2 Figtree Drive, Sydney Olympic *Park*—

Stormwater Management Strategy

FOR / Civil Engineering Services

CLIENT / Mirvac Projects Pty Ltd

DOCUMENT NO / S14184-RPT-C-0001 REV / E DATE / 04/04/2016

bgeeng.com—

CONTENTS

Appendices

Document *Control*

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1 INTRODUCTION

1.1 Background

The subject site is located within the land known as 2 Figtree Drive, Sydney Olympic Park (Site 53). The subject site is located within the Auburn City Council Local Government Area (LGA), however the Sydney Olympic Park Authority (SOPA) will be the consent authority for the stormwater drainage design. The site is located within the SOPA Masterplan 2030 Town Centre Central Precinct. The site is bounded by Figtree Drive to the north, Australia Avenue to the east, the Olympic Sprint Lidcombe Shuffle railway corridor to the south and a Fujitsu Data Centre to the west at 4 Figtree Drive. There is an existing building and carpark on the site that are to be demolished to make way for 422 residential units, approximately 1500sq.m of retail that will split between four proposed towers of varying height atop an expansive podium. A proposed road from Figtree Drive will provide access to the development. This road has been titled "New Street" for the purposes of this documentation. The Landscape Architect's overall layout plan is attached as Appendix A which gives the general arrangement of the whole development. The location of the subject site can be seen in Figure 1.

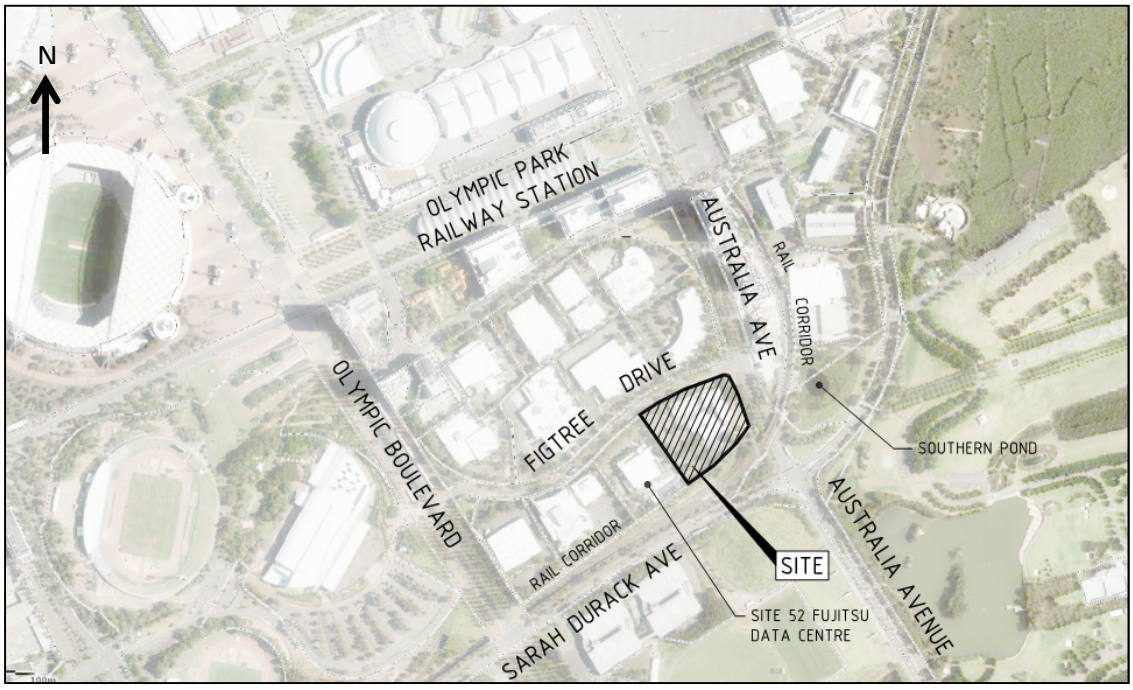

Figure 1 - Locality Plan (Aerial mapping source – SIX Maps)

1.2 Scope and Objectives

This Stormwater Management Strategy aims to provide an overall philosophy for the collection, treatment, and disposal of stormwater from the development site. The stormwater drainage design aims to satisfy the requirements of SOPA's Stormwater Policy *"Stormwater Management and Water Sensitive Urban Design Policy"*, (The Stormwater Policy), Version 1, Policy Number POL13/04, dated October 2013 (SOPA Environment and Ecology review undertaken January 2014 and January 2015). If the requirements of The Policy cannot be met, full justification has been provided.

2 BACKGROUND

2.1 Proposed Plan of Subdivision

It is proposed to subdivide the subject site in accordance with the proposed plan of subdivision, attached as Appendix B. The New Street will ultimately be retained by Sydney Olympic Park Authority (SOPA) as a public lot (noted as Area 2 on the plan of subdivision). Areas noted 3 and 4 on the plan of subdivision are allocated as future public reserve, which will also be retained by SOPA. These areas will ultimately form part of SOPA's public domain. The remainder of the site (noted as Area 5 on the plan of subdivision) will form the final total site area of 9,943sq.m.

Due to the abovementioned parcels of land being retained SOPA, they have been removed from any subsequent calculations.

2.2 Proposed New Street

The centreline of the proposed New Street coincides with the boundary between the neighbouring Fujitsu site. Therefore, an interim road section is proposed to be constructed as part of these works which is contained within the existing subject site boundary. The road and associated turning head will be graded to ensure that the drainage strategy for the development will only allow for half of the road that is located within the subject site boundary. It is assumed that the stormwater drainage associated with the future half-road construction to be built on the Fujitsu site by others will be drained by a separate drainage scheme.

Upon the completion of the Fujitsu development at 4 Figtree Drive, the New Street will have been transformed into its ultimate road width comprised of two traffic lanes and two parking lanes in accordance with Road 21A (Figure S21A) of SOPA's Urban Element Design Manual 2009 (UDEM). Once complete, this road will be dedicated to Council. As the New Street will ultimately be dedicated to Council, its catchment has been removed from both the water quality and water quantity calculations.

2.3 Fig tree Relocation

The fig tree that is currently located on the boundary between Site 52 and Site 53 is to be relocated to the south western corner of the site (refer to the Arborist's report for further detail). The fig tree will sit on a 10m x 10m root plate. As directed by the Arborist, construction work within the Tree Protection Zone (TPZ) is to be minimised. Any works within the TPZ will require approval from the Arborist to ensure the health and longevity of the tree.

The current drainage scheme includes minor stormwater pipe encroachments into the TPZ. The Arborist has reviewed this element of the design and has confirmed that this minor encroachment will be acceptable.

3 EXISTING STORMWATER DRAINAGE

Map 1 attached to The Stormwater Policy indicates that the subject site is situated within a 20.5 hectare (approximate) catchment that drains to the Southern Pond located on Site 68 to the east of Australia Avenue (attached as Appendix C).

The subject site covers an area of 1.23 hectares. The site is currently occupied by a vacant building and associated car parking. The site falls generally from Figtree Drive towards the railway corridor in the south. A topographical survey of the site is attached as Appendix D.

SOPA has provided a plan of existing services and is attached as Appendix E. The site is currently drained via the stormwater drainage network shown on the attached services plan and discharges to a trunk drainage line in the south-eastern corner of the site of varying diameter and size. There is a discrepancy between the supplied records and the information contained within the topographical survey. SOPA's services plan indicates this pipe to be a 600mm diameter pipe, however the topographical survey attached as Appendix D indicates a combination of various pipe diameters and culverts, with pipe diameters ranging from 375mm diameter in the south-western corner of the site to 1200mm diameter pipe in the south-eastern corner of the site. The pipe dimensions contained within the survey are assumed to be correct and have been adopted for design purposes.

This trunk stormwater pipe conveys flows under Australia Avenue before ultimately discharging into the Sothern Pond to the east of Australia Avenue.

It is understood that there is currently no On-Site Stormwater Detention (OSD) or Water Sensitive Urban Design (WSUD) measures on site to treat storm flows prior to discharging offsite.

The existing overland flow path is attached as Appendix F.

4 PROPOSED DRAINAGE

4.1 SOPA's Stormwater Policy Requirements

The proposed drainage scheme has been broken down into the following categories:

- Road drainage
- Roof and building drainage
- Podium drainage
- Landscape drainage

The roof and building drainage is covered by the Hydraulics scope. The podium drainage will be designed by the Hydraulics consultant and Landscape Architect. The civil drainage scope includes all site drainage outside of the proposed building footprint. This includes the OSD and WSUD treatment train.

The proposed drainage system comprises of road drainage for the New Street, OSD, and (WSUD) measures in accordance with The Stormwater Policy. These are discussed in the following sections.

4.2 Drainage Strategy

4.2.1 Concept Layout

A concept layout of the proposed drainage scheme is attached as Appendix G.

4.2.2 Discharge Location

The existing drainage network discharges to the pit shown in Figure 2.

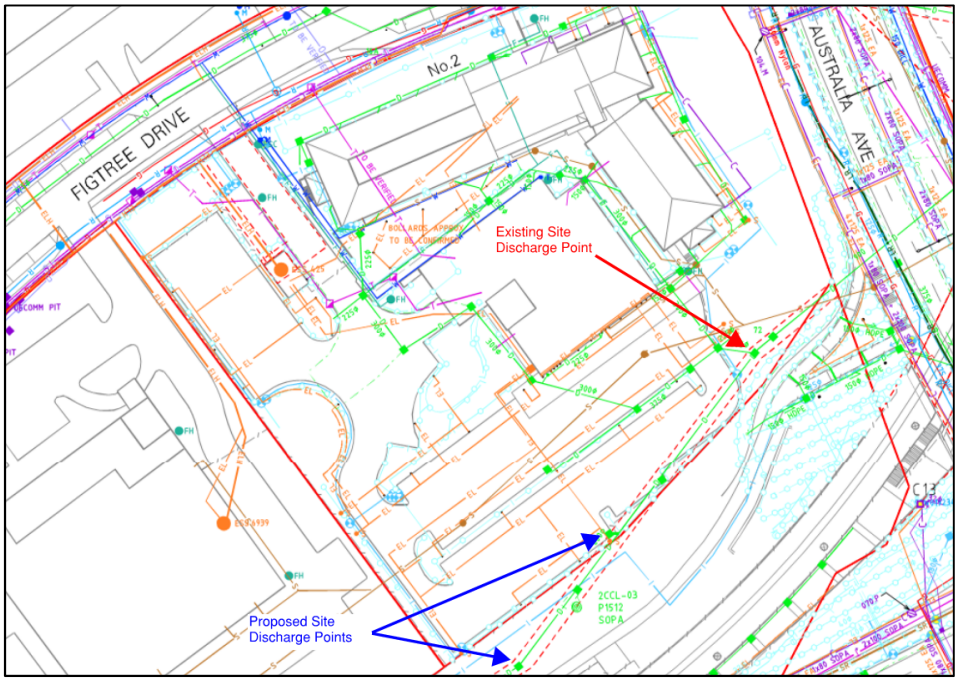

Figure 2 – Proposed and Existing Site Discharge Points

Due to site constraints, it is proposed to relocate the existing discharge location to the upstream pit, as shown in Figure 2. Refer to Section 4.5.9 for further justification of this connection point.

As noted previously, the New Street catchment has not been included in either the water quality or water quantity calculations.

This has created the need for two separate drainage lines. It is proposed to connect the New Street drainage directly to the trunk drainage line to the western pit shown in Figure 2 via a proposed GPT, and the outlet from the site water quality treatment train to the eastern pit shown in Figure 2. Two discharge locations have been proposed in order to avoid the tree root plate of the relocated fig tree location. Refer to the stormwater layout plan attached as Appendix G.

Stormwater run-off generated by the New Street will be collected by kerb inlet pits and piped to the discharge point which connects to the existing trunk drainage line.

4.3 Drainage Network Modelling Software

The computer software package DRAINS (Version 2015.03 – 3 April 2015) has been used for the design of the drainage network. DRAINS performs design and analysis calculations for urban stormwater drainage systems and models the flooding behaviour of rural and urban catchments.

The software MUSIC has been used for the water quality modelling. MUSIC is the Model for Urban Stormwater Improvement Conceptualisation. MUSIC provides the ability to simulate both quantity and quality of runoff from catchments ranging from a single house block up to many square kilometres, and the effect of a wide range of treatment facilities on the quantity and quality of runoff downstream.

4.4 Overland Flow

Should the stormwater system become blocked or the capacity of the system is exceeded, a safe overland flow route has been provided. The turning circle at the end of the New Street and the levels of the basement entry has been set to ensure that the basement will be flood free for the 1 in 100 year Average Recurrence Interval (ARI) event. The proposed overland flow route is attached as Appendix F. Flows that exceed the capacity of the system will top the kerb in the turning circle at the end of the New Street, where it will make its way down the hill to the footpath to the south of the site. It will follow the footpath until it ultimately discharges into Australia Avenue.

4.5 New Street Road Grading

The New Street will be graded to ensure that Site 53 will not receive flows from the upstream external catchment from Figtree Drive. Stormwater flows that are currently conveyed within Figtree Drive and then onto the Australia Avenue will not be altered by the current proposal.

4.6 Water Quantity Measures (OSD)

4.6.1 SOPA OSD Policy Requirements

The Stormwater Policy requires that *"development within a Sydney Olympic Park non-stormwater harvesting catchment must maintain a 1 in 5 year ARI (Average Recurrence Interval) peak discharge to pre-*

development (non-urbanised) magnitude." Through various discussions and correspondence with SOPA, it has been agreed that post development flows are to be reduced to greenfields pre-development flows for the 1 in 5 year ARI event only.

4.6.2 Pre-development Flow Rate – Permissible Site Discharge

In order to achieve SOPA's requirement of limiting the post-development flows from the development site to the greenfield pre-development flow, a baseline permissible site discharge (PSD) needs to be established.

The steps below have been taken to determine the 5 year ARI PSD.

4.6.3 Time of Concentration

In order to determine a greenfield time of concentration, a number of assumptions have been made regarding the greenfield site. The topography of the site prior to the construction of the existing building and carpark are unknown. Whilst it is assumed that there has been some re-grading and modification of the existing levels, it has been assumed that the levels at the boundaries are similar to the original levels. Therefore, it has been deemed reasonable to assume that the overall average gradient of the site will be similar now to when it was in it's greenfield state.

In accordance with the procedure recommended in the Queensland Urban Drainage Manual (QUDM), the time of concentration has been determined using *Friends Equation*.

Table 1 summarises the greenfield site properties that have been assumed (based on the current topographic survey).

Greenfields Catchment	Adopted Value
Overland flow length (m)	120
Average Slope (%)	7.5
Percentage Impervious	0% (Assumed to be fully grassed / vegetated

Table 1 – Assumed Greenfields Site Properties

QUDM provides guidance on the maximum length of overland sheet flow, beyond which it is assumed that minor concentrated flow forms. Table 2, sourced from QUDM provides guidance on maximum sheet flow.

Surface condition	Assumed maximum flow length (m)
Steep (say >10%) grassland (Horton's n = 0.045)	20
Steep (say >10%) bushland (Horton's n = 0.035)	50
Medium gradient (approx. 5%) bushland or grassland	100
Flat (0–1%) bushland or grassland	200

Table 2 – Recommended maximum length of overland sheet flow

As the site slope is 7.5%, the recommended maximum length of sheet flow of 75m has been interpolated from Table 2.

Figure 3 contains the *Friends Equation* nomograph (sourced from QUDM). The chart is entered with the recommended maximum sheet flow length of 75m and average site slope of 7.5%. A travel time of 14mins is determined for the 75m sheet flow with a roughness 'n' value of 0.045, which corresponds to an average grassed surface.

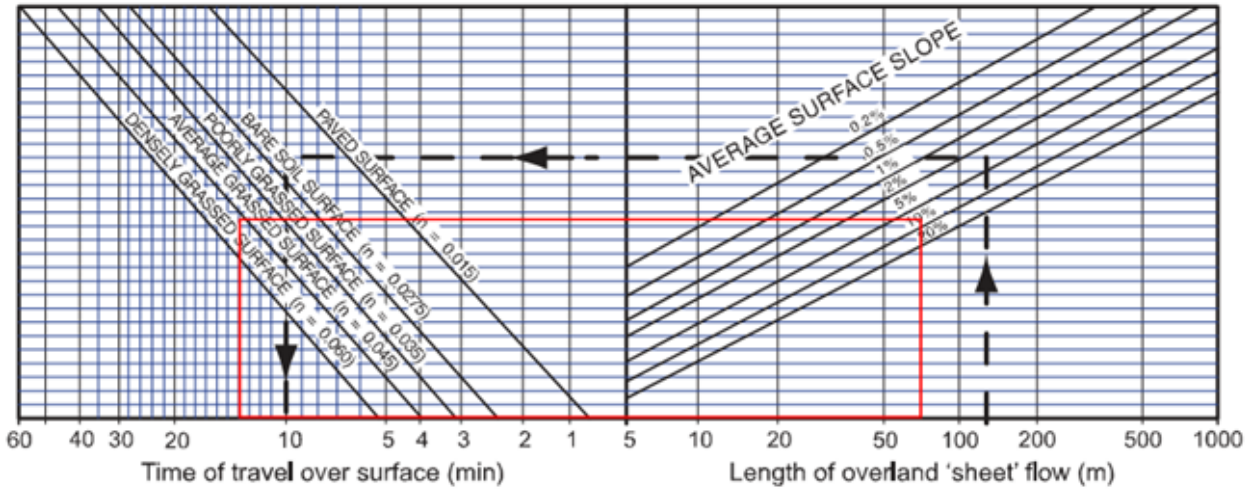

Figure 3 Overland sheet flow times (shallow sheet flow only)

The remaining 45m is assumed to be minor concentrated flow. A Manning's calculation was performed on a simple channel profile, indicating that channel flow velocity at this gradient will be approximately 1.5m/s. This results in approximately 1 minute of travel of channel flow.

Therefore, the adopted time of concentration is the sum of sheet flow travel time and channel travel time, totalling 15 minutes.

4.6.4 Pre-Development Catchment Area

As discussed in Section 1, the site is proposed to be sub-divided. To ensure a like-for-like comparison, the proposed reduced ultimate site area of 9,943m2 has been adopted for the greenfield pre-development flow.

4.6.5 Intensity-Frequency-Duration (IFD) Data

The following IFD data has been adopted. It has been sourced from the Bureau of Meteorology (BOM) website. For co-ordination purposes, both the Hydraulic and Civil consultants have adopted identical IFD data for consistency. The IFD data is contained in Figure 4.

Intensity-Frequency-Duration Table

Location: 33.850S 151.050E NEAR.. Homebush Issued: 27/7/2015

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

	Average Recurrence Interval						
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	87.3	112	141	158	180	210	232
6Mins	81.8	105	132	148	169	197	218
10Mins	66.9	85.7	109	122	139	162	179
20Mins	48.9	62.6	79.6	89.2	102	119	132
30Mins	39.8	51.0	64.9	72.8	83.4	97.1	108
1Hr	27.0	34.6	44.2	49.8	57.1	66.7	73.9
2Hrs	17.5	22.6	29.2	33.0	38.0	44.5	49.5
3Hrs	13.5	17.4	22.6	25.7	29.7	34.9	38.9
6Hrs	8.55	11.1	14.6	16.7	19.4	23.0	25.8
12Hrs	5.52	7.20	9.56	11.0	12.8	15.2	17.1
24Hrs	3.66	4.77	6.34	7.28	8.49	10.1	11.3
48Hrs	2.43	3.15	4.16	4.76	5.54	6.57	7.35
72Hrs	1.84	2.39	3.15	3.60	4.19	4.96	5.55

(Raw data: 34.77, 7.16, 2.39, 66.74, 15.23, 4.96, skew=0.00, F2=4.29, F50=15.84)

Figure 4 IFD Data

4.6.6 Post-Development Catchments

As discussed in Section 1, it is proposed to subdivide the site. Therefore the total catchment will be the site area post subdivision of the subject site, having an area of 9,943sq.m.

The post-development catchment has been split into two main categories, these being roof catchments and the podium drainage. These are discussed below in turn.

Roof catchment

Due the expansive podium, it is proposed to drain the 4 towers via a siphonic system to the rainwater tank via a first flush system. Please refer to the hydraulics report for further detail.

The roof catchment areas provided by the Hydraulics Consultant are contained in Table 3.

Building Number	Roof Area (sq.m)
Building 1	638
Building 2	1,175
Building 3	1,040
Building 4	1,140
TOTAL ROOF AREA	**3,993**

Table 3 Roof Catchment Areas

All building roof catchments are assumed to be 100% impervious with a time of concentration of 5 minutes. The roof, guttering and downpipe system has been designed for a 1 in 100 year Average Recurrence Interval (ARI) event.

Podium Catchment

As discussed in Section 1, the total site area is 9,943sq.m. The roof catchment area is 3,993sq.m. Therefore, the remaining site area comprising of podium area and landscaping area is 5,950sq.m. This includes the landscaped area adjacent Figtree Drive and the proposed dedicated landscape buffer adjacent the New Street.

Approximately 75% of this area is proposed to be landscaped, with varying depths of soil and planting (refer to the Landscape Architects report). Although most of this landscaping is located on the podium slab, rainfall losses will be higher than if the soft landscaping was not present. The landscaping will also substantially increase the time of concentration of this catchment. Hardstand areas make up 25% of the total podium area (excluding the four building footprints). However, for modelling purposes, the podium catchment has been assumed to be 50% impervious.

The detail podium drainage design is to be undertaken by the Hydraulic and Landscape Architect. The piped podium drainage is to be designed for the 1 in 20 year ARI event. Events exceeding the 1 in 20 year ARI will comprise overland flow across the podium away from the building areas.

4.6.7 Rainwater Tanks

The building roof catchments will drain directly to a series of rainwater tanks with a combined total volume of 68.1kL. This will be provided by the use of 3 x 22.7kL pre-fabricated plastic rainwater tanks.

Prior to roof water entering the rainwater tanks, flows will pass through a first flush device. This will ensure that the first few millimetres of “dirty’ storm flows are captured and diverted to the water quality treatment train via the OSD. Therefore, theoretically only clean water will be stored in the rainwater tanks. The first flush device will drain the dirty water via a penetration in the slab to the OSD below. Refer to hydraulics report for details. Figure 5 diagrammatically displays the drainage system connectivity.

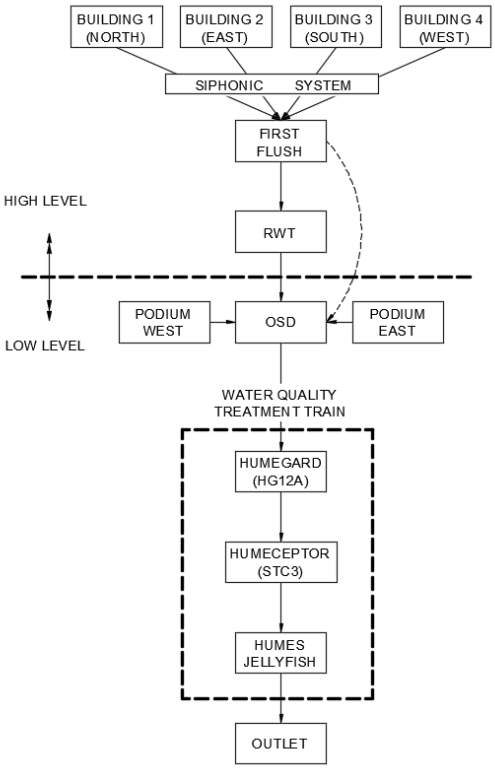

Figure 5 OSD / WSUD Schematic

4.6.8 Adopted Tailwater Level

It is proposed to connect the outlet from the OSD system into the trunk stormwater drain located along the south-eastern edge of the site.

SOPA have provided the tailwater levels at the discharge location for a range of design storms. Design water levels have been sourced from SOPA's catchment-wide DRAINS model. These levels are summarised in Table 4.

ARI Event	Peak water level (m AHD)		
	Pit 71** cover level 11.76 invert level 10.16	**Pit 71A**** cover level 12.23 invert level 9.70	**Pit 72**** cover level 12.50 invert level 9.59
1 year	11.28	10.70	10.34
2 year	11.75	10.94	10.45
5 year	*11.76*	11.00	10.52
10 year	*11.76*	11.02	10.54
20 year	*11.76*	11.05	10.58
100 year	*11.76**	11.76*	11.76*

Table 4 Design tailwater levels

Notes:

*Assumed level. As the upstream pit is surcharged, the maximum water level is the surface level of the upstream pit.

** Refer to the Civil drawings attached as Appendix G for pit locations

11.76 (italicised) indicates that the design water level is higher than the pit surface (ie surcharging)

It can be seen in Table 4 that Pit 71 is expected to surcharge in storms greater than a 2 year ARI. SOPA have recommended that no new connections are made to this pit. SOPA have also advised that Pit 71 is upstream of an existing GPT. Given that Site 53 will have its own stormwater treatment system it is more efficient to introduce flows from Site 53 downstream of the existing GPT.

It is proposed to connect the site drainage from Site 53 from the OSD tank to Pit 71A. As noted previously, the New Street is to be retained by SOPA. Due to site constraints, it is proposed to connect the New Street Road drainage to Pit 71.

4.6.9 Design ARIs

Table 5 displays the design ARI for various catchment components:

Catchment	Design ARI
Roof/Guttering/ downpipes	100 years
Podium	20 years
OSD	5 years

Table 5 Design ARIs

- It can be noted in Table 5 that the OSD is to be designed for a 5 year ARI whilst the podium piped drainage will be designed for a 1 in 20 year ARI. The OSD tank outlet is proposed to be controlled via the use of 1 outlet pipe and associated orifice. Whilst the OSD will be designed to ensure that post-development flows are reduced to pre-development flows for a 1 in 5 year ARI event, larger storms will also be routed through the tank. The tank has been designed to ensure the safe conveyance of these larger flows. In the event of a blockage, or the system's capacity is exceeded, flow will escape via the two upstream pits located within landscaped areas external to the basement. The tank has been designed to ensure that these pits do not surcharge in storms less than or equal to the 1 in 20 year ARI. For larger events surcharge flows will be directed south towards Linear Park, away from the building.

4.6.10 Modelling Results

DRAINS software has been utilised to perform the hydrological and hydraulic calculations. A pre-development node was created to establish the 1 in 5 year ARI PSD. Figure 6 displays the DRAINS model.

Figure 6 – DRAINS model

Model results are summarised in Table 6 below.

ARI	Pre-Dev Peak flow (l/s)	POST-Dev Peak flow (Without OSD) (l/s)	Post Dev Peak Flow (With OSD) (l/s)	Post-Dev Flow < Pre Dev-Flow	OSD Top Water Level (RL mAHD)	Max Water Depth (m)	Max Volume (cu.m)	US Pit Surcharged
5yr	140	291	140	YES	12.64	0.79	85	NO
20yr	262	408	185	YES	13.29	1.44	154	NO
100yr	372	516	347	YES	13.95	2.1	225	YES

Table 6 – DRAINS Modelling Results

Notes:

1. The outlet pipe is a 375mm diameter pipe
2. The outlet is controlled by a single 275mm diameter orifice

In order to satisfy the requirements of The Policy, 85 cu.m of storage volume will be required to limit the post development peak flows to pre development greenfield peak flows for a 1 in 5 year ARI. However, as the OSD tank is online, larger storms are routed through the system, a larger detention volume is actually utilised. This "additional' volume will be captured in the 'dead airspace'. The base RL of the tank is a function of the lowest incoming pipe, hence allowing the top water level to rise will not increase the requirement for more or less of the structure to be constructed.

4.6.11 Access and Maintenance

It is assumed that access to the OSD tank will be via manhole access covers located in the rainwater tank room. It should be noted that this will be classified as a confined space.

4.6.12 Emergency Overflow

In the event of an outlet failure, either due to blockage or the system capacity is exceeded, the two inlet pits from the podium will surcharge, and allow the flow to exit the system. This will ensure that storm flows will surcharge external to the building, protecting the basement from flooding risk.

4.6.13 Rainwater offset

The Stormwater Policy does not exclude the option offsetting the rainwater tank volume against the OSD volume. As the site is located within Auburn City Council LGA, previous design revisions looked to adopt Auburn City Council's approach to offsetting rainwater volumes. However, subsequent to a meeting held with SOPA on 2nd March 2016, clear direction was given that SOPA will not accept an offset mechanism. Subsequent to this direction, the OSD volume has not been reduced by an offset rainwater tank volume.

5 WATER QUALITY MEASURES (WSUD)

5.1 SOPA's Water Quality Objectives

The Stormwater Policy requires that the following water quality targets are met, depending on which SOPA defined catchment the development site is located within:

*"All development **must as a minimum** meet the following baseline water quality targets* (referred to as baseline targets)*:*

- *45% reduction in the mean annual load of Total Nitrogen*
- *65% reduction in the mean annual load of Total Phosphorus*
- *85% reduction in the mean annual load of Total Suspended Solids*
- *90% reduction in the mean annual load of hydrocarbons*
- *90% reduction in the mean annual load of gross pollutants*

*Development within a Sydney Olympic Park non-stormwater harvesting catchment **must strive to the maximum extent practicable**, to meet the following water quality targets* (referred to as enhanced targets):

- *65% reduction in the mean annual load of Total Nitrogen*
- *85% reduction in the mean annual load of Total Phosphorus*
- *90% reduction in the mean annual load of Total Suspended Solids*
- *90% reduction in the mean annual load of hydrocarbons*
- *95% reduction in the mean annual load of gross pollutants"*

As the subject site is located within a Sydney Olympic Park *non-stormwater* harvesting catchment, the intent is to exceed the *baseline* targets outlined above, with the objective of attaining the *stretch* water quality targets required for a development within a non-stormwater harvesting catchment as far as practicably possible.

5.2 WSUD Design Intent

The design intent is to provide above ground water quality treatment measures in favour of underground propriety products. However, as the proposed basement extent occupies a large percentage of the site, and due to the site topography, there is little opportunity to provide swales, raingardens or other above-ground WSUD treatment measures.

The following discussion outlines the options that were explored, and the reason why each option was discounted.

Option 1 – New Street Landscaping Buffer

A 3.0m wide landscape buffer zone has been proposed adjacent the proposed New Street. An option to utilise this space for a bio-swale was explored. The proposed road gradient is approximately 7.5%. Bio-swales operate effectively in the gradient range of 1-3% longitudinal gradient. The option to cascade the swale was also explored, which is considered to be an effective solution to counteract steep grades.

This option has been discounted however due to the levels of the proposed podium drainage. The western portion of the podium will drain to pit in the New Street road reserve. The indicative IL at these locations is RL 16.70, some 4m below the road level (approximately). The podium drainage would feasibly drain to a

swale at CH85.0. The basement entrance is located at approximately CH95.0. This leaves approximately 10 lineal metres available for a swale. This spatial requirement would be further reduced to allow the swale to cascade. For this reason, this option has been discounted.

Option 2 –Adjacent the Rail Corridor Boundary

The option to utilise the landscaping area between the rail corridor and the south eastern basement wall as a bio-swale was explored. It was discounted for the following reasons:

1. The piped gravity drainage levels from the podium are too low to allow an above ground swale to work.
2. The existing stormwater easement runs underneath this area. Any hard landscaping works associated with facilitating a swale will reduce future access to the storm water pipe.
3. The landscaping intent is to softly blend the levels from the Linear Park up to the podium level. Excavating this area to install a bio-swale will increase the landscaping grades, introduce retaining walls, and expose the basement wall, reducing the visual appeal of this pedestrianised public space.
4. Maintenance access will be very difficult for future swale maintenance
5. The relocated Fig Tree TPZ excludes a large portion of the available space
6. The resulting area would be insufficient to meet the Water Quality Objectives alone, and would still require to be deployed in conjunction with proprietary products.

Option 3 –Australia Avenue Verge

The option to utilise the landscaping area parallel to the Australia Avenue verge as a bio-swale was explored. It was discounted for the following reasons:

1. The landscaping intent is to softly blend the levels from Australia Avenue. Excavating this area to install a bio-swale will increase the landscaping grades, introduce retaining walls, and expose the basement wall, reducing the visual appeal of this highly pedestrianised public space.
2. The resulting area would be insufficient to meet the Water Quality Objectives alone, and would still require to be deployed in conjunction with proprietary products.

5.3 WSUD Proprietary Product Providers

As all options to provide above ground treatment have been discounted, underground proprietary products have been sought.

The following providers were contacted in order to propose a value-for-money solution whilst providing acceptable access and maintenance requirements whilst achieving the water quality targets – Humes, Stormwater360, SPEL and Rocla. Each of the providers has provided an indicative 50 year life-cycle costing. The outcome of this analysis was considered when selecting the currently proposed WSUD treatment train.

5.4 Preferred WSUD provider

The selection criteria (not in order of priority) include access, maintenance, cost and ability to achieve the WQO's. Based on these selection criteria, it is proposed to implement the Humes treatment train at this point in time. The Humes treatment train achieves Stretch Targets required by SOPA, is easily accessible by vacuum trucks from the Level 00 carpark and has low annual maintenance costs.

5.5 Water Quality Treatment Train

In order to achieve SOPA's stretch targets, primary, secondary and tertiary treatment will be required.

The proposed treatment train is as per the Figure 7.

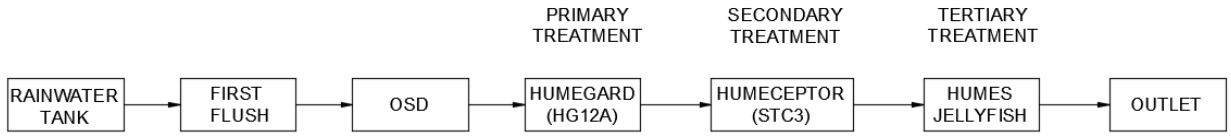

Figure 7 – WSUD Treatment Train

5.6 MUSIC Modelling

Figure 8 shows the MUSIC model used to demonstrate that the WSUD treatment train can meet the WQO's.

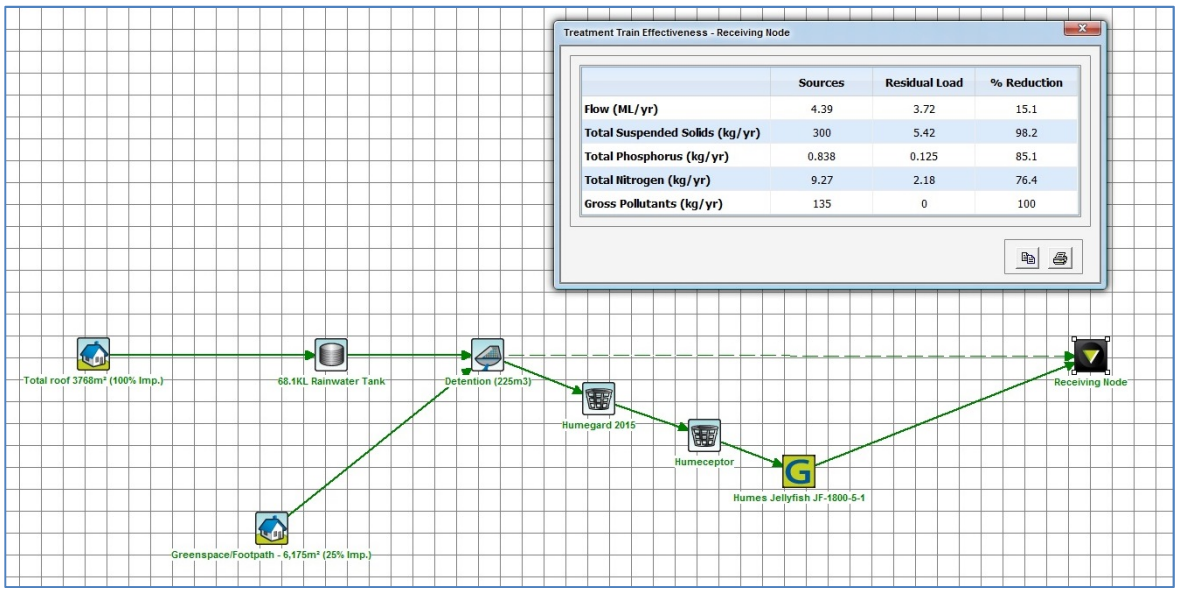

Figure 8 – MUSIC Model

5.7 Water Quality Modelling Results

A summary of the results is contained in Table 8.

	Baseline Targets	Stretch Targets	% Reduction Achieved	Stretch Target Achieved?
Total Suspended Solids	85	90	98.2	Yes
Phosphorus	65	85	85.1	Yes
Nitrogen	45	65	76.4	Yes
Gross Pollutants	90	95	100	Yes

Table 7 – MUSIC Modelling results

5.8 Water Quality Conclusion

It can be demonstrated from the MUSIC modelling results that SOPA's stretch targets are met.

6 STORMWATER QUALITY MANAGEMENT PLAN – CONSTRUCTION PHASE

6.1 Objectives

The objective of the Construction Phase Management Plan is to ensure compliance with the SOPA's and Landcom's "Blue Book" requirements. The purpose of the management plan is to prevent the discharge of polluted stormwater off the site and to ensure that the environmental values of receiving waters are maintained or enhanced.

Pollutants typically generated during the Construction Phase are outlined in Table 9.

Pollutant	Sources
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts.
Sediment	Unprotected exposed soils and stockpiles during earthworks and building.
Hydrocarbons	Fuel and oil spills, leaks from construction equipment.
Toxic materials	Cement slurry, asphalt prime, solvents, cleaning agents, wash waters (e.g. from tile works).
pH altering substances	Acid sulphate soils, cement slurry and wash waters.

Table 8 – Typical Construction Phase Pollutants

6.2 Management of Sedimentation & Erosion

A siltation and erosion fence is to be erected. It is expected that the siltation fence along the perimeter of the site will eliminate almost all risk of sediment being washed off the site. Accidental spills of soil or any other material shall be removed immediately if rainfall is likely to occur or at least upon completion of the days work depending upon the material.

Entry and exit from the site will be restricted to a single stabilised location to minimise the risk of tracking sediment over the site. It is expected that a layer of crushed rock will provide the necessary stabilisation for the access route. A specific area on the site shall be designated for washing down construction plant. The washdown area will be contained by earth bunds. There will be no waste water discharged from the site during construction.

Conceptual details of the control measures to be implemented during construction are presented in Appendix G. The details of the erosion and sediment control devices are to be confirmed during the Construction Certificate phase.

6.3 Management of Contaminated Soils

The site is not known to contain acid sulfate soils. However in the event that Acid Sulfate Soils or Contaminated Land is found on site, a management plan is to be implemented and maintained by a suitably qualified professional.

6.4 Management of Imported Materials

Any material imported onto the site (including construction materials) will be stockpiled in a location where it cannot contaminate stormwater runoff.

6.5 Monitoring & Maintenance

Silt traps, sediment fences and structural measures should be checked daily during construction by the Construction Manager. Inspections will ensure the integrity of control structures and other structural measures. Additional inspections will be required immediately following periods of heavy rain. Sediment build-up is to be removed from behind the silt fences and other barriers immediately after each major rainfall event. All noted stormwater treatment devices within this report are to be inspected, maintained, rectified and reported on.

6.6 Responsibility & Reporting

Performance monitoring of all drainage control measures along with erosion and sediment control devices will remain the responsibility of the contractor. Site inspection forms/checklists shall be reported to the Construction Manager following inspection of water quality devices/measures.

The contractor should erect signage at the entrance to the site with contact information (including after-hours contact information). The contractor shall be responsible for the appropriate handling of all complaints.

7 CONCLUSION

This Stormwater Management Strategy has provided an overall philosophy for the collection, treatment and disposal of stormwater from the development site. The site will incorporate a stormwater collection and disposal system that meets the requirements of The Stormwater Policy. Exact layouts and sizing for the stormwater system will be confirmed during detailed design.

APPENDIX A

Landscape Plan

LEGEND

1 PRIVATE COURTYARDS
2 SUBSTATION
3 PATHWAY VERGE AND STREET TREE PLANTINGS AS PER UEDM (REFER SECTIONS FOR FURTHER DETAIL)
4 MIN 2M WIDE COMMUNAL LANDSCAPE MAINTAINED BY BODY CORPORATE
5 1.5M HIGH PALISADE FENCE TO PRIVATE COURTYARDS
6 NEW STREET TREE PLANTING - EUCALYPTUS SALIGNA
7 PRIVATE PEDESTRIAN ENTRY TO TERRACES OFF FIG TREE DRIVE

Notes

1. All planting areas to be mulched, typically 75mm depth. Organic mulch to conform to *AS 4454 - 2003 Compost Soil Conditioners & Mulches*

2. Soils to conform to AS 4419 - 2003 Soils for Landscaping & Garden Use

Soil Depths:
- Grass Areas minimum 300mm deep
- Planting/Garden areas minimum 450mm deep

3. All planting areas to have drip irrigation lines with a backup connection to main water supply, installed to satisfy all current Sydney Water requirements and relevant Australian Standards.

4. Refer to arborist report prepared by Arboreport Vegetation Management Consultants for details of tree protection measures, trees for removal and transplant process.

Project North | True North | 0 3 6 10m | 1:300 @ A1

ISS.	AMENDMENT	DATE	BY
A	DRAFT Development Application	10.06.15	KR
B	DRAFT Development Application	05.08.15	LB
C	Development Application	07.08.15	LB/KR
D	Development Application	10.08.15	LB/KR
E	Development Application	23.09.15	LB/KR

ARCHITECT
BVN Architecture
255 Pitt Street
Sydney, NSW, 2000, AUS
T +61 2 8297 7200

IMPORTANT NOTES:

CLIENT
MIRVAC
Level 26, 60 Margaret St
Sydney NSW 2000

CHECKED LB

SCALE | DRAWN KR | ISSUE DA

DWG. TITLE
LANDSCAPE MASTERPLAN - LEVEL 02

PROJECT
SOP53 - 2 Fig Tree Drive, Sydney Olympic Park

360°
Studio 5.1 21-8 Street
Surry Hills NSW 2010
+612 9332 3601
www.360.net.au
ABN 60 146 901 322

LAN-A-06

LEGEND

1 MAIN ENTRY
2 LETTER BOXES
3 ENTRY PORTAL
4 COMUNITY ROOM BREAKOUT SPACE
5 PING PONG TABLES
6 " NEW STREET " ENTRY
7 ENTRY STEPS FROM LINEAR PARK
8 PLAY SPACE
9 UNDERCOVER PLAY SPACE
10 BRICK PAVING TO DISTINGUISH LOBBY ENTRANCES
11 MAIN WALKWAY TO ACCESS BUILDINGS
12 CIRCULATION PATHS FOR PRIVATE COURTYARD ACCESS
13 SEATING WALL
14 FIRE EGRESS PATH

Notes

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Project North | True North | 0 3 6 10m | 1:300 @ A1

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ARCHITECT
BVN Architecture
255 Pitt Street
Sydney, NSW, 2000, AUS
T +61 2 8297 7200

BVN

IMPORTANT NOTES:

CLIENT
MIRVAC
Level 26, 60 Margaret St
Sydney NSW 2000

CHECKED: LB
SCALE
DRAWN: KR
ISSUE: DA

DWG. TITLE
LANDSCAPE MASTERPLAN - LEVEL 01 UPPER GROUND

PROJECT
SOP53 - 2 Fig Tree Drive, Sydney Olympic Park

360°
Studio 5.1 2 Hill Street
Surry Hills NSW 2010
p +612 9332 3601
w www.360.net.au
ABN 60 146 901 322

LAN-A-07

LEGEND

1	EXISTING PLANTED VERGE
2	EXISTING STREET TREE *EUCALYPTUS MICROCORYS* TO BE RETAINED AND PROTECTED
3	RETAIN EXISTING ASPHALT PATHWAY
4	MOUNDED LANDSCAPE EDGE PLANTED WITH NATIVE TREES, SHRUBS AND GRASSES
5	1.20 m PALISADE FENCE
6	MULCH UNDER EXISTING FIG TREE
7	EXISTING *FICUS MACROPHYLLA* (T3) TO BE RETAINED AND PROTECTED
8	" ROCLA PERMA TRAK " RAISED BOARDWALK
9	PLAY NET
10	TERRACE GARDENS PLANTED WITH SCREENING SHRUBS
11	EXISTING CONCRETE RETAINING WALL
12	RETAIL SPACE
13	EXISTING SOPA PARLAND, TO BE RETAINED AND PROTECTED, REINSTATED WHERE DAMAGED
14	BBQ AREA
15	LAWN AREA
16	TRANSPLANTED *FICUS MACROFHYLLA* (T1)
17	ACCESSIBLE PATHWAY
18	RETAIL PLAZA
19	SEATING RETAING WALL
20	ACCESS STEPS TO RETAIL SPACE
21	EXISTING *FICUS RUBIGONOSA* (T2) TO BE RETAINED AND PROTECTED
22	BICYCLE PARKING LOOPS, (5X LOOPS TO ACCOMMODATE 10 BICYCLES)
23	DASHED LINE INDICATES TREE PROTECTION ZONE (REFER ARBORIST REPORT)

Notes

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2. Soils to conform to AS 4419 - 2003 Soils for Landscaping & Garden Use
   Soil Depths:
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Project North | True North | 0 3 6 10m | 1:300 @ A1

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ARCHITECT
BVN Architecture
255 Pitt Street
Sydney, NSW, 2000, AUS
T +61 2 8297 7200

IMPORTANT NOTES:

CLIENT
MIRVAC
Level 26, 60 Margaret St
Sydney NSW 2000

CHECKED
LB

SCALE

DRAWN
KR

ISSUE
DA

DWG. TITLE
LANDSCAPE MASTERPLAN - LEVEL 00 LOWER GROUND

PROJECT
SOP53 - 2 Fig Tree Drive, Sydney Olympic Park

360°
Studio 01 214 Street
Surry Hills NSW 2010
t +612 9332 3691
e www.360.net.au
ABN 80 148 901 392

LAN-A-08

APPENDIX B

Plan of Subdivision

PLAN FORM 1 (A3)

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

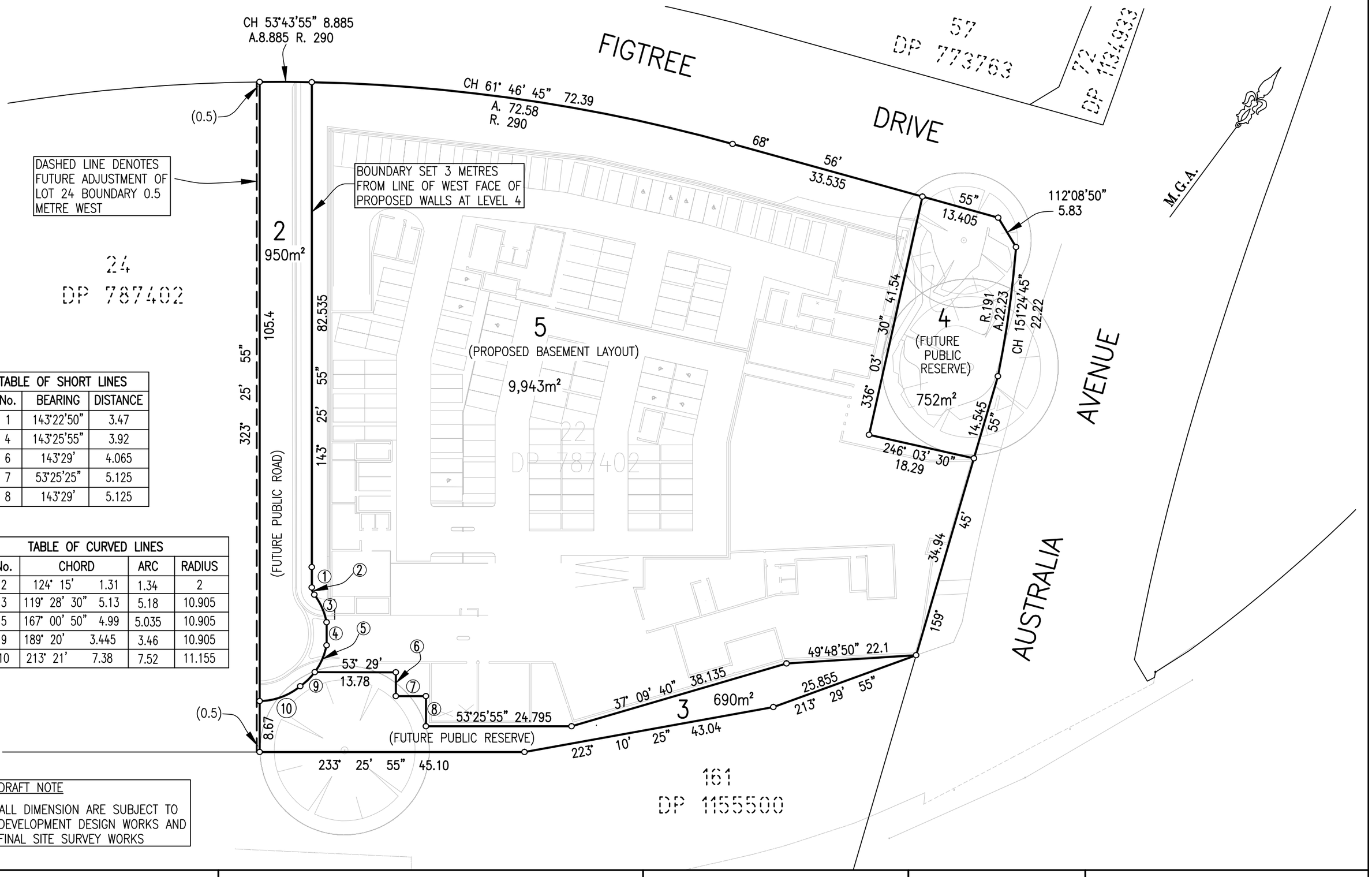


TABLE OF SHORT LINES		
No.	BEARING	DISTANCE
1	143°22'50"	3.47
4	143°25'55"	3.92
6	143°29'	4.065
7	53°25'25"	5.125
8	143°29'	5.125

TABLE OF CURVED LINES			
No.	CHORD	ARC	RADIUS
2	124° 15' 1.31	1.34	2
3	119° 28' 30" 5.13	5.18	10.905
5	167° 00' 50" 4.99	5.035	10.905
9	189° 20' 3.445	3.46	10.905
10	213° 21' 7.38	7.52	11.155

DRAFT NOTE

ALL DIMENSION ARE SUBJECT TO DEVELOPMENT DESIGN WORKS AND FINAL SITE SURVEY WORKS

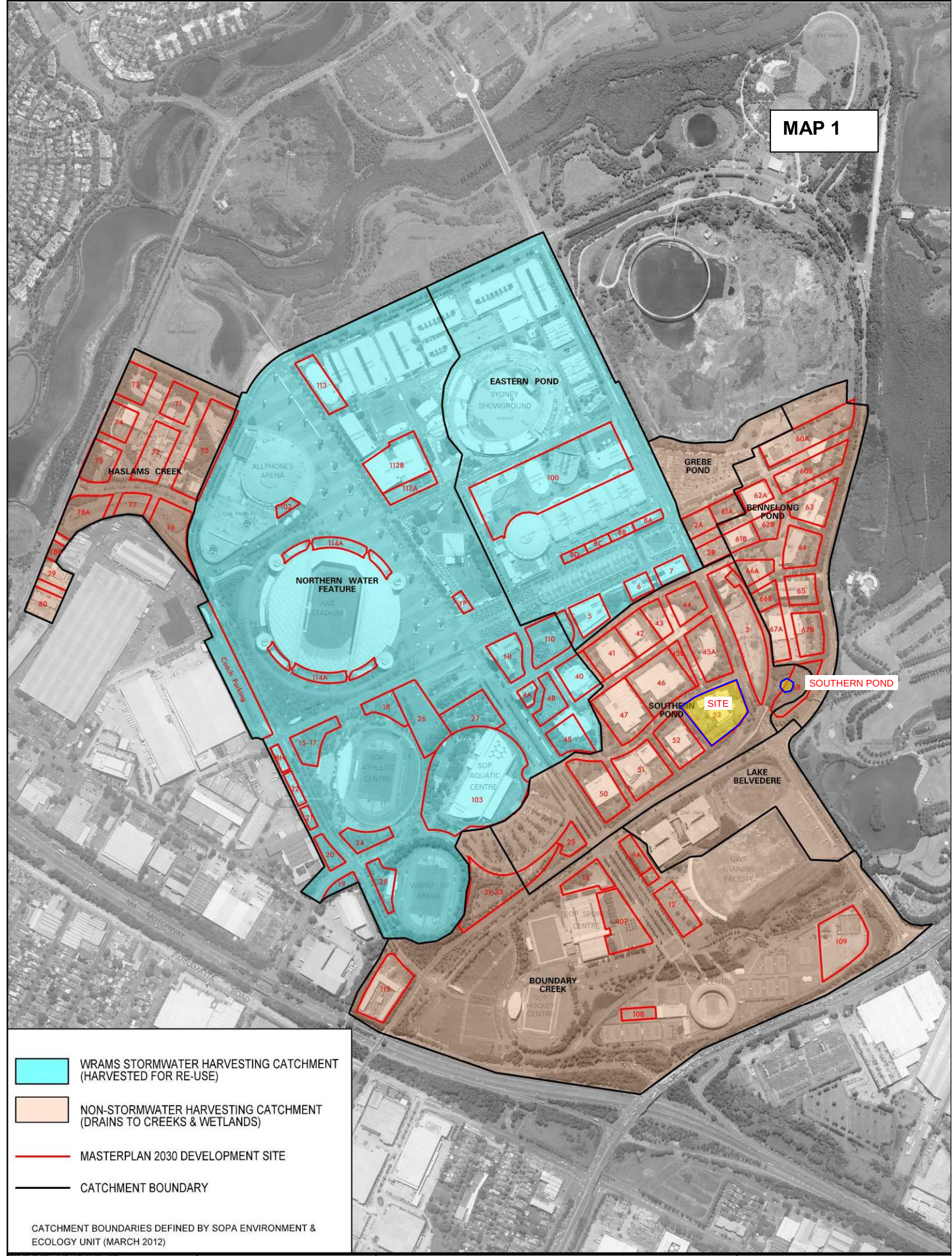
Surveyor: TASY MORAITIS Date of Survey: / / Surveyor's Ref: 140632	PLAN OF PROPOSED SUBDIVISION FOR CONCEPT DESIGN PURPOSES OF LOT 22 IN D.P. 787402	LGA: AUBURN Locality: SYDNEY OLYMPIC PARK Subdivision No: Lengths are in metres. Reduction Ratio 1: 600	REGISTERED	PRELIMINARY DRAFT PLAN PRINTED 4 AUG 2015 ISSUE 1

10mm 20 30 40 50 60 70 80 90 100 110 120 130 140 150 Table of mm

X:\14JOBS\140632-OlympicPark-FigtreeDrive\Proposed Road Subdivision\140632 SITE 53 PROPOSED SUB.dwg

APPENDIX C

SOPA Rainwater Harvesting Catchments



PRODUCT OF SOPA CADD UNIT (02) 9714-7875

MGA

0 50 100 150 200 250m

SYDNEY OLYMPIC PARK AUTHORITY
8 AUSTRALIA AVENUE SYDNEY OLYMPIC PARK NSW 2127
PH. (02) 9714 7300 FAX. (02) 9714 7810

SYDNEY OLYMPIC PARK
TOWN CENTRE
STORMWATER DRAINAGE AREAS

NSW GOVERNMENT SydneyOlympicPark

DRG. NO. : 001-G-G-0223 REV. C
SCALE: AS PER SCALE BAR
PLOT DATE: 6/06/2013

APPENDIX D

Survey Plan