		Flood volume from UWMP	COMPLETE	COMPLETE	YES	YES	NO	3

BEELIAR

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m^3)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000101	31816	0.60	19090	6	15.2	1742	1866	21.1	1163	5	1742.4	579.8	703	20.2	3.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000102	4736	0.60	2842	12	9.82	335	26	24	246	5	335.1	88.8	-221	24.1	0.8	No significant flooding. Overflow spills onto POS and not likely to cause flooding.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000237	44270	0.60	26562	3	22.9	1826	5808	11.6	1048	5	1826.3	778.6	4761	8.9	1.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000257	123400	0.60	74040	12	9.82	8732	1533	28.2	6122	5	8731.9	2609.6	-4589	28.3	1.3	Overflow spills onto Beeliar Oval	COMPLETE	NONE	NO	NO	YES	1
DSU_000279	18130	0.60	10878	3	22.9	748	1971	37.1	486	5	747.9	261.7	1485	34.7	2.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000280	63310	0.60	37986	6	15.2	3467	4304	22	2322	5	3467.1	1145.2	1982	20.6	2.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000281	4997	0.60	2998	72	2.34	506	0	0	506	5	505.5	0.0	-506	#N/A	#N/A	Relatively small runoff volume. If overflow occurs, it would likely spill onto adjacent bushland.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000282	3795	0.60	2277	72	2.34	384	0	0	384	5	383.9	0.0	-384	#N/A	#N/A	Relatively small runoff volume. If overflow occurs, it would likely spill onto adjacent bushland.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000293	21940	0.60	13164	3	22.9	905	2175	22.6	507	5	905.1	398.1	1668	20.6	1.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000311	105348	0.60	63209	6	15.2	5769	4690	6.1	3439	5	5769.3	2330.1	1251	5.7	1.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000375	13510	0.60	8106	3	22.9	557	1087	24.5	309	5	557.3	248.7	779	23.0	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000381	1160	0.70	812	72	2.34	137	0	0	137	5	136.9	0.0	-137	#N/A	#N/A	Runoff volume not significant (< 200m3). Storage provided in pits and pipes.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000389	8072	0.60	4843	72	2.34	817	0	0	817	5	816.6	0.0	-817	#N/A	#N/A	Small basin, may overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	YES	YES	TBC
DSU_001022	22640	0.60	13584	72	2.34	2290	0	0	2290	5	2290.5	0.0	-2290	#N/A	#N/A	Large basin. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001023	57560	0.60	34536	1	44.2	1528	4842	31.5	1029	5	1527.7	499.2	3813	30.4	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001024	15410	0.60	9246	1	44.2	409	757	37.5	241	5	409.0	167.5	515	37.1	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001025	12550	0.60	7530	1	44.2	333	1009	54.4	187	5	333.1	146.1	822	53.6	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001026	24680	0.60	14808	72	2.34	2497	0	0	2497	5	2496.8	0.0	-2497	#N/A	#N/A	Large basin. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001027	26320	0.60	15792	72	2.34	2663	0	0	2663	5	2662.8	0.0	-2663	#N/A	#N/A	Large basin. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001028	7128	0.60	4277	72	2.34	721	0	0	721	5	721.1	0.0	-721	#N/A	#N/A	Relatively small runoff volume. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC

BIBRA LAKE

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Critical Rainfall Duration (hour)	Critical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000053	25130	0.60	15078	3	22.9	1037	1922	33.6	625	5	1036.7	411.5	1296	32.1	1.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000060	10998	0.50	5499	3	22.9	378	658	22.2	205	5	378.1	172.7	452	21.0	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000061	670	0.60	402	1	44.2	18	12	22.4	12	5	17.8	6.2	0	22.4	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000062	13260	0.60	7956	3	22.9	547	881	19.5	327	5	547.0	219.8	554	18.4	1.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000063	17771	0.60	10663	2	29.1	621	1978	29.9	371	5	621.1	250.4	1608	28.0	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000064	12171	0.60	7303	3	22.9	502	522	30.8	337	5	502.1	164.7	185	30.4	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000065	16755	0.60	10053	6	15.2	918	803	45.8	532	5	917.6	385.9	271	45.3	2.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000066	16070	0.60	9642	1	44.2	427	1886	42.1	249	5	426.5	177.4	1637	40.6	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000067	17132	0.60	10279	2	29.1	599	1631	53.3	328	5	598.7	270.4	1303	51.7	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000068	35042	0.65	22566	6	15.2	2060	2497	34.2	1157	5	2059.6	902.3	1339	32.9	1.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000103	17607	0.53	9826	6	15.2	897	1098	32.3	460	5	896.9	436.9	638	31.0	2.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000104	4839	0.60	2903	1	44.2	128	435	37.8	81	5	128.4	47.7	354	36.6	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000105	33220	0.60	19932	6	15.2	1819	917	29.1	1233	5	1819.3	586.0	-316	29.2	1.9	Overflow likely to spill onto undeveloped land east of basin.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000106	11023	0.55	6348	3	22.9	436	794	27.5	261	5	436.4	175.3	533	26.2	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000107	2502	0.60	1501	0.5	68.2	51	393	32.1	34	5	51.2	17.2	359	30.2	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000108	20443	0.50	10222	6	15.2	933	852	21.7	502	5	932.9	430.6	350	21.1	1.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000110	14364	0.60	8618	6	15.2	787	375	41.3	523	5	786.6	264.1	-147	41.4	2.0	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000111	13101	0.60	7861	1	44.2	348	1663	31.6	199	5	347.7	149.2	1464	30.0	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000112	37030	0.70	25921	6	15.2	2366	2079	22.3	1592	5	2365.9	774.2	487	21.8	2.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000113	10701	0.60	6421	2	29.1	374	995	26.1	224	5	374.0	150.3	772	24.3	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000114	55747	0.60	33448	12	9.82	3945	3494	31.3	2244	5	3944.7	1700.2	1250	30.2	4.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000115	20310	0.60	12186	1	44.2	539	4137	28.9	344	5	539.1	194.9	3793	25.5	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000116	18317	0.60	10990	0.5	68.2	375	5450	31.5	238	5	375.1	137.1	5212	28.5	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000117	21645	0.80	17316	24	5.92	2462	155	29	1782	5	2462.2	680.3	-1627	29.1	1.1	Basin catchment is the Stock Road Central shopping development. Overflow spills onto Spearwood Ave.	COMPLETE	NONE	NO	NO	YES	1
DSU_000244	1642	0.70	1149	12	9.82	136	17	32.5	78	5	135.6	57.4	-61	32.6	0.7	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000245	39133	0.60	23480	12	9.82	2769	1313	24.6	1582	5	2769.1	1187.2	-269	24.7	2.9	No significant flooding. Overflow spills onto light industrial property south of basin.	COMPLETE	NONE	NO	YES	NO	2
DSU_000284	6123	0.80	4898	3	22.9	337	498	40.2	205	5	336.8	131.4	293	39.3	1.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000336	24736	0.60	14842	6	15.2	1355	1079	22.3	816	5	1354.6	538.2	263	22.0	1.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000337	33339	0.65	21171	12	9.82	2497	741	23.6	1571	5	2496.7	925.9	-830	23.7	1.9	Basin is interconnected to DSU_000336. Overflow spills onto South Lake Nature Reserve.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000338	46000	0.60	27600	24	5.92	3925	178	17.5	2860	5	3924.5	1064.8	-2682	17.6	0.9	Overflow likely to spill onto South Lake Reserve and may spill onto North Lake Rd.	COMPLETE	NONE	NO	NO	YES	1
DSU_000356	71407	0.55	42478	6	15.2	3877	2677	19.1	2581	5	3877.0	1295.8	96	19.1	2.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000377	8656	0.60	5194	72	2.34	876	0	0	876	5	875.7	0.0	-876	#N/A	#N/A	Relatively small runoff volume compared to area of basin. Not lilely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000395	28304	0.60	16982	6	15.2	1550	863	37.5	1071	5	1550.0	478.8	-208	37.6	2.1	Very minor overflow onto undelevoped land possible. Not likely to have any impact.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000413	41399	0.60	24839	6	15.2	2267	1108	22.3	1510	5	2267.2	757.6	-401	22.4	1.6	Overflow spills onto undeveloped bushland to the east of the basin.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001009	59956	0.60	35974	6	15.2	3283	4681	33.1	1882	5	3283.4	1401.0	2798	31.3	1.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001029	49070	0.50	15565	6	15.2	1421	244	28.5	750	5	1420.7	671.1	-506	28.6	0.6	Overflow likely to spill onto adjacent bushland.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001030	26738	0.50	13369	0.5	68.2	456	10440	17.2	-252	5	456.2	708.0	10692	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001031	211200	0.60	126720	2	29.1	7381	4512	17	4617	5	7381.0	2763.8	-106	17.1	0.9	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001032	44670	0.63	28253	0.5	68.2	964	9866	18.2	435	5	964.2	529.5	9431	16.9	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001033	73280	0.60	43968	3	22.9	3023	1933	17	1877	5	3023.0	1146.4	56	17.0	1.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001034	87920	0.80	70336	12	9.82	8295	7122	27	5188	5	8295.0	3106.8	1934	26.1	4.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000161	22340	0.50	11170	24	5.92	1588	72	46	1106	5	1588.3	482.1	-1034	46.1	0.8	Overflow likely to spill onto lot west of basin.	COMPLETE	NONE	NO	YES	NO	2
DSU_001035	0	#DIV/0!	0	1			83969	27.5	-1277	5	0.0	1277.3	85246	#N/A	#N/A	Very large storage in wetland, not likely not overflow.	COMPLETE	NONE	NO	NO	NO	No Overflow

COCKBURN CENTRAL

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m^3)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000090	33497	0.57	19258	3	22.9	1324	656	22.8	843	5	1324.1	481.0	-188	22.9	0.8	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000098	20909	0.60	12545	3	22.9	863	1591	29.5	482	5	862.6	380.3	1109	28.2	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000099	15988	0.60	9593	2	29.1	559	312	30.3	306	5	558.7	253.1	6	30.3	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000283	27826	0.53	15495	6	15.2	1414	847	32.6	915	5	1414.3	499.4	-68	32.7	2.2	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000399	42268	0.60	25361	0.5	68.2	865	3932	20.8	510	5	865.5	355.0	3421	20.1	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001043	0	#DIV/0!	0	0.5	68.2	0	0	0	0	5	0.0	0.0	0	#N/A	#N/A	Catchment Unknown. Basin is part of group of 3 large basins. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001044	0	#DIV/0!	0	0.5	68.2	0	0	0	0	5	0.0	0.0	0	#N/A	#N/A	Catchment Unknown. Basin is part of group of 3 large basins. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001045	0	#DIV/0!	0	0.5	68.2	0	0	0	0	5	0.0	0.0	0	#N/A	#N/A	Catchment Unknown. Basin is part of group of 3 large basins. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000481_000482_000483	85230	0.60	51138	72	2.34	8623	0	0	8623	5	8622.6	0.0	-8623	#N/A	#N/A	Large basin area. Overflow unlikely, if overflow occurred, it would spill onto DSU_001046	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001046	0	#DIV/0!	0	0.5	68.2	0	0	0	0	5	0.0	0.0	0	#N/A	#N/A	Likely takes overflow from DSU_000481_000482_000483	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC

COOGEE

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000050	129292	0.50	64646	12	9.82	7624	1502	5.2	5258	5	7624.0	2365.8	-3757	5.3	2.5	Overflow spills onto undeveloped land west of the basin.	COMPLETE	NONE	NO	NO	YES	1
DSU_000051	46300	0.60	27780	12	9.82	3276	835	17.4	2461	5	3276.2	815.3	-1626	17.5	2.4	Part of catchment also drains to DSU_000186. Overflow spills onto Picotee Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_000052	51884	0.60	31130	12	9.82	3671	2889	14.9	2330	5	3671.3	1341.6	559	14.4	4.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000057	2322	0.60	1393	0.5	68.2	48	376	8	28	5	47.5	20.0	349	6.2	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000072	39970	0.60	23982	12	9.82	2828	1305	7.6	1976	5	2828.3	852.6	-671	7.7	4.5	Overflow spills onto Hamilton Rd.	COMPLETE	NONE	NO	NO	YES	1
DSU_000074	18235	0.55	10737	3	22.9	738	1444	7.4	463	5	738.2	275.5	981	5.7	1.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000276	1952	0.50	976	2	29.1	57	50	12	35	5	56.8	21.6	15	11.9	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000374	15496	0.50	7748	6	15.2	707	334	8.5	474	5	707.2	233.3	-139	8.6	1.7	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000439	7965	0.80	6372	72	2.34	1074	0	0	1074	5	1074.4	0.0	-1074	#N/A	#N/A	Relatively small runoff compared to area of basin. Not likely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000461	11730	0.60	7038	72	2.34	1187	0	0	1187	5	1186.7	0.0	-1187	#N/A	#N/A	Likely to overflow . May overflow onto Cross Rd.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	YES	TBC
DSU_001047	10630	0.60	6378	0.5	68.2	218	2615	1.4	-157	5	217.7	374.2	2772	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001048	21420	0.60	12852	72	2.34	2167	0	0	2167	5	2167.0	0.0	-2167	#N/A	#N/A	Basin likely to have sufficient area and volume to store runoff. Not likely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000073	0	#DIV/0!	0	0.5	68.2	0	1744	3.2	-148	5	0.0	148.1	1892	#N/A	#N/A	Basin seems to provide overflow capacity for DSU_000050. Not likely to overflow. If overflow did occur, it would spill onto surround undeveloped land and likely infiltrate quickly.	COMPLETE	NONE	NO	NO	NO	No Overflow

COOLBELLUP

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m^3)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000118	10922	0.60	6553	3	22.9	451	368	46	245	5	450.6	205.9	123	45.8	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000119	9858	0.50	4929	1	44.2	218	287	46.1	140	5	218.0	78.5	148	45.9	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000120	27989	0.60	16793	3	22.9	1155	534	45.4	765	7	1154.6	389.4	-231	45.5	1.3	Overflow likely to spill onto Simons street and onto residnetial lots to the east due to the road being at a low point at this location.	COMPLETE	NONE	YES	YES	YES	3
DSU_000121	25382	0.50	12691	24	5.92	1805	185	50.6	1251	5	1804.6	553.5	-1066	50.7	1.8	Overflow likely to spill onto residnetial lots to the south fo the basin.	COMPLETE	NONE	NO	YES	NO	2
DSU_000122	66772	0.50	33386	12	9.82	3937	1173	41.1	2431	5	3937.4	1506.6	-1258	41.2	1.8	Overflow likely to spill onto Robb Park and Winterfold Rd. Flooding on Winterfold Rd lilely due to the location being a low point.	COMPLETE	NONE	NO	NO	YES	1
DSU_000123	29913	0.60	17948	6	15.2	1638	731	44.7	834	12	1638.1	804.6	-103	44.8	3.1	The location is a low point. Flooding not likely to be considerable, but may affect all roads and properties surrounding the basin.	COMPLETE	NONE	YES	YES	YES	3
DSU_000124	126077	0.53	69818	24	5.92	9928	2098	26.5	6766	5	9927.6	3161.4	-4668	26.6	3.0	Overflow likely to spill onto Monfloors Park, and may flow past southern boundary of park onto Radnor Way. Lots south of Radnor Way may be affected.	COMPLETE	NONE	NO	YES	YES	2
DSU_000125	46800	0.60	28080	24	5.92	3993	526	47.4	2753	5	3992.8	1240.1	-2226	47.5	2.6	Overflow likely to spill onto Robb Park and Winterfold Rd.	COMPLETE	NONE	NO	NO	YES	1
DSU_000126	37162	0.50	18581	6	15.2	1696	1097	43.1	896	5	1695.9	799.7	201	43.0	1.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000127	7817	0.50	3909	6	15.2	357	78	52.7	210	5	356.7	146.4	-132	52.8	0.7	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000128	8532	0.50	4266	2	29.1	248	90	48.3	149	5	248.5	99.8	-58	48.4	0.4	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000129	7730	0.50	3865	1	44.2	171	206	50.6	99	5	171.0	71.8	107	50.4	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000130	54793	0.50	27397	12	9.82	3231	429	31.1	2166	5	3231.0	1064.7	-1737	31.2	1.0	Overflow likely to spill onto Rinalo Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_000131	8876	0.50	4438	3	22.9	305	200	36.5	175	5	305.1	130.1	25	36.5	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000133	43826	0.60	26296	6	15.2	2400	385	27.7	1454	5	2400.1	946.0	-1069	27.8	0.5	Overflow likely to spill onto Varna Pl and may affect some lots north-east of the basin.	COMPLETE	NONE	NO	YES	YES	2
DSU_000134	3392	0.50	1696	1	44.2	75	272	26.6	49	5	75.0	26.4	223	25.2	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000135	21487	0.50	10744	2	29.1	626	832	45	349	5	625.8	276.3	483	44.6	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000136	20967	0.50	10484	3	22.9	721	1183	41.9	403	5	720.8	318.0	780	40.6	1.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000137	40253	0.50	20127	6	15.2	1837	786	38.2	1160	9	1837.0	677.2	-374	38.3	2.7	Overflow likely to spill onto Cordelia Ave and may affect lots on the corner of Cordelia Ave and Ferdinand Cres, as this is a low point.	COMPLETE	NONE	NO	YES	YES	2
DSU_000138	25032	0.60	15019	3	22.9	1033	637	39	596	5	1032.6	436.9	42	39.0	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000139	29071	0.60	17443	6	15.2	1592	327	38.1	938	5	1592.0	654.3	-611	38.2	0.6	Overflow likely to spill onto Cordelia Ave Stephano Way.	COMPLETE	NONE	NO	NO	YES	1
DSU_000246	28593	0.50	14297	6	15.2	1305	293	28	918	3	1304.9	386.5	-625	28.1	0.9	Overflow likely to spill onto lots to the west of the basin and may affect propeties on the lots.	COMPLETE	NONE	YES	YES	YES	3
DSU_000436	10040	0.60	6024	72	2.34	1016	0	0	1016	2	1015.7	0.0	-1016	#N/A	#N/A	Relatively small runoff volume compared to basin area. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000444_DSU_000442	3081	0.60	1849	72	2.34	312	0	0	312	5	311.7	0.0	-312	#N/A	#N/A	Relatively small runoff volume compared to basin area. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000443	4137	0.60	2482	72	2.34	419	0	0	419	5	418.5	0.0	-419	#N/A	#N/A	Relatively small runoff volume compared to basin area. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000132	22900	0.60	13740	72	2.34	2317	0	0	2317	5	2316.8	0.0	-2317	#N/A	#N/A	Large surface area. Overflow unlikely. If overflow did occur, it would likely spill onto park.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC

HAMILTON HILL

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000140	18747	0.65	12692	3	22.9	873	1200	23.2	566	5	872.6	306.8	634	22.4	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000141	70339	0.53	39179	12	9.82	4621	2439	28.8	2991	5	4620.5	1629.3	-553	28.9	3.5	Minor overflow likely to spill onto lots to the south and east of the basin, and onto Oconnell St and Halstead St.	COMPLETE	NONE	NO	YES	YES	2
DSU_000142	44404	0.56	25103	12	9.82	2961	786	31.5	2171	5	2960.5	789.9	-1385	31.6	2.6	Overflow likely to spill onto carpark to the south of the basin, onto Redmont Rd and further onto the lot to the lot south of the carpark.	COMPLETE	NONE	YES	YES	YES	3
DSU_000143	29889	0.60	17933	72	2.34	3024	0	0	3024	5	3023.8	0.0	-3024	#N/A	#N/A	relatively large runoff volume and small basin size. Overflow may occur and impact properties.	NO	CoC to provide data to complete model: Survey or Ascon data	YES	YES	YES	TBC
DSU_000144	25221	0.60	15133	3	22.9	1040	1608	30.7	683	5	1040.4	357.5	925	29.6	1.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000145	54397	0.58	31347	6	15.2	2861	3529	23.5	1690	5	2861.2	1171.2	1839	22.3	2.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000146	29318	0.60	17591	12	9.82	2075	370	18.3	1396	7	2074.6	679.0	-1026	18.4	2.1	Overflow likely to spill onto all surrounding lots. Propoerties may be affected.	COMPLETE	NONE	YES	YES	YES	3
DSU_000147	56837	0.63	34512	48	3.32	5504	771	12	4734	1	5504.2	770.3	-3963	12.1	2.8	Overflow likely to spill onto surrounding lots south-west of the basin and flow overland, affecting multiple properties.	COMPLETE	NONE	YES	YES	YES	3
DSU_000148	14233	0.70	9963	12	9.82	1175	315	7.9	855	5	1175.0	320.0	-540	8.0	2.6	Overflow likely to spill onto undeveloped lot south-west of the basin.	COMPLETE	NONE	NO	YES	YES	2
DSU_000150	17115	0.57	9774	6	15.2	892	587	14.4	574	5	892.1	318.4	13	14.4	2.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000151	21794	0.57	12572	12	9.82	1483	477	5.6	1102	4	1482.7	380.8	-625	5.7	2.6	Overflow likely to spill onto surrounding lots and Showell St.	COMPLETE	NONE	YES	YES	YES	3
DSU_000152	90370	0.58	54059	24	5.92	7687	628	2.4	5804	5	7686.8	1882.4	-5176	2.5	1.6	Overflow likely to spill onto Dixon Reserve.	COMPLETE	NONE	NO	NO	YES	1
DSU_000155	24745	0.55	14590	3	22.9	1003	538	34.6	629	5	1003.1	374.2	-91	34.7	0.9	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000156	68600	0.50	34300	6	15.2	3131	1039	12.4	2201	5	3130.7	929.3	-1162	12.5	1.4	Overflow likely to spill onto south-western portion of Isted Reserve and may flow onto Packham Rd.	COMPLETE	NONE	NO	NO	YES	1
DSU_000157	11363	0.60	6818	24	5.92	969	24	17.6	765	5	969.4	204.3	-741	17.7	0.6	Overflow likely to spill onto lot west of the basin.	COMPLETE	NONE	NO	YES	YES	2
DSU_000158	32721	0.60	19633	12	9.82	2315	425	24.2	1500	5	2315.4	815.7	-1075	24.3	1.2	Overflow likely to spill onto Grandpre Cesc nad may flow onto lots west of the road due to the steep western grade at the area.	COMPLETE	NONE	NO	YES	YES	2
DSU_000159	8068	0.50	4034	6	15.2	368	165	42.6	236	5	368.2	131.8	-72	42.7	1.5	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000160	3648	0.50	1824	12	9.82	215	21	39.8	128	5	215.1	86.9	-107	39.9	0.6	Excess water volume not significant (< 200m3). Storage provided in pits and pipes. Any overflow from the basin would spill onto undeveloped land and very likely would	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000162	33385	0.60	20031	3	22.9	1377	541	33.6	877	5	1377.2	499.8	-336	33.7	0.7	Overflow likely to spill onto Goodchild Park	COMPLETE	NONE	NO	NO	YES	1
DSU_000163	8856	0.50	4428	24	5.92	630	31	28.9	436	5	629.6	194.1	-404	29.0	0.8	Overflow likely to spill onto undeveloped bushland west of the basin. Some overflow may flow futher west via Ely St and into basin DSU_000157.	COMPLETE	NONE	NO	NO	YES	1
DSU_000164	10534	0.60	6320	6	15.2	577	276	7.1	396	5	576.9	181.0	-120	7.2	2.2	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000165	28527	0.58	16766	12	9.82	1977	842	5.1	1089	6	1977.2	888.4	-247	5.2	2.6	Overflow likely to be very minor. Any overflow would spill onto surrounding lots.	COMPLETE	NONE	NO	YES	NO	2
DSU_000166	35923	0.65	22627	12	9.82	2668	138	5.8	1940	5	2668.5	728.8	-1802	5.9	0.5	Overflow likely to spill onto Davilak Reserve.	COMPLETE	NONE	NO	NO	YES	1
DSU_000167	12440	0.70	8708	6	15.2	795	557	4.6	498	5	794.8	297.2	59	4.5	2.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000168	13306	0.70	9215	72	2.34	1554	0	0	1554	5	1553.8	0.0	-1554	#N/A	#N/A	Aerial indicates large basin area. Overtopping unlikely to occur.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000169	5432	0.60	3259	2	29.1	190	152	13.9	119	5	189.8	71.1	34	13.8	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000174	10000	0.60	6000	2	29.1	349	672	20.6	223	5	349.5	126.4	449	19.5	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000175	4546	0.60	2728	2	29.1	159	188	28.8	101	5	158.9	58.1	88	28.5	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000176	10536	0.60	6322	6	15.2	577	258	14.7	347	5	577.0	229.7	-90	14.8	1.2	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000247	7612	0.53	4177	12	9.82	493	90	21.8	318	5	492.6	175.1	-227	21.9	1.4	Overflow likely to be very minor. Any overflow would spill onto the lot south of the basin, which is currently undeveloped.	COMPLETE	NONE	NO	YES	NO	2
DSU_000249	4909	0.60	2945	12	9.82	347	644	18.4	239	5	347.4	108.6	405	13.1	3.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000250	8827	0.65	5514	12	9.82	650	120	13	399	5	650.3	250.8	-279	13.1	1.2	Overflow likely to be very minor. The area is at a low point and any overflow would spill onto surrounding lots.	COMPLETE	NONE	NO	YES	NO	2
DSU_000251	27550	0.60	16530	12	9.82	1949	496	6.4	1368	5	1949.5	581.9	-871	6.5	2.3	Overflow likely to spill onto lots west and north of the basin.	COMPLETE	NONE	YES	YES	NO	3
DSU_000252	68875	0.57	40813	12	9.82	4813	2783	6.6	2768	5	4813.2	2044.8	15	6.6	4.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000277	7489	0.50	3745	3	22.9	257	139	12.8	149	5	257.5	108.3	-10	12.9	0.8	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000278	14100	0.60	8460	6	15.2	772	37	8.9	434	5	772.2	338.2	-397	9.0	0.2	Minor overflow. Overflow spills onto Davilak Reserve	COMPLETE	NONE	NO	NO	YES	1
DSU_001002	16162	0.60	9697	72	2.34	1635	0	0	1635	5	1635.1	0.0	-1635	#N/A	#N/A	Small basin area. Overflow may occur and impact surrounding properties.	NO	CoC to provide data to complete model: Survey or Ascon data	YES	YES	NO	TBC
DSU_001003	13743	0.60	8246	2	29.1	480	294	15.8	294	5	480.3	186.7	1	15.8	0.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001040	3278	0.60	1967	0.5	68.2	67	73	16	46	5	67.1	21.1	27	16.0	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000153_DSU_000154	9335	0.45	4404	2	29.1	257	122	44.5	149	5	256.5	107.8	-27	44.6	0.7	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001041	22204	0.47	12886	72	2.34	2173	95836	1.2	2173	0	2172.8	0.0	93663	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000177	13630	0.50	6815	6	15.2	622	464	8.9	408	5	622.0	213.9	56	8.8	2.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001042	13551	0.60	8131	0.5	68.2	277	1566	44	72	5	277.5	205.5	1494	43.3	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow

HAMMOND PARK

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m³)	TWL (mAHD)	Max Volume in Basin (m³)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m³)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000344	3738	0.60	2243	6	15.2	205	19	29.3	114	5	204.7	90.4	-95	29.4	0.3	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000376	8412	0.60	5047	3	22.9	347	208	24.8	219	5	347.0	128.1	-10	24.9	1.0	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000397	2935	0.60	1761	0.5	68.2	60	173	25.9	34	5	60.1	25.9	139	25.2	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000403	7413	0.60	4448	72	2.34	750	0	0	750	5	750.0	0.0	-750	#N/A	#N/A	Relatively small runoff volume compared to basin area. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000463	6604	0.60	3962	72	2.34	668	0	0	668	5	668.1	0.0	-668	#N/A	#N/A	Relatively small runoff volume compared to basin area. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000468	17916	0.60	10750	72	2.34	1813	0	0	1813	5	1812.5	0.0	-1813	#N/A	#N/A	Small basin area. Overflow likely to spill onto park.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	YES	TBC
DSU_000044_DSU_000312	73100	0.60	43860	3	22.9	3016	1704	23.2	1685	5	3015.6	1330.4	19	23.2	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000378	23497	0.60	14098	12	9.82	1663	95	23.1	1260	5	1662.7	403.1	-1165	23.2	0.7	Overflow likely to spill onto Baler Reserve.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000379	3238	0.60	1943	2	29.1	113	57	22.8	70	5	113.2	42.9	-13	22.9	0.6	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000380	0	#DIV/0!	0	0.5	68.2	0	74	22.8	-14	5	0.0	14.4	88	#N/A	#N/A	Overflow likely to spill onto Baler Reserve.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001049	0	#DIV/0!	0	0.5	68.2	0	0	0	0	5	0.0	0.0	0	#N/A	#N/A	Catchment and basin dimensions unknown. If overflow did occur, its likely to spill onto undeveloped land.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000345	21930	0.60	13158	6	15.2	1201	288	22.7	783	5	1201.0	417.6	-495	22.8	1.0	Minor overflow. Likely to pill onto oval or overflow into DSU_000346.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000346	16790	0.60	10074	1	44.2	446	711	22.5	273	5	445.6	172.3	437	22.1	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000347	50730	0.60	30438	2	29.1	1773	2599	22.5	947	5	1772.9	826.0	1652	21.8	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001050	32370	0.70	22659	72	2.34	3821	0	0	3821	5	3820.6	0.0	-3821	#N/A	#N/A	Large basin area, unlikelt to overflow. If overflow did occur, it would likely flow west over Frankland Ave and onto Harry Waring Marsupial Reserve.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001051	15490	0.60	9294	72	2.34	1567	0	0	1567	5	1567.1	0.0	-1567	#N/A	#N/A	Basin area likely to provide sufficient infiltration. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001052	10400	0.60	6240	72	2.34	1052	0	0	1052	5	1052.2	0.0	-1052	#N/A	#N/A	Basin area likely to provide sufficient infiltration. Overflow unlikely. If overflow did occur, it would likely spill onto park.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001053	11435	0.60	6861	72	2.34	1157	0	0	1157	5	1156.9	0.0	-1157	#N/A	#N/A	Basin size likely yo be sufficient. If overflow did occur, it would spill onto park.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001054	18400	0.60	11040	72	2.34	1862	0	0	1862	5	1861.5	0.0	-1862	#N/A	#N/A	Difficult to determine if basin. Large infiltration area. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000402	6263	0.60	3758	72	2.34	634	0	0	634	5	633.6	0.0	-634	#N/A	#N/A	Large basin area. Overflow unlikely.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000460	24000	0.60	14400	72	2.34	2428	0	0	2428	5	2428.1	0.0	-2428	#N/A	#N/A	Large baisn area. Overflow unlikely. If overflow did occur, it would spill onto park.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC

HENDERSON

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000076	43344	0.30	13003	3	22.9	894	509	7.3	555	5	894.0	339.3	-46	7.4	0.9	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000077	30300	0.30	9090	3	22.9	625	299	7.9	392	5	625.0	232.9	-93	8.0	0.8	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000078	8091	0.50	4046	0.5	68.2	138	528	8	90	5	138.1	48.1	438	7.4	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000079	4947	0.80	3958	6	15.2	361	53	9.1	185	5	361.2	176.6	-132	9.2	0.4	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000080	56415	0.60	33913	1	44.2	1500	10157	5.4	856	5	1500.2	644.4	9301	3.5	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000082	11430	0.70	8001	2	29.1	466	704	8.6	288	5	466.0	177.9	416	8.0	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000219	47225	0.60	28335	3	22.9	1948	5191	9.7	1080	5	1948.2	868.4	4111	7.8	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000241	29792	0.60	17875	2	29.1	1041	4492	9.1	617	5	1041.2	423.7	3874	6.2	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000243	17776	0.60	10666	2	29.1	621	1190	7.3	394	5	621.2	227.0	796	6.2	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001014	37372	0.60	22423	24	5.92	3188	97	18.7	2544	5	3188.4	644.1	-2448	18.8	0.8	Overflow likely to spill onto Quill Way and flow into western reserve.	COMPLETE	NONE	NO	NO	YES	1
DSU_000371	34355	0.60	20613	3	22.9	1417	805	2.5	805	5	1417.2	612.7	0	2.5	0.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001004	14058	0.60	8435	1	44.2	373	1792	12.4	219	5	373.1	154.4	1573	9.9	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001005	20169	0.60	12101	6	15.2	1105	695	8.1	756	5	1104.5	348.6	-61	8.2	2.2	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002001	2740	0.70	1918	6	15.2	175	68	12.6	89	5	175.1	86.0	-21	12.7	1.1	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002002	3820	0.70	2674	3	22.9	184	186	3.5	118	5	183.9	66.3	69	3.2	1.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002003	5200	0.70	3640	0.5	68.2	124	554	2.5	83	5	124.2	41.1	471	1.5	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002004	12795	0.80	10776	0.5	68.2	368	3315	1.2	-101	5	367.7	468.6	3416	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002005	10070	0.90	9063	12	9.82	1069	153	2.4	722	5	1068.8	346.5	-569	2.5	1.3	Overflow likely to spill south-west onto adjacent roadway.	COMPLETE	NONE	NO	NO	YES	1
DSU_002006	4065	0.90	3659	3	22.9	252	265	4.1	161	5	251.5	91.0	105	3.7	1.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002007	2100	0.90	1890	2	29.1	110	113	3.6	70	5	110.1	40.1	43	3.4	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002008	5291	0.90	4762	0.5	68.2	163	96	2.8	110	5	162.5	52.6	-14	2.9	0.3	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002009	10870	0.90	9783	6	15.2	893	469	2.7	496	5	892.9	397.2	-26	2.8	1.4	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002010	2205	0.90	1985	6	15.2	181	70	3.1	109	5	181.1	72.1	-39	3.2	1.4	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002011	1720	0.90	1548	0.5	68.2	53	258	3.1	37	5	52.8	15.8	221	1.7	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002012	2990	0.90	2691	3	22.9	185	157	2.8	107	5	185.0	78.0	50	2.6	1.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002013	2370	0.80	1896	0.5	68.2	65	349	20	43	5	64.7	21.3	306	18.9	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002014	5195	0.70	3637	6	15.2	332	111	15.5	232	5	331.9	100.0	-120	15.6	1.5	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	YES	No Overflow
DSU_002015	5400	0.70	3780	1	44.2	167	711	24.5	113	5	167.2	54.4	598	22.7	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow

JANDAKOT

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m^3)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000046	4226	0.60	2536	3	22.9	174	148	27.1	97	5	174.3	77.5	51	26.9	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000047	6954	0.60	4172	1	44.2	185	562	25.3	123	5	184.6	61.6	439	24.3	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000093	23380	0.63	14815	0.5	68.2	506	3486	28.1	241	5	505.6	265.0	3245	27.0	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000094	11299	0.60	6779	1	44.2	300	355	27.1	176	5	299.9	124.0	179	26.9	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000095	16619	0.60	9971	1	44.2	441	1474	25.3	274	5	441.1	167.5	1200	24.3	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000225	5740	0.70	4018	6	15.2	367	86	27.1	232	5	366.7	135.0	-146	27.2	0.8	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000226	7339	0.60	4403	0.5	68.2	150	2073	29.6	82	5	150.3	68.0	1991	26.9	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000391	37777	0.60	22666	2	29.1	1320	4303	27.7	700	5	1320.2	619.8	3602	25.9	0.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001006	29020	0.60	17412	12	9.82	2053	645	27.1	1257	5	2053.5	796.5	-612	27.2	1.9	Overflow may spill onto Dean Rd.	COMPLETE	NONE	NO	NO	YES	1
DSU_001007	8987	0.60	5392	24	5.92	767	31	26.3	657	5	766.7	109.5	-626	26.4	1.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002026	13755	0.60	8253	0.5	68.2	282	3554	35	-133	5	281.7	414.8	3687	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002027	10250	0.60	6150	12	9.82	725	95	36.6	441	5	725.3	284.3	-345	36.7	0.9	Overflow will spill onto adjacent golf course.	COMPLETE	NONE	NO	NO	YES	1
DSU_002028	9615	0.60	5769	2	29.1	336	208	25.5	205	5	336.0	131.1	3	25.5	0.6	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002029	12820	0.60	7692	1	44.2	340	391	25.6	230	5	340.3	110.2	161	25.5	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002030	2850	0.60	1710	0.5	68.2	58	100	25.2	40	5	58.4	17.9	59	25.0	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002031	17076	0.60	10246	6	15.2	935	166	26.1	577	5	935.1	357.8	-411	26.2	0.7	Overflow will spill onto adjacent golf course.	COMPLETE	NONE	NO	NO	YES	1
DSU_002032	12275	0.60	7365	0.5	68.2	251	1135	26.3	87	5	251.3	164.3	1048	25.8	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002033	8595	0.60	5157	72	2.34	870	0	0	870	5	869.5	0.0	-870	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002034	11200	0.60	6720	0.5	68.2	229	860	26.6	108	5	229.3	121.0	752	26.1	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002035	8085	0.60	4851	2	29.1	283	240	25.7	151	5	282.6	132.0	89	25.6	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002036	3215	0.70	2251	0.5	68.2	77	2670	26	-21	5	76.8	98.1	2692	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002037	7630	0.60	4578	0.5	68.2	156	1380	26	86	5	156.2	70.2	1294	24.5	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002038	2140	0.60	1284	0.5	68.2	44	783	27.6	14	5	43.8	29.5	769	25.3	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002039	1325	0.60	795	0.5	68.2	27	959	28.2	-22	5	27.1	49.2	981	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002040	3495	0.60	2097	0.5	68.2	72	1772	28	-36	5	71.6	108.0	1809	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002041	9270	0.60	5562	0.5	68.2	190	1681	28	92	5	189.8	97.6	1589	26.7	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002042	11650	0.60	6990	12	9.82	824	174	29.6	485	5	824.4	339.6	-310	29.7	1.4	Overflow will spill onto surrounding grassed area.	COMPLETE	NONE	NO	NO	YES	1
DSU_002043	31170	0.60	18702	24	5.92	2659	194	28.6	2183	5	2659.3	476.0	-1989	28.7	2.5	Overflow will spill onto parking areas to the south.	COMPLETE	NONE	NO	NO	YES	1
DSU_002057	3590	0.70	2513	3	22.9	173	99	26.3	105	5	172.8	67.6	-6	26.4	1.0	Excess water volume not significant (< 200m3). Surrounding undeveloped bushland will provide storage of flows.	COMPLETE	NONE	NO	NO	NO	No Impact

MUNSTER

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000211	7734	0.60	4640	1	44.2	205	215	1.6	118	5	205.3	87.2	97	1.5	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000212	9228	0.60	5537	0.5	68.2	189	570	1.8	108	5	189.0	81.3	462	1.4	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000213	9508	0.60	5705	2	29.1	332	209	9.4	205	5	332.3	127.6	4	9.4	0.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000214	3398	0.60	2039	0.5	68.2	70	2556	4.3	-12	5	69.6	81.6	2568	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000215	44310	0.60	26586	24	5.92	3780	444	23.8	2794	5	3780.4	986.5	-2350	23.9	2.1	Overflow discharged to Hagon Park. No issue	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000216	4788	1.00	4788	3	22.9	329	214	2.2	219	5	329.2	109.9	-6	2.3	1.2	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000217	6977	0.60	4186	2	29.1	244	390	2.6	144	5	243.8	99.8	246	1.9	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000236	14497	0.40	5799	24	5.92	825	33	11.3	556	5	824.6	268.8	-523	11.4	0.8	Overflow likely to be minor and will spill onto undeveloped bushland south of basin.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000310	15493	0.60	9296	12	9.82	1096	430	4.5	762	4	1096.3	334.5	-332	4.6	2.7	Overflow likely to be minor and will spill onto Riverina Parade and flow into the adjacent wetland and may also spill onto Fanstone Ave	COMPLETE	NONE	NO	NO	YES	1
DSU_000334	9299	0.60	5579	0.5	68.2	190	134	1.7	126	5	190.4	64.8	9	1.7	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000335	7561	0.60	3973	0.5	68.2	136	557	1.9	16	5	135.6	119.4	541	1.5	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000373	3576	0.60	2146	0.5	68.2	73	697	6.6	50	5	73.2	23.4	648	3.8	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000392	10623	0.60	6374	72	2.34	1075	0	0	1075	5	1074.7	0.0	-1075	#N/A	#N/A	Large storage within this basin. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000396	40390	0.60	24234	0.5	68.2	827	2977	2.5	552	5	827.0	274.9	2425	1.5	0.4	Basin area indicates the storage volume is inadequate. Overflow will spill onto surrounding POS	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000406	12151	0.55	7043	2	29.1	410	229	2.3	228	5	410.2	182.2	1	2.3	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000440	13475	0.60	8085	72	2.34	1363	0	0	1363	5	1363.3	0.0	-1363	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000462	3615	0.60	2169	72	2.34	366	0	0	366	5	365.7	0.0	-366	#N/A	#N/A	Overflow pipe connection to POS to the west.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	YES	TBC
DSU_000466	1300	0.60	780	72	2.34	132	0	0	132	5	131.5	0.0	-132	#N/A	#N/A	Gully pit. Minor runoff volume. Likely to be stored in pits and pipes. Data not necessary.	NO	NONE	NO	NO	NO	No Overflow
DSU_000467	1263	0.60	758	72	2.34	128	0	0	128	5	127.8	0.0	-128	#N/A	#N/A	Gully pit. Minor runoff volume. Likely to be stored in pits and pipes. Data not necessary.	NO	NONE	NO	NO	NO	No Overflow
DSU_002000	5291	0.70	3704	1	44.2	164	97	1.8	103	5	163.8	61.1	-6	1.9	0.4	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002016	92380	0.60	55428	0.5	68.2	1892	59007	8.8	421	5	1891.6	1470.2	58586	5.3	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002017	10710	0.60	6426	0.5	68.2	219	6250	9.4	-2373	5	219.3	2592.4	8623	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002018	50956	0.60	30574	0.5	68.2	1043	3657	1.8	657	5	1043.4	386.6	3001	1.3	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002019	1889	0.70	1322	0.5	68.2	45	761	8.5	14	5	45.1	31.1	747	6.2	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002020	22050	0.60	13230	0.5	68.2	452	15632	1.8	-682	5	451.5	1133.2	16314	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002021	6758	0.50	3379	0.5	68.2	115	1095	5	26	5	115.3	89.1	1069	3.9	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002022	10950	0.50	5475	0.5	68.2	187	378	2.9	123	5	186.8	63.5	255	2.6	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002023	5525	0.70	3868	72	2.34	652	0	0	652	5	652.1	0.0	-652	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002024	4227	0.60	2536	72	2.34	428	0	0	428	5	427.6	0.0	-428	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002025	2800	0.60	1680	72	2.34	283	0	0	283	5	283.3	0.0	-283	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC

NORTH COOGEE

Sump	Runoff						Basin									Comments	Available Data	Action Required	Risk Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000170	7808	0.55	4416	3	22.9	304	382	12	177	5	303.6	126.4	205	11.4	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000171	31172	0.63	19528	6	15.2	1782	2406	6.6	954	5	1782.3	828.3	1452	5.2	1.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000172	10043	0.50	5022	6	15.2	458	374	6.4	260	5	458.3	198.4	114	6.0	2.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000173	12705	0.60	7623	6	15.2	696	572	6.2	414	5	695.8	282.0	159	5.8	2.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000464	4685	0.60	2811	72	2.34	474	0	0	474	5	474.0	0.0	-474	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_000465	11748	0.60	7049	72	2.34	1189	0	0	1189	5	1188.5	0.0	-1189	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_001010	8385	0.60	5031	72	2.34	848	0	0	848	5	848.3	0.0	-848	#N/A	#N/A	Overflow likely to spill onto Bennett Ave.	COMPLETE	NONE	NO	NO	YES	1
DSU_001011	12876	0.50	6438	0.5	68.2	220	2124	6.1	142	5	219.7	77.3	1982	4.0	0.5	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002044	4618	0.60	2771	0.5	68.2	95	4678	6.5	-79	5	94.6	173.2	4757	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002045	8405	0.50	4203	3	22.9	289	379	8.8	194	5	288.9	94.7	185	8.1	1.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002046	1970	0.70	1379	72	2.34	233	0	0	233	5	232.5	0.0	-233	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002047	4265	0.70	2986	72	2.34	503	0	0	503	5	503.4	0.0	-503	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002048	34270	0.70	23989	72	2.34	4045	0	0	4045	5	4044.9	0.0	-4045	#N/A	#N/A	Basin area indicates the storage volume is inadequate. Overflow will likely spill onto Corromundel Approach and lots to the north.	NO	CoC to provide data to complete model: Survey or Ascon data	YES	YES	YES	TBC
DSU_002049	4800	0.60	2880	2	29.1	168	441	9	96	5	167.8	71.6	345	7.5	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002050	5970	0.80	4776	3	22.9	328	518	8.7	220	5	328.4	107.9	298	7.5	1.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002051	5970	0.70	4179	1	44.2	185	745	8.6	116	5	184.9	68.4	628	7.2	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002052	8655	0.50	4328	1	44.2	191	728	6.6	120	5	191.4	71.5	608	5.3	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002053	1905	0.60	1143	0.5	68.2	39	93	10.3	25	5	39.0	14.3	68	10.0	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow

NORTH LAKE

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000048	28660	0.55	15526	3	22.9	1067	1937	20.9	628	5	1067.5	439.8	1310	19.8	1.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000049	22779	0.50	11390	6	15.2	1040	797	26.4	661	5	1039.6	378.5	135	26.2	2.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000058	62824	0.50	31412	12	9.82	3705	2917	23.1	2784	5	3704.6	920.2	133	23.1	1.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000059	67410	0.53	36435	6	15.2	3326	3077	18.2	2184	5	3325.5	1141.8	893	17.6	2.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002054	7575	0.50	3788	2	29.1	221	227	19.7	132	5	220.6	89.1	96	19.5	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow

SOUTH LAKE

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m²)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m³)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m³)	Total Infiltration (m^3)	Remaining Storage (m³)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000054	3368	0.75	2440	0.5	68.2	83	159	20.6	48	5	83.3	35.1	111	20.4	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000055	143861	0.60	86317	1	44.2	3818	7577	20	2536	5	3818.2	1282.0	5041	19.6	0.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000056	132620	0.70	92834	1	44.2	4107	9940	20.2	2710	5	4106.5	1396.6	7230	19.4	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000083	143861	0.60	86317	3	22.9	5935	6570	20.1	3222	5	5934.7	2712.7	3348	19.7	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000084	53266	0.60	31960	12	9.82	3769	1225	26	2739	5	3769.1	1030.5	-1514	26.1	3.5	Overflow likely to spill west onto the POS and basin DSU_000400, and north onto the undeveloped land which is in a depression.	COMPLETE	NONE	NO	NO	YES	1
DSU_000085	11878	0.60	7127	6	15.2	650	368	34.8	363	5	650.5	287.1	4	34.8	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000086	154161	0.70	107913	2	29.1	6286	10461	19.7	3616	5	6285.5	2669.8	6845	19.1	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000087	9920	0.60	5952	6	15.2	543	218	21.3	299	5	543.3	244.7	-80	21.4	1.3	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000088	25492	0.60	15295	12	9.82	1804	101	20.9	999	5	1803.8	804.4	-899	21.0	0.4	Overflow likely to spill into existing channel .	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000089	40634	0.60	24380	12	9.82	2875	556	21.7	1781	5	2875.3	1094.7	-1225	21.8	1.2	Overflow likely to spill into existing channel .	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000317	2995	0.60	1797	3	22.9	124	80	20.2	70	5	123.6	53.1	9	20.2	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000340	26697	0.60	16018	6	15.2	1462	300	22.3	1008	5	1462.0	454.3	-708	22.4	0.8	Overflow likely to spill onto lots south of the basin and onto Colgrave Mews	COMPLETE	NONE	NO	YES	YES	2
DSU_000400	14650	0.60	8790	2	29.1	512	229	26.5	306	5	512.0	205.9	-77	26.6	0.5	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_001008	25400	0.70	17780	1	44.2	787	2282	24.2	428	5	786.5	358.4	1854	23.5	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002055	73225	0.60	43935	0.5	68.2	1499	59238	26.6	-211	5	1499.4	1710.4	59449	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002056	1230	0.60	738	0.5	68.2	25	96	22.8	11	5	25.2	13.8	85	22.3	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002058	76880	0.60	46128	72	2.34	7778	23004	19.6	7778	0	7777.9	0.0	15226	19.1	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow

SPEARWOOD

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000179	153574	0.60	92144	6	15.2	8410	14904	4.3	4420	5	8410.3	3990.8	10485	2.2	1.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000180	153574	0.60	92144	24	5.92	13102	646	2.4	11434	5	13102.3	1668.0	-10788	2.5	1.6	Connected to DSU_00179, unlikely to overflow	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000181	38548	0.48	22686	12	9.82	2675	1165	9.4	1693	5	2675.4	982.4	-528	9.5	2.6	Overflow likely to spill onto lot south-west of the basin.	COMPLETE	NONE	YES	YES	NO	3
DSU_000182	118750	0.55	68593	3	22.9	4716	3334	12.5	2893	5	4716.1	1823.3	441	12.5	0.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000183	4360	0.60	2616	0.5	68.2	89	91	1.3	56	5	89.3	33.4	35	1.3	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000184	58545	0.60	35127	12	9.82	4143	176	1.3	3214	5	4142.7	929.0	-3037	1.4	0.5	Overflow likely to spill into lake.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000185	10576	0.50	5288	0.5	68.2	180	601	1.5	87	5	180.5	93.8	514	1.2	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000186_DSU_000187	17952	0.70	12566	6	15.2	1147	1426	1.6	794	5	1147.0	352.5	632	1.6	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000189	5540	0.60	3324	0.5	68.2	113	256	1.4	41	5	113.4	72.7	215	1.2	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000190	16655	0.60	9993	1	44.2	442	94	1.4	292	5	442.0	150.4	-198	1.5	0.2	Overflow likely to spill into basin DSU_000191 and subsequently into lake.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000192	1106	0.60	664	0.5	68.2	23	597	1.5	-51	5	22.6	73.4	648	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000193	19063	0.60	11438	1	44.2	506	176	1.1	319	5	506.0	187.0	-143	1.2	0.3	Overflow likely to spill into lake.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000194	57435	0.60	34461	24	5.92	4900	100	1.4	3286	5	4900.1	1613.9	-3186	1.5	0.4	Overflow likely to spill into lake.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000195	9895	0.60	5937	0.5	68.2	203	601	1.4	50	5	202.6	152.8	552	1.1	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000196	5288	0.60	3173	0.5	68.2	108	63	1.3	60	5	108.3	48.7	3	1.3	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000197	3541	0.70	2479	1	44.2	110	90	1.3	71	5	109.6	38.4	19	1.3	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000198	75090	0.56	43446	3	22.9	2987	2557	9.7	1940	5	2987.1	1047.1	617	9.5	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000199	28891	0.50	14446	6	15.2	1318	1083	13.2	834	5	1318.5	484.0	249	13.2	2.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000200	15120	0.70	10584	6	15.2	966	725	10.1	604	5	966.0	361.6	120	9.9	2.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000201	14950	0.55	8038	2	29.1	468	384	23.1	288	5	468.2	179.8	96	23.0	0.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000202	14100	0.60	8460	3	22.9	582	421	19.1	327	5	581.7	255.0	94	19.1	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000203	29879	0.60	17927	12	9.82	2114	519	21.6	1648	2	2114.3	466.2	-1129	21.7	2.5	Overflow likely to spill onto lot west of the basin.	COMPLETE	NONE	NO	YES	NO	2
DSU_000204	11906	0.50	5953	6	15.2	543	508	20.2	354	5	543.3	189.2	153	19.7	2.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000205	40626	0.55	21712	12	9.82	2561	369	18.9	1968	8	2560.6	592.6	-1599	19.0	2.3	Overflow likely to spill onto surrounding lots and edeline street.	COMPLETE	NONE	YES	YES	YES	3
DSU_000206	44921	0.57	24956	12	9.82	2943	541	17.1	2179	7	2943.1	764.5	-1637	17.2	2.4	Overflow likely to spill onto lots south-west of the basin.	COMPLETE	NONE	YES	YES	NO	3
DSU_000207	30300	0.60	18180	3	22.9	1250	1119	16	823	5	1250.0	427.0	296	16.0	1.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000208	37314	0.60	22388	24	5.92	3183	592	5.8	2271	3	3183.5	912.8	-1679	5.9	1.8	Overflow likely to spill onto Rockingham Rd and the POS north of the basin.	COMPLETE	NONE	NO	NO	YES	1
DSU_000209	45003	0.60	27002	24	5.92	3839	189	6.2	3365	5	3839.5	474.7	-3176	6.3	2.2	Overflow likely to spill onto Rockingham Rd.	COMPLETE	NONE	NO	NO	YES	1
DSU_000210	45790	0.50	22895	6	15.2	2090	1385	20.7	1135	5	2089.7	954.9	251	20.6	1.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000242	66064	0.50	33032	6	15.2	3015	2214	34.1	1835	5	3014.9	1179.6	379	34.1	1.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000254	14739	0.70	10317	6	15.2	942	551	15.6	508	5	941.7	434.1	43	15.6	1.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000357	22748	0.60	13649	0.5	68.2	466	5663	17.6	223	5	465.8	243.2	5441	15.7	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001000	19165	0.60	11499	12	9.82	1356	189	36.3	1021	5	1356.1	335.2	-832	36.4	1.4	Overflow likely to spill onto lots east of the basin.	COMPLETE	NONE	NO	YES	NO	2
DSU_000484 - DSU_000487	28965	0.70	20276	72	2.34	3419	0	0	3419	5	3418.7	0.0	-3419	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002059	16165	0.60	9699	0.5	68.2	331	4566	28.2	23	5	331.0	308.5	4543	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002060	3160	0.60	1896	3	22.9	130	74	29.7	84	5	130.4	46.1	-10	29.8	1.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002061	28965	0.70	20276	72	2.34	3419	0	0	3419	5	3418.7	0.0	-3419	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002062	26990	0.70	18893	72	2.34	3186	0	0	3186	5	3185.6	0.0	-3186	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002063	10080	0.70	7056	72	2.34	1190	0	0	1190	5	1189.7	0.0	-1190	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to complete model: Survey or Ascon data	NO	NO	NO	TBC
DSU_002064	49420	0.70	34594	12	9.82	4080	564	2	2746	5	4079.8	1334.0	-2182	2.1	1.0	Overflow likely spill to wetland to west and lots to the north of sump.	COMPLETE	NONE	NO	NO	YES	1

SUCCESS

Sump	Runoff						Basin									Comments	Available Data	Action Required	Risk Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000040	105255	0.60	63153	3	22.9	4342	3617	24.9	2797	5	4342.1	1544.7	820	24.9	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000041	7700	0.60	4620	6	15.2	422	94	26.2	279	5	421.7	142.7	-185	26.3	0.8	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000287	5621	0.60	3373	6	15.2	308	101	25.1	194	5	307.8	113.4	-93	25.2	1.1	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000289	29196	0.60	17518	2	29.1	1020	1442	22.1	596	5	1020.3	424.1	846	21.7	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000291	11478	0.60	6887	2	29.1	401	339	20.3	228	5	401.1	173.6	111	20.2	0.6		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000043	236100	0.70	165270	12	9.82	19491	15475	28.1	13233	5	19491.0	6258.2	2242	28.1	4.5	Drains Gateways shopping center.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000227	29762	0.60	17857	12	9.82	2106	213	27.8	1554	5	2106.0	551.9	-1341	27.9	1.0	Basin seems to to have a surcahrge outflow pipe which joins to the network draining S001 and which has an outlet at the lake west of Jubilee Ave.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000228	70867	0.60	42520	6	15.2	3881	3749	26.9	2138	5	3880.9	1742.7	1611	26.2	1.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000234	30234	0.70	21164	3	22.9	1455	5665	29.9	957	2	1455.1	498.2	4708	28.1	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000235	5654	0.50	2827	1	44.2	125	707	28.1	75	5	125.1	49.6	632	25.9	0.6		COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000285	9299	0.60	5579	3	22.9	384	312	22.7	257	5	383.6	126.3	55	22.6	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000292_DSU_000385	2445	0.70	1712	0.5	68.2	58	454	24.4	6	5	58.4	51.9	448	24.3	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000314	0	#DIV/0!	0	0.5	68.2	0	13728	19.8	-1448	5	0.0	1447.7	15176	#N/A	#N/A	Copulup Lake. Receives overflow from DSU_000333 and DSU_000386	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000315	63889	0.60	38333	12	9.82	4521	962	24.4	2704	5	4520.8	1817.2	-1742	24.5	1.2	Overflow spills onto Wentworth Parade Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_000316	58547	0.60	35128	2	29.1	2046	4686	24	1166	5	2046.1	880.1	3520	24.0	1.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000333	61440	0.60	36864	24	5.92	5242	315	20.2	3509	5	5241.8	1733.0	-3194	20.3	0.9	Overflow likelty spills onto Waterbuttons Park and into Copulup Lake	COMPLETE	NONE	NO	NO	YES	1
DSU_000339	2958	0.60	1775	1	44.2	79	150	26.7	48	5	78.5	30.5	102	26.2	0.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000342_DSU_000045	80331	0.58	52122	6	15.2	4757	3336	22.3	3064	5	4757.3	1693.1	272	22.3	1.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000354	19056	0.70	13339	24	5.92	1897	157	21.9	1302	5	1896.7	594.8	-1145	22.0	1.4	Connected to swale traversing Horse Hire Park ultimately discharging to Thomsons Lake. Unlikely to overflow.	NO	CoC to provide data to completeodel: Survey or Ascon data	NO	NO	NO	TBC
DSU_000367	5736	0.60	3442	12	9.82	406	26	20.6	322	5	405.9	84.3	-296	20.7	0.8	Minor Overflow. Likely to spill onto Horse Hire Park	COMPLETE	NONE	NO	NO	YES	1
DSU_000368	4602	0.50	2301	0.5	68.2	79	993	23.7	23	5	78.5	55.4	970	22.1	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000386	36763	0.60	22058	72	2.34	3719	0	0	3719	5	3719.3	0.0	-3719	#N/A	#N/A	Overflow likelty spills into Copulup Lake	NO	CoC to provide data to completeodel: Survey or Ascon data	NO	NO	NO	TBC
DSU_000394	19150	0.60	11490	72	2.34	1937	0	0	1937	5	1937.4	0.0	-1937	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to completeodel: Survey or Ascon data	NO	NO	NO	TBC
DSU_000404	36970	0.60	22182	6	15.2	2025	333	22.3	1423	5	2024.6	601.3	-1090	22.4	0.7	Overflow likely to spill onto Boronia Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_000446	35960	0.60	21576	72	2.34	3638	0	0	3638	5	3638.0	0.0	-3638	#N/A	#N/A	Overflow likey to spill onto surrounding POS	NO	CoC to provide data to completeodel: Survey or Ascon data	NO	NO	YES	1
DSU_000447	70803	0.60	42482	12	9.82	5010	5658	28.1	3978	5	5010.1	2604.9	1680	27.2	3.7		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000455	13780	0.60	8268	72	2.34	1394	0	0	1394	5	1394.1	0.0	-1394	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to completeodel: Survey or Ascon data	NO	NO	NO	TBC
DSU_000456	13780	0.60	8268	72	2.34	1394	0	0	1394	5	1394.1	0.0	-1394	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to completeodel: Survey or Ascon data	NO	NO	NO	TBC
DSU_002065	70710	0.60	42426	0.5	68.2	1448	25911	21.8	-293	5	1447.9	1741.0	26204	#N/A	#N/A		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002066	70710	0.60	42426	3	22.9	2917	1358	21.7	1832	5	2917.0	1084.5	-474	21.8	0.8	Connected to DSU_002065. Overflow will spill into this wetland/lake. Impacts unlikely to occur.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002067	29830	0.60	17898	0.5	68.2	611	5343	28.8	404	5	610.8	206.9	4939	27.0	0.5		COMPLETE	NONE				No Overflow
DSU_002068	6718	0.70	4703	6	15.2	429	164	21.7	223	5	429.2	206.3	-59	21.8	1.1	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002069	10180	0.70	7126	12	9.82	840	69	23.7	578	5	840.4	262.1	-509	23.8	0.7	Overflow likely to spill onto road reserve.	COMPLETE	NONE	NO	NO	YES	1
DSU_002070	4900	0.50	2450	0.5	68.2	84	127	20.6	39	5	83.6	44.2	87	20.5	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002071	6155	0.50	3078	0.5	68.2	105	255	21.1	40	5	105.0	65.5	215	20.9	0.2		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002072	6700	0.60	4020	72	2.34	678	0	0	678	5	677.8	0.0	-678	#N/A	#N/A	Basin area indicates the storage volume is adequate. Unlikely to overflow.	NO	CoC to provide data to completeodel: Survey or Ascon data	NO	NO	NO	TBC

TREEBY

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000488 - DSU_000490	88680	0.60	53208	0.5	68.2	1816	6334	29.4	1043	5	1815.8	772.9	5291	28.4	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000491 - DSU_000492	24290	0.60	14574	2	29.1	849	875	29	507	5	848.9	341.7	368	27.1	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000457	77890	0.60	46734	3	22.9	3213	4486	28.7	1984	5	3213.2	1229.7	2502	26.1	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002079	52720	0.60	31632	6	15.2	2887	3262	30.4	1512	5	2887.1	1375.0	1750	28.8	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002080	53980	0.60	32388	1	44.2	1433	3670	29.53	976	5	1432.7	457.0	2694	28.4	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002081	19980	0.60	11988	2	29.1	698	1546	29.66	417	5	698.3	281.3	1129	28.2	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002082	22860	0.60	13716	1	44.2	607	2366	29.55	391	5	606.7	215.5	1975	28.3	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow

WATTLEUP

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000069	28284	0.40	11314	6	15.2	1033	723	5.2	683	5	1032.6	349.2	39	5.2	3.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000070	21925	0.40	8770	3	22.9	603	610	2.6	377	5	603.0	226.2	233	2.3	1.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000071	6433	0.50	3217	2	29.1	187	445	5.7	119	5	187.4	68.7	326	4.1	1.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000220	21205	0.50	10603	6	15.2	968	485	2.7	542	5	967.7	425.6	-57	2.8	1.8	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact

YANGEBUP

Sump	Runoff						Basin									Comments	Available Data	Action Required	Priority Rating			Category
ID	Gross Road Catchment Area (m^2)	Average Runoff Coeff.	Connected Impervious Area	Crtical Rainfall Duration (hour)	Crtical Rainfall Intensity (mm/hr)	Total Catchment Runoff (m^3)	Available Storage (m^3)	TWL (mAHD)	Max Volume in Basin (m^3)	Permeability (m/d)	Total Runoff Volume (m^3)	Total Infiltration (m^3)	Remaining Storage (m^3)	Modelled TWL (mAHD)	Maximum Water Depth (m)	Comments			Resident Buildings Impacted	Residents Lots Impacted	Flooding of Road Reserves or POS	
DSU_000042	25055	0.60	15033	6	15.2	1372	1394	21.5	826	5	1372.1	545.9	568	20.7	2.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000106	11023	0.65	7450	3	22.9	512	794	27.5	344	5	512.2	168.5	450	26.5	1.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000109	18640	0.60	11184	6	15.2	1021	538	21.9	695	5	1020.8	325.8	-157	22.0	2.7	Excess water volume not significant (< 200m3). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000224	6156	0.50	3078	1	44.2	136	281	18.9	75	5	136.2	60.7	206	18.4	0.5		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000229	12750	0.50	6375	24	5.92	906	72	25.4	639	5	906.5	267.5	-567	25.5	1.4	Overflow likely to spill onto Erceg Rd and flow into the undevelopoed lot north of the basin.	COMPLETE	NONE	NO	NO	YES	1
DSU_000230	40780	0.60	24468	24	5.92	3479	600	27.6	3042	2	3479.2	436.8	-2442	27.7	3.0	Liekly to overflow onto eastern lots.	COMPLETE	NONE	YES	YES	YES	3
DSU_000231	35120	0.60	21072	12	9.82	2485	957	39.3	1644	5	2485.1	840.7	-688	39.4	2.8	Overflow likely spill onto Spearwood Ave and flow onto road reserve to the east. Some lots to the east may be affected.	COMPLETE	NONE	NO	YES	YES	2
DSU_000232	41811	0.60	25087	6	15.2	2290	2677	13.3	1491	5	2289.7	798.3	1185	12.3	3.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000233	49462	0.70	34623	6	15.2	3160	1293	24	1880	5	3160.2	1280.7	-587	24.1	1.2	Overflow likely to spill onto adjacent park.	COMPLETE	NONE	NO	NO	YES	1
DSU_000238	4768	0.60	2861	12	9.82	337	67	30.1	201	5	337.4	136.6	-134	30.2	1.4	Excess water volume not significant (< 200m2). Storage provided in pits and pipes.	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_000239	113327	0.60	67996	12	9.82	8019	7835	20	5278	5	8019.1	2741.4	2557	18.8	5.0		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000240	38012	0.70	26608	6	15.2	2429	2693	18	1624	5	2428.6	804.6	1069	17.0	3.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_000330	12776	0.60	7666	12	9.82	904	250	49.6	499	5	904.0	405.5	-249	49.7	1.4	Minor Overflow likely to spill onto road reserve east of the site.	COMPLETE	NONE	NO	NO	YES	1
DSU_000401	121105	0.60	72663	0.5	68.2	2480	13785	18	1684	5	2479.8	795.6	12100	16.9	0.3		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001013	46874	0.50	23437	6	15.2	2139	1441	38	1409	5	2139.2	730.6	32	38.0	2.4		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_001012	53070	0.50	26535	24	5.92	3773	462	27.9	2566	5	3773.1	1206.9	-2104	28.0	2.1	Overflow likely to spill onto Warthwyke Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_002073	20420	0.60	12252	12	9.82	1445	773	28.5	815	5	1444.9	630.1	-42	28.6	3.6	Overflow likely to spill onto Warthwyke Park.	COMPLETE	NONE	NO	NO	YES	1
DSU_002074	66981	0.60	40189	0.5	68.2	1372	8239	18.7	509	5	1371.5	862.6	7730	17.9	0.1		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002075	225030	0.60	135018	3	22.9	9283	6893	16.3	5191	5	9283.2	4091.9	1702	16.2	0.9		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002076	184250	0.60	110550	2	29.1	6439	8570	15.3	3965	5	6439.2	2474.2	4605	14.8	0.8		COMPLETE	NONE	NO	NO	NO	No Overflow
DSU_002077	12125	0.60	7275	12	9.82	858	70	18.7	518	5	858.0	340.3	-448	18.8	0.6	Overflow likely to spill onto surrounding undeveloped bushland	COMPLETE	NONE	NO	NO	NO	No Impact
DSU_002078	4415	0.60	2649	12	9.82	312	40	20	221	5	312.4	91.5	-181	20.1	1.3	Overflow likely to spill onto surrounding undeveloped bushland	COMPLETE	NONE	NO	NO	NO	No Impact

City of Cockburn

APPENDIX B

DRAINAGE CATCHMENT DRAWINGS

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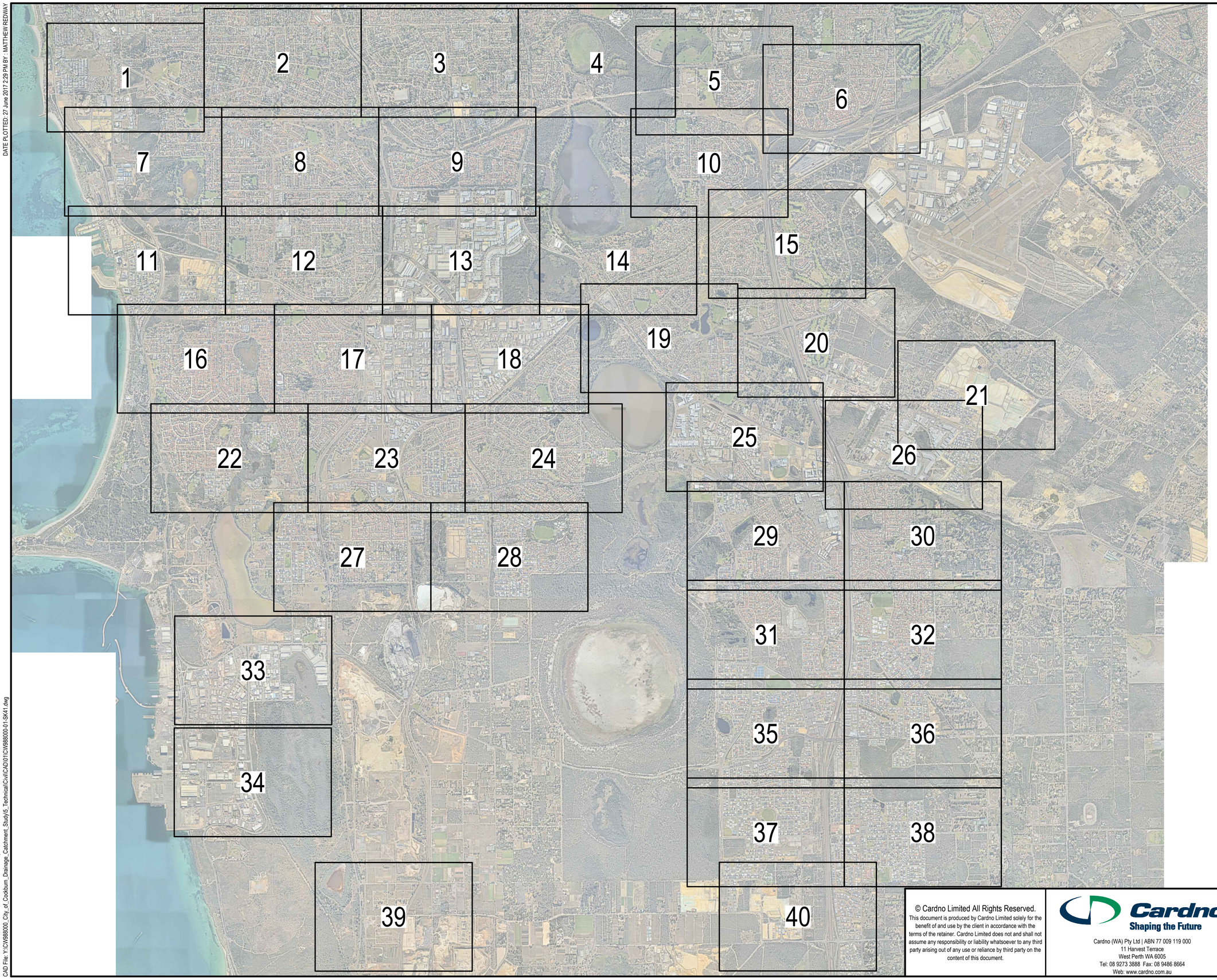
DATE PLOTTED: 27 June 2017 2:29 PM BY : MATTHEW REDWAY



LEGEND:

21 DRAWING SHEET NUMBER

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DRAINAGE STUDY
LOCALITY PLAN

Datum	Date	Scale	Size
A.H.D.	06.06.2017	Not To Scale	A1

Drawing Number	Revision
CW988000-01-SK41	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
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DATE PLOTTED: 28 June 2017 9:17 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000251
DSU_000150
DSU_000250
DSU_000151
DSU_000168
DSU_002084
DSU_002083
DSU_002044
DSU_002113
DSU_000152
DSU_000167
DSU_000171
DSU_000172
DSU_000170
DSU_000169
DSU_000173
DSU_000278
DSU_000464
DSU_000164
DSU_000465
DSU_001011
DSU_000277

1:2500

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 1 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK1	A

XREF's: X-CW988000-01-Image; X-CW988000-01-Base
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DATE PLOTTED: 28 June 2017 9:45 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000149
DSU_000145
DSU_000144
DSU_002086
DSU_000128
DSU_001040
DSU_000128
DSU_000142
DSU_000146
DSU_000147
DSU_000247
DSU_000141
DSU_000249
DSU_000140
DSU_001002
DSU_000148
DSU_000174
DSU_002085
DSU_001003

1:2500
0 25m 50 75 100 125 150 175 200 225 250

XREFs: X:CW988000-01-Image; X:CW988000-01-Base
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK2.dwg

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 2 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK2	A

DATE PLOTTED: 28 June 2017 9:43 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000122
DSU_000125
DSU_000124
DSU_000121
DSU_000119
DSU_000120
DSU_000123
DSU_000133
DSU_000436
DSU_000135
DSU_000444
DSU_000118
DSU_000443
DSU_000443
DSU_002087
DSU_000129
DSU_000127
DSU_000126
DSU_000132
DSU_000136
DSU_000139

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 3 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK3	A

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DATE PLOTTED: 4 July 2017 3:25 PM BY: MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000124

DSU_000059

DSU_002088

DSU_000134

DSU_000058

DISCHARGE INTO NORTH LAKE

DSU_001030

0 25m 50 75 100 125 150 175 200 225 250

1:2500

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 4 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK4	A

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DATE PLOTTED: 28 June 2017 9:42 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DISCHARGE INTO NORTH LAKE

DSU_002089

DSU_000049

DSU_000048

DSU_002054

DSU_001030

1:2500

0 25m 50 75 100 125 150 175 200 225 250

XREF's: X-CW988000-01-Base; X-CW988000-01-Image

CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK5.dwg

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 5 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK5	A

DATE PLOTTED: 28 June 2017 9:42 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002089

DSU_002090

1:2500

0 25m 50 75 100 125 150 175 200 225 250

XREFs: X-CW988000-01-Base; X-CW988000-01-Image

CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK6.dwg

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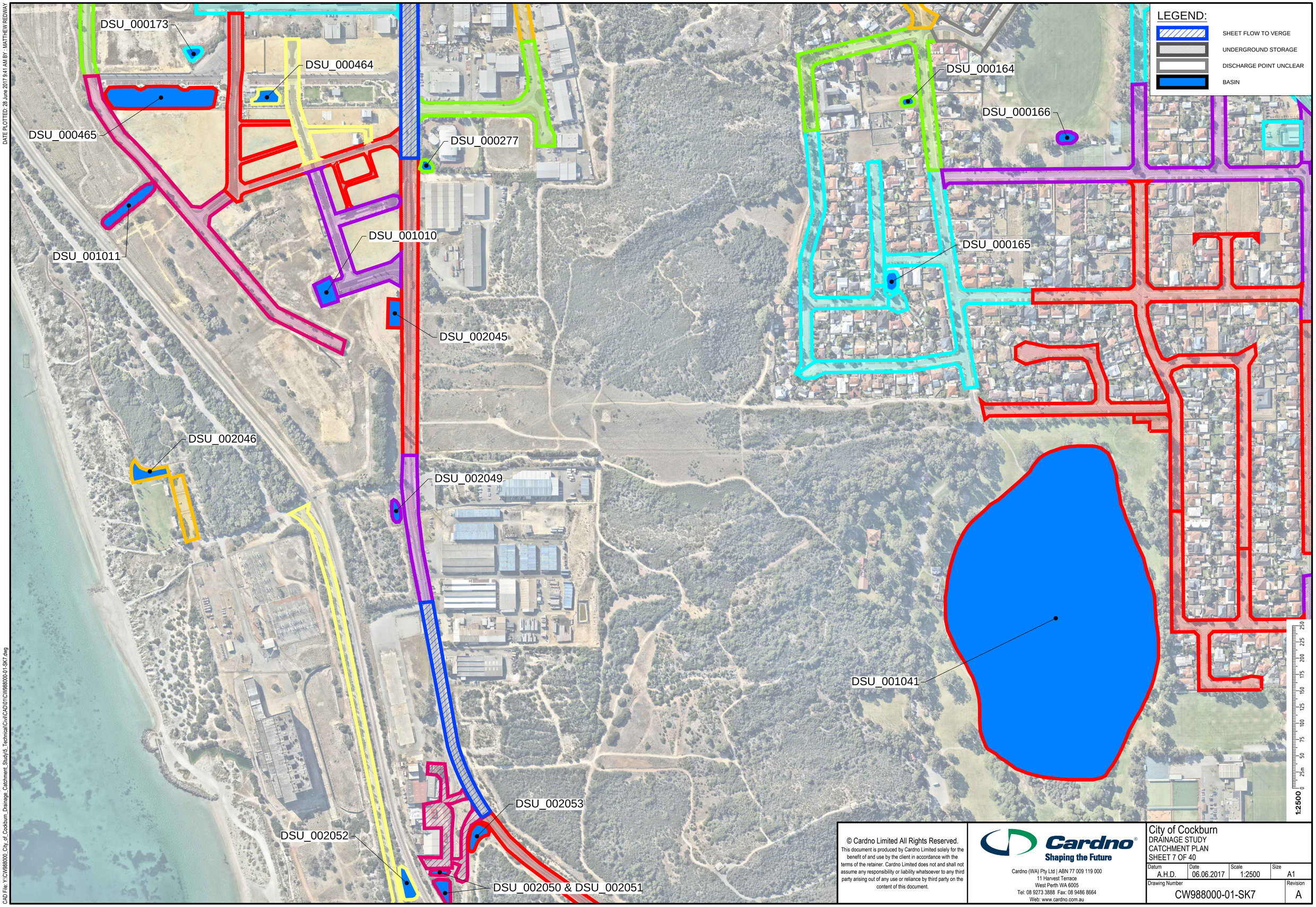
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 6 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK6	A

DATE PLOTTED: 28 June 2017 9:41 AM BY: MATTHEW REDWAY



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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 7 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK7	A

DATE PLOTTED: 28 June 2017 9:41 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_001003
DSU_000155
DSU_000156
DSU_000157
DSU_000163
DSU_002092
DSU_002091
DSU_000162
DSU_000153
DSU_000154
DSU_000176
DSU_001042
DSU_000158
DSU_000252
DSU_000177
DSU_000159
DSU_000160
DSU_000181
DSU_000242
DSU_001000
DSU_000198

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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CATCHMENT PLAN
SHEET 8 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK8	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
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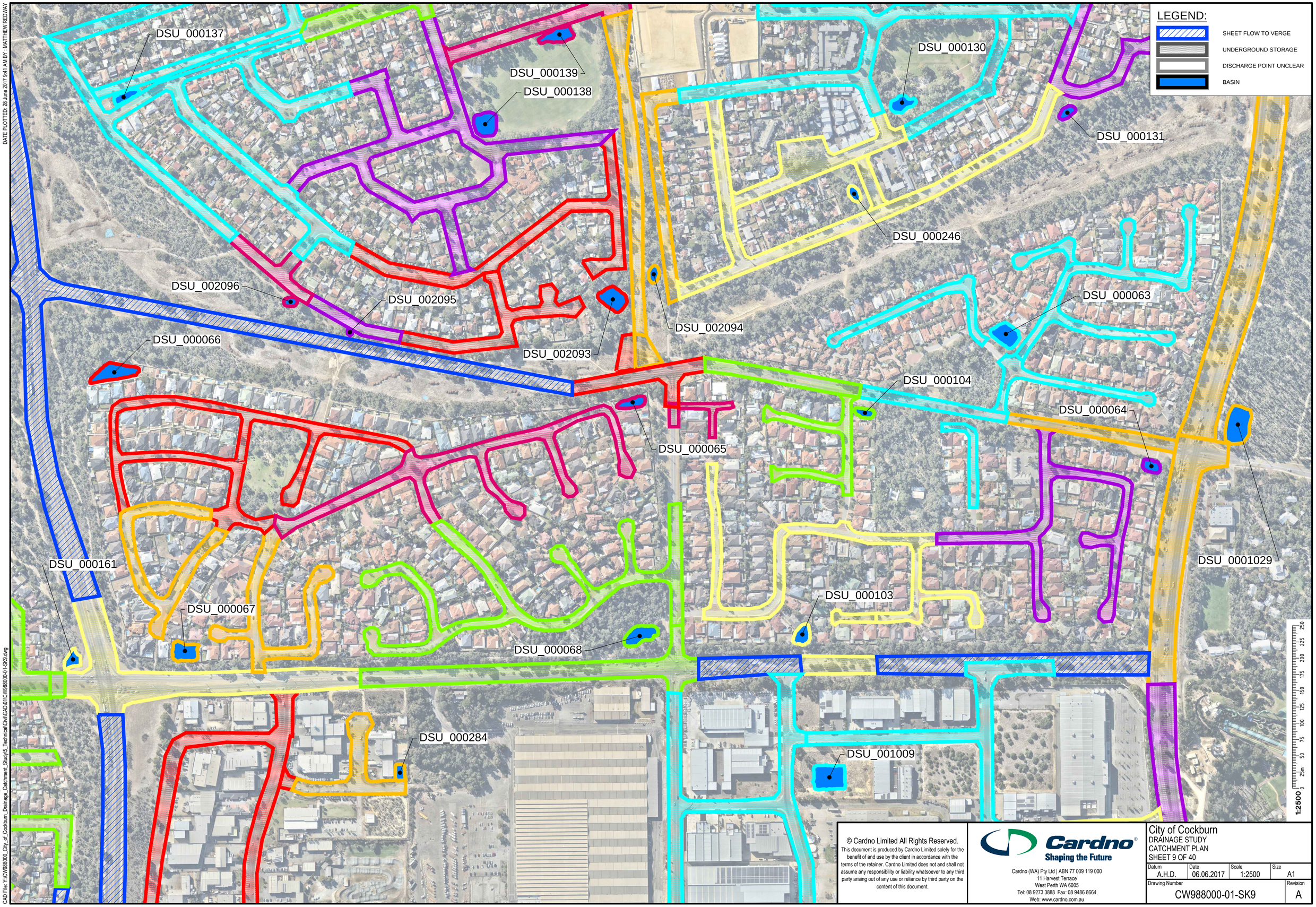
DATE PLOTTED: 28 June 2017 9:41 AM BY : MATTHEW REDWAY



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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 9 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK9	A

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_001030

DSU_001031

DSU_000053

DSU_000060

DSU_002027

DSU_000085

DSU_001033

1:2500

0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 10 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK10	A

DATE PLOTTED: 28 June 2017 9:19 AM BY : MATTHEW REDWAY

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DATE PLOTTED: 28 June 2017 9:38 AM BY : MATTHEW REDWAY

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK11.dwg

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002052

DSU_002053

DSU_002050 & DSU_002051

DSU_002048

DSU_002047

DSU_000461

DSU_001047

DSU_002112

1:2500

0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 11 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK11	A

DATE PLOTTED: 28 June 2017 9:38 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000198
DSU_000254
DSU_000182
DSU_000180
DSU_000201
DSU_000202
DSU_000179
DSU_002059
DSU_000204
DSU_000203
DSU_000205
DSU_000199
DSU_001035
DSU_002062
DSU_002097
DSU_000206
DSU_002060
DSU_000200
DSU_002063
DSU_002061
DSU_002098
DSU_000111
DSU_000357
DSU_000484-DSU_000487
DISCHARGE INTO PUBLIC OPEN SPACE
DSU_002102

1:2500

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 12 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK12	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
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DATE PLOTTED: 28 June 2017 9:38 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000105
DSU_000244
DSU_000112
DSU_000117
DSU_001035
DSU_001034
DSU_000110
DSU_000116
DSU_000356
DSU_000336
DSU_000338
DSU_000337

1:2500

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 13 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK13	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
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DATE PLOTTED: 28 June 2017 9:37 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_001033

DSU_001032

DSU_000062

DSU_000084

DSU_000400

DSU_000061

DSU_002099

DSU_002056

DSU_002100

DSU_000413

1:2500

0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 14 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK14	A

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
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DATE PLOTTED: 28 June 2017 9:37 AM BY: MATTHEW REDWAY

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK15.dwg

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000085
DSU_002027
DSU_002026
DSU_002035
DSU_001006
DSU_002055
DSU_002029
DSU_002028
DSU_002030
DSU_002031
DSU_002032
DSU_002037
DSU_00095
DSU_00056

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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City of Cockburn
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 15 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK15	A

DATE PLOTTED: 28 June 2017 9:37 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_001048

DSU_000484-DSU_000487

DSU_000057

DSU_000374

DSU_002101

DSU_000183

DSU_000184

DSU_000193

DSU_000185

DSU_000194

DSU_000051

DSU_000186

DSU_000187

DSU_000192

DSU_000188

DSU_000189

DSU_000191

DSU_000190

DSU_000195

DSU_000073

DSU_000050

1:2500

0 25m 50 75 100 125 150 175 200 225 250

XREF's: X-CW988000-01-Base; X-CW988000-01-Image

CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK16.dwg

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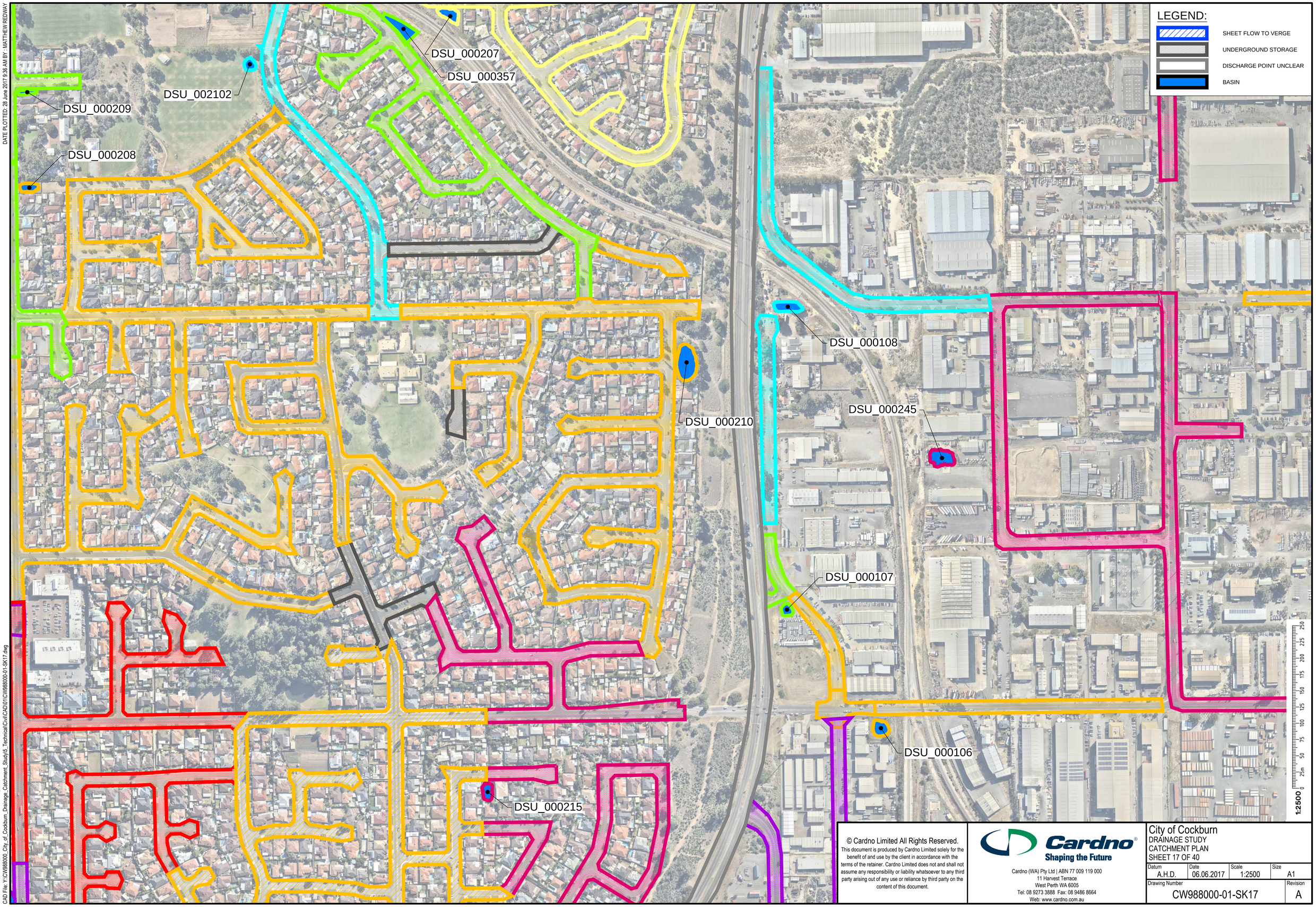
City of Cockburn
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 16 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK16	A

DATE PLOTTED: 28 June 2017 9:36 AM BY : MATTHEW REDWAY



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City of Cockburn
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 17 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK17	A

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK17.dwg

DATE PLOTTED: 28 June 2017 9:36 AM BY : MATTHEW REDWAY

XREFs: X-CW988000-01-Base, X-CW988000-01-Image

CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK18.dwg

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000413

DISCHARGE INTO LITTLE RUSH LAKE

DSU_000114

DSU_000395

DSU_000113

DSU_000115

DSU_000230

DISCHARGE INTO YANAGALOUP LAKE

DSU_000377

1:2500 0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 18 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK18	A

DATE PLOTTED: 28 June 2017 9:35 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002099
DSU_002056
DSU_002100
DSU_000054
DSU_000081
DSU_002078
DSU_000077
DSU_000224
DSU_000083
DSU_000055
DSU_000037 - DSU_000039
DSU_000056
DSU_002058
DSU_000086
DSU_000087
DSU_000317
DSU_000088

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 19 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK19	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK19.dwg

DATE PLOTTED: 28 June 2017 9:35 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002037
DSU_000095
DSU_002033
DSU_002032
DSU_002034
DSU_002103
DSU_002036
DSU_000046
DSU_000340
DSU_001008
DSU_000047
HEADWALL BUT
NO FORMAL SUMP
DSU_001007
DSU_002043
DSU_002038
DSU_002039
DSU_002040
DSU_002041
DSU_002057

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 20 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK20	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK20.dwg

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002080

DSU_002081

DSU_000226

DSU_002079

DSU_002082

DSU_000093

DSU_000488-DSU_000490

DSU_000272

DSU_000273

DSU_000094

1:2500

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 21 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK21	A

DATE PLOTTED: 28 June 2017 9:40 AM BY : MATTHEW REDWAY

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5 Technical\Civil\CAD\01\CW988000-01-SK21.dwg

DATE PLOTTED: 28 June 2017 9:40 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000052
DSU_000195
DSU_000197
DSU_002064
DSU_000196
DSU_002104
DSU_000217
DSU_000072
DSU_000216
DSU_002016-DSU_002017
DSU_000334
DSU_000074
DSU_000335
OVERFLOW TO WETLAND
DSU_002018
DSU_000212
DSU_000211
DSU_002025
DSU_002019
DSU_000406
DSU_000276
DSU_000439
DSU_002023
DSU_002024

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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City of Cockburn
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 22 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK22	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK22.dwg

DATE PLOTTED: 28 June 2017 9:40 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000109
DSU_000377
DSU_002073
DSU_000229
DSU_001012
DSU_002016-DSU_002017
DSU_000042
DSU_000231
DSU_000238
DSU_000213
DSU_000232
DSU_000239
DSU_000311
DSU_000293

1:2500

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK23.dwg

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 23 OF 40

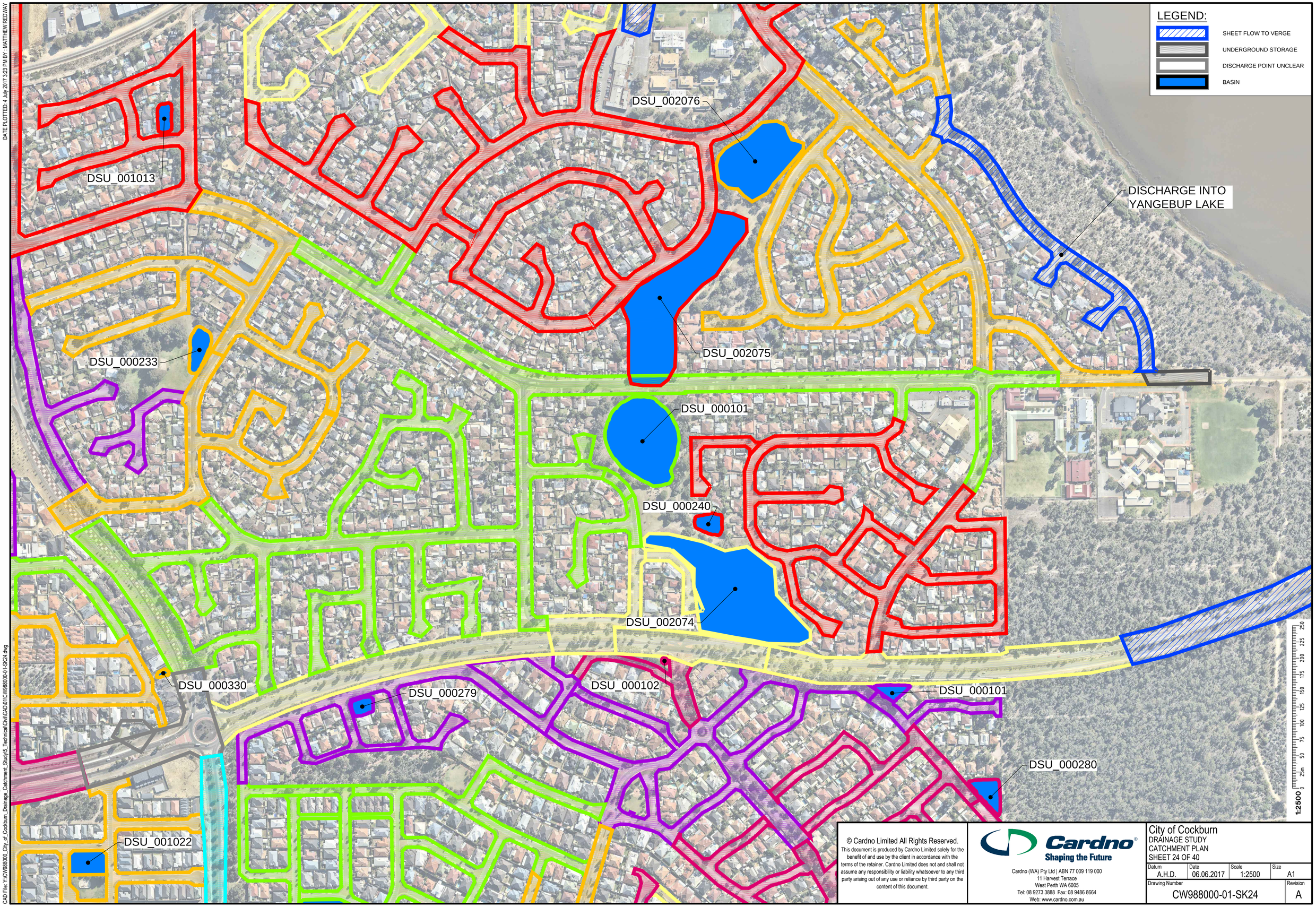
Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK23	A

DATE PLOTTED: 4 July 2017 3:23 PM BY : MATTHEW REDWAY

XREFs: X-CW988000-01-Base; X-CW988000-01-Image

CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK24.dwg



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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 24 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK24	A

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000089
DSU_000399
DSU_001045
DSU_000096
DSU_001044
DSU_002057
DSU_000097
DSU_001043
DSU_000090
DSU_000098
DSU_000481-DSU_000483
DSU_000100
DSU_000099
DSU_001046

1:2500

0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 25 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK25	A

DATE PLOTTED: 28 June 2017 9:35 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000226
DSU_002079
DSU_000093
DSU_000488-DSU_000490
DSU_000391
DSU_000094
DSU_000272
DSU_000273
DSU_000359
DSU_000360
DSU_000361
DSU_000362
DSU_000366
DSU_000365
DSU_000364
DSU_000363
DSU_000091 - DSU_000092
DSU_002105
DSU_000457
DSU_000491
DSU_001021 & DSU_001037
DSU_001036
DSU_002067

1:2500 0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 26 OF 40

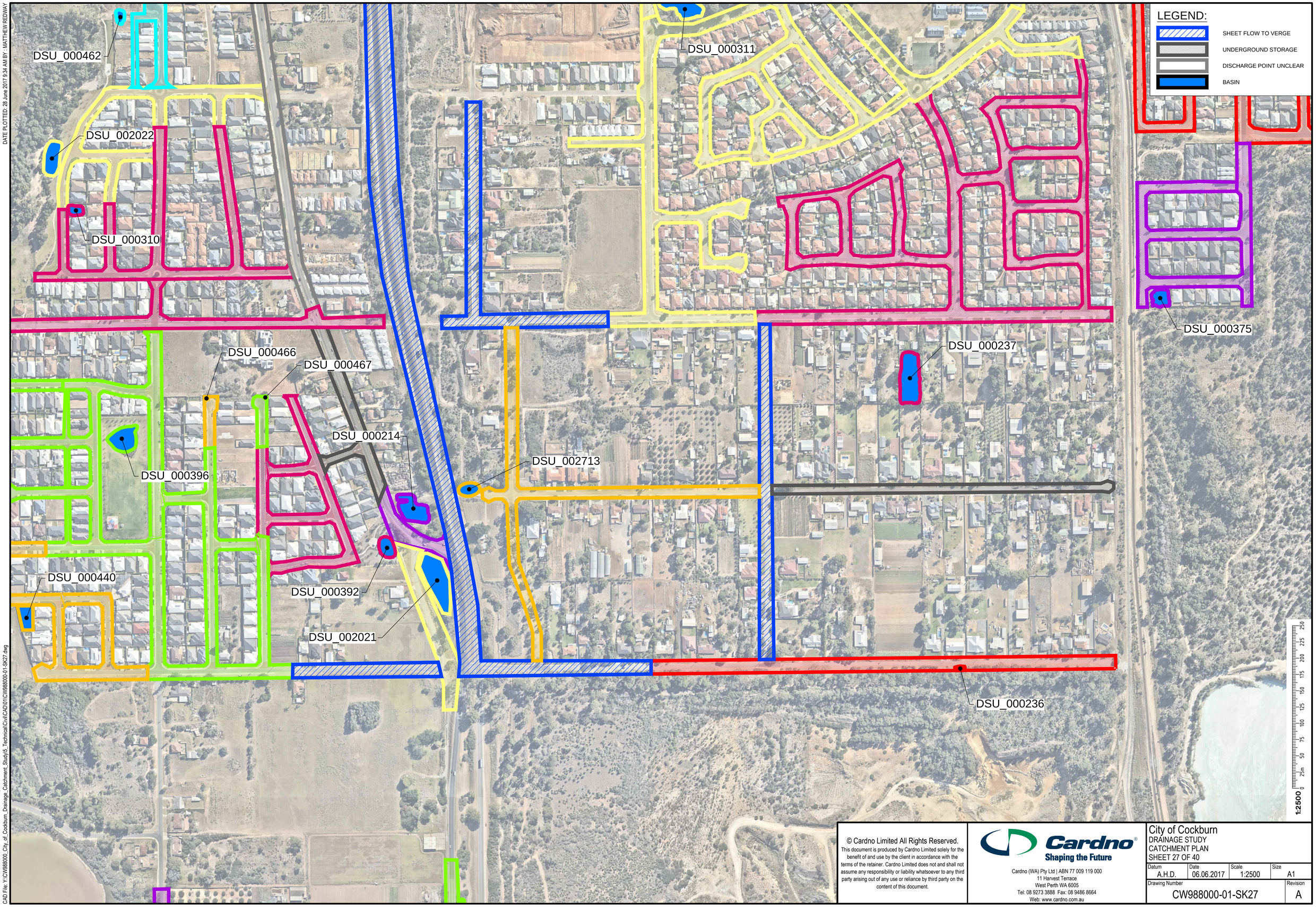
Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK26	A

XREFs: X:CW988000-01-Base; X:CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5. Technical\Civil\CAD\01\CW988000-01-SK26.dwg

DATE PLOTTED: 28 June 2017 9:34 AM BY : MATTHEW REDWAY

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK27.dwg



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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 27 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK27	A

DATE PLOTTED: 28 June 2017 9:33 AM BY : MATTHEW REDWAY

DSU_001022
DSU_002106
DSU_001023
DSU_000438
DSU_000381
DSU_000281
DSU_000282
DSU_001026
DSU_000257
DSU_000286
DSU_001024
DSU_001027
DSU_002107
DSU_001028
DSU_001025

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

1:2500 0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 28 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK28	A

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK28.dwg

DATE PLOTTED: 28 June 2017 9:33 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002069
DSU_000283
DSU_000446
DSU_002067
DSU_002068
DSU_000447
DSU_000043
DSU_002070
DSU_002065 & DSU_002066
DSU_002071
DSU_000227
DSU_000285
DSU_000287
DSU_000339
DSU_000291

1:2500 0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 29 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK29	A

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK29.dwg

DATE PLOTTED: 28 June 2017 9:32 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000091

DSU_001036

DSU_001037 & DSU_001021

DSU_000313

DSU_001038

1:2500 0 25m 50 75 100 125 150 175 200 225 250

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City of Cockburn
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 30 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK30	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK30.dwg

DATE PLOTTED: 28 June 2017 9:32 AM BY : MATTHEW REDWAY

XREFs: X-CW988000-01-Base; X-CW988000-01-Image

CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK31.dwg

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002072
DSU_000235
DSU_000228
DSU_000041
DSU_000455 - DSU_000456
DSU_000234
DSU_000040
DSU_000383
DSU_000367
DSU_000354
DSU_000368
DSU_000026
DSU_000258
DSU_000316
DSU_000394

1:2500 0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 31 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK31	A

DATE PLOTTED: 28 June 2017 9:32 AM BY : MATTHEW REDWAY

XREF's: X-CW988000-01-Base; X-CW988000-01-Image

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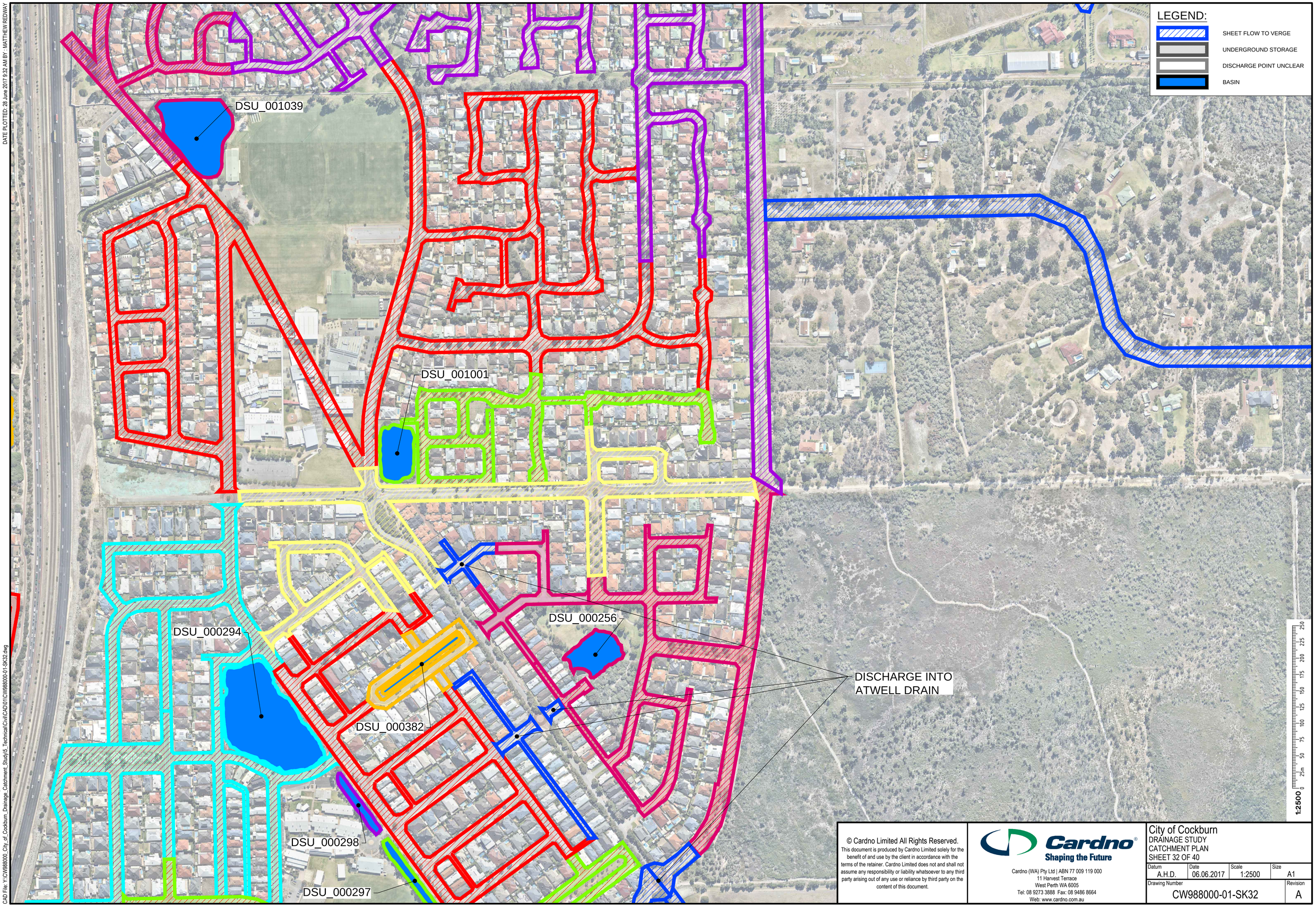

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 32 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK32	A

DATE PLOTTED: 28 June 2017 9:31 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002020
DSU_001005
DSU_002000
DSU_002003
DSU_002004
DSU_002008
DSU_000082
DSU_000075
DSU_002002
DSU_002007
DSU_002006
DSU_002005
DSU_002009
DSU_002001
DSU_000243
DSU_000371
DSU_002013
DSU_002010
DSU_002011
DSU_002012
DSU_002014
DSU_002015
DSU_000219
DSU_000274
DSU_001014

1:2500

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 33 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK33	A

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK33.dwg

DSU_000076

DSU_001004

DSU_000241

DSU_000077

DSU_000078

DSU_000079

DSU_000080

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

1:2500

0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 34 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK34	A

DATE PLOTTED: 28 June 2017 9:31 AM BY : MATTHEW REDWAY

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK34.dwg

DATE PLOTTED: 28 June 2017 9:31 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000394
DSU_000029
DSU_000385
DSU_000315
DSU_000404
DISCHARGE INTO ATWELL DRAIN
DSU_000333
DSU_000289
DSU_000265
DSU_000314
DSU_000386
DSU_000378
DSU_000379
DSU_001049
DSU_000044, DSU_000312 & DSU_000380
DSU_000045 & DSU_000342
DSU_002108
DSU_001017

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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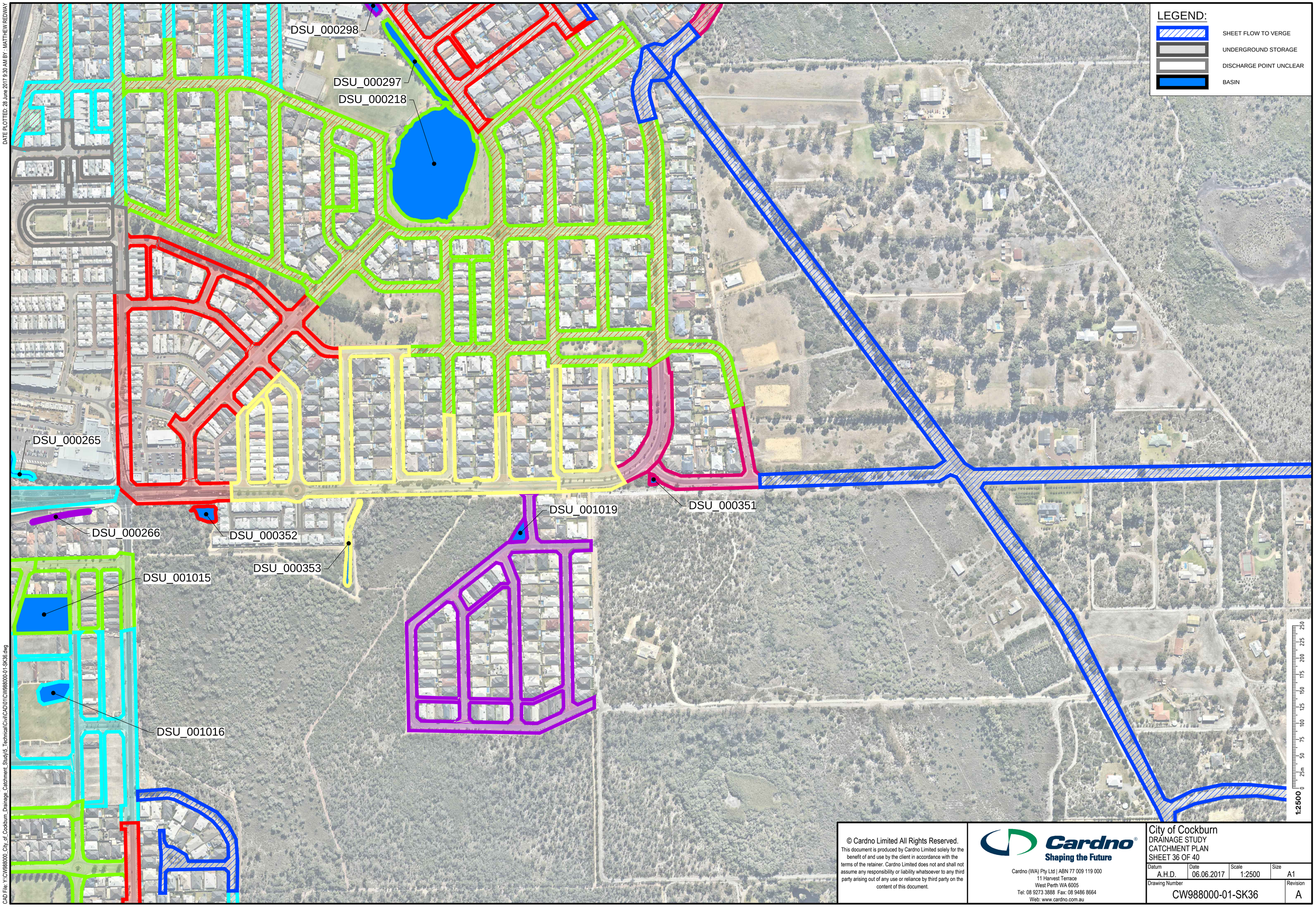
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 35 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK35	A

XREF's: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK35.dwg

DATE PLOTTED: 28 June 2017 9:30 AM BY: MATTHEW REDWAY



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CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK36.dwg

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City of Cockburn
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 36 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK36	A

DATE PLOTTED: 28 June 2017 9:29 AM BY : MATTHEW REDWAY

XREFs: X-CW988000-01-Base; X-CW988000-01-Image

CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK37.dwg

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_001017
DSU_000343
DSU_000344
DSU_000397
DSU_000348
DSU_000345
DSU_000347
DSU_000346
DSU_000376
DSU_001020
DSU_001050
DSU_000415
DSU_000405
DSU_000388
DSU_001051
DSU_001052
DSU_001058
DSU_001054
DSU_000402
DSU_000403
DSU_000463

1:2500 0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 37 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK37	A

DATE PLOTTED: 28 June 2017 9:29 AM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_000323-DSU_000324
DSU_000322
DSU_000321
DSU_000320
DSU_000319
DSU_001020
DSU_000369
DSU_000350
DSU_000370
DSU_000329
DSU_000393

1:2500
0 25m 50 75 100 125 150 175 200 225 250

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City of Cockburn
DRAINAGE STUDY
CATCHMENT PLAN
SHEET 38 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK38	A

XREFs: X-CW988000-01-Base; X-CW988000-01-Image
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK38.dwg

DATE PLOTTED: 4 July 2017 3:24 PM BY : MATTHEW REDWAY

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

DSU_002110

DSU_000220

DSU_000069

DSU_002111

DSU_000071

DSU_000070

1:2500

0 25m 50 75 100 125 150 175 200 225 250

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 39 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK39	A

XREF's: X-CW988000-01-Image, X-CW988000-01-Base
CAD File: Y:\CW988000_City_of_Cockburn_Drainage_Catchment_Study\5_Technical\Civil\CAD\01\CW988000-01-SK39.dwg

DSU_001054
DSU_000402
DSU_000403
DSU_000463
DSU_000468
DSU_000460
DSU_000329
DSU_000407
DSU_000349
DSU_000448
DSU_001018

1:2500
0 25m 50 75 100 125 150 175 200 225 250

LEGEND:

- SHEET FLOW TO VERGE
- UNDERGROUND STORAGE
- DISCHARGE POINT UNCLEAR
- BASIN

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DRAINAGE STUDY
CATCHMENT PLAN
SHEET 40 OF 40

Datum	Date	Scale	Size
A.H.D.	06.06.2017	1:2500	A1

Drawing Number	Revision
CW988000-01-SK40	A

DATE PLOTTED: 28 June 2017 9:25 AM BY : MATTHEW REDWAY

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