State Significant Development: Stormwater Management Plan

Dicker Data Warehouse and Distribution Centre

Prepared for DCI Projects 03.09.18 Revision A

171516 CAAA

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Revision Control

Revision	Date	Description		Prepared by	Checked by	Approved by
A	26.02.2018	Issue for SEARs	**Name**	W. Webb	K. Holey	P.Yannoulatos
			Signature			
B	28.08.2018	Revision for SEARs	**Name**	K. Holey	K. Holey	P.Yannoulatos
			Signature			

1.0 Introduction

1.1 Preface

This State Significant Development report has been prepared in accordance with Sutherland Shire Council's Development Control Plan to support the Dicker Data Warehouse and Distribution Centre Development with respect to the management of stormwater.

A detailed assessment of the environmental factors expected to be encountered during the State Significant Development as well details of the final stormwater management strategy have been explored throughout this report by discussing the following segments; sediment and erosion control measures, the primary components of the pit/piped drainage network, the permanent water quality/quantity systems.

Temporary measures outlined in this report must be implemented prior to and maintained during the construction phase until the permanent measures are implemented. Ultimately this document forms a guide to the minimum controls to be installed and as such the final design, implementation and maintenance of all measures is the sole responsibility of the contractor. Furthermore, the permanent stormwater measures outlined in this report are required to be assessed and as such the final system may need to be revised during the detailed tender design period.

The following information and documents were utilised in this investigation:

- Concept Civil Engineering Drawings by TTW;
- Concept Architectural Plans by WMK Architecture
- "Managing Urban Stormwater – Soils and Construction, 4th Edition (2004)" by Landcom;
- EPA – Pollution control manual for urban stormwater.
- Geotechnical Investigation by Douglas Partners Report Ref No: 84677.01.R.002.Rev0 (Dated Feb 2015).
- Sutherland Shire Council Development Control Plan 2015;
- "Australian Runoff Quality – A Guide to Water Sensitive Urban Design", Engineers Australia (2006);
- "Australian Rainfall and Runoff – A Guide to Flood Estimation", Institute of Engineers, Australia (2016);
- "Draft NSW MUSIC Modelling Guidelines", Sydney Catchment Management Authority (August 2010)
- NSW Government Water Quality and River Flow Environmental Objectives
- ANZECC (2000) Guidelines for Fresh and Marine Water Quality

The increase in impervious areas, disturbance of existing topography and alteration of the natural terrain associated with land development has a potential to increase surface run off and subsequently concentrate peak storm flow rates. Consequently, existing flow regimes are adversely affected resulting in excessive flows and velocities through the downstream drainage network which may cause erosion of the associated waterways.

To mitigate any negative impacts to the downstream drainage network, the site stormwater management system has been designed to safely convey flows through the site. The proposed stormwater strategy will ensure flows leaving the site are within the capacity of the existing downstream trunk drainage systems whilst also managing post development pollutants on site via a water quality treatment train.

The results of this assessment is an Ecological Sustainable Development that ensures the safe discharge of stormwater whilst maintaining the existing flow regimes in a healthy environmental state.

A separate flood report will be issued to address the specific flood related SEAR conditions.

1.2 SEAR General Requirements (SSD 8662)

This report addresses the relevant SEAR requirements as follows:

- **Soils and Water:**
  - A description of the proposed erosion and sediment controls during construction and operation;
  - A description of the surface and stormwater management system, including On-site Stormwater Detention, measures to treat or re-use water and the potential impact of flooding on this system;
  - An assessment of potential surface and groundwater impacts associated with the development;
  - A description of the nature and degree of any likely impacts that the proposed development may have on the receiving environment;
  - Details of impact mitigation, management and monitoring measures;
  - Stormwater management measures will maintain the NSW Water Quality Objectives and Marine Water Quality Objectives for NSW Ocean Waters.

1.3 General Instructions

This report is to be read in conjunction with the concept engineering plans, and any other plans or specifications that may be issued in relation to the Project.

Contractors shall ensure that all soil, sediment, erosion and water management works are undertaken as instructed in this report and constructed as per the guidelines stated in “Managing Urban Stormwater – Soils and Construction, 4th Edition (2004)” by Landcom.

The Contractor shall ensure that all subcontractors are informed of their responsibilities in minimising the potential for soil erosion and pollution to downslope areas, Council’s stormwater network and the receiving waterways.

2.0 Site Background

2.1 Site

The site is located at 238-258 Captain Cook Drive, Kurnell which is within the Sutherland Local Government Area (LGA). It is bound by a large warehouse to the north-east, Captain Cook Drive to the north-west, bushland to south-east and an unnamed gravel road to the south-west. The site currently exists as an industrial warehouse, with hard stand areas as roads, parking, and buildings. The existing industrial site, about 12Ha, will be redeveloped as part of the proposed project.

Figure 1 - Aerial Photo of Existing Site (Source: SIX Maps)

As shown in Figure 2, the site has a total area of 17 Ha, with 5 Ha on the south west side of the site not being developed due to being environmentally restricted.

The proposed development includes construction of a new warehouse, truck loading areas, carparking, stormwater infrastructure, and associated utility services.

Figure 2 - Aerial Photo of Existing Site (Source: SIX Maps) Area

The site is sandy with some shallow rock in eastern corner, the land fall undulates and has ponding/low points across the site. Refer to **Appendix D** for existing site catchments and fall, as well as proposed catchments.

The sand infiltration rate has been confirmed by Douglas Partners, an excerpt is included in **Figure 3**.

8. Comments

8.1 Hydraulic Conductivity

The results of the constant head tests, as summarised in Table 1, indicate that the hydraulic conductivity of soils within 1 m of the ground surface ranges from 2.14 x 10^{-4} m/s to 1.20 x 10^{-2} m/s. Based on the results, the following hydraulic conductivity values could be adopted for the existing soil profile in each of the infiltration areas:

Infiltration Area A – 4.55 x 10^{-3} m/s
Infiltration Area B – 4.55 x 10^{-3} m/s
Infiltration Area C – 2.14 x 10^{-4} m/s
Infiltration Area D – 3.76 x 10^{-3} m/s

Geotechnical Investigation, Proposed Industrial Development
238 – 258 Captain Cook Drive, Kurnell
Project 84677
February 2015

Figure 3 - Douglas Partners Hydraulic Conductivity

2.2 Key Issues

The key issues to be addressed in this report include:

- Sedimentation and erosion control
- Stormwater Quantity Control
- Stormwater Quality Control

3.0 Sedimentation and Erosion Control

3.1 Strategies

The proposed sedimentation and erosion control measures to manage runoff and ensure no detriment to the receiving environments have been divided into temporary and permanent strategies as summarised below.

STRATEGY	DESCRIPTION
Temporary	Temporary strategies generally refer to the control of sediment erosion and water pollution during the construction phase. The primary risks occur when soil is excavated and exposed to the elements during construction works. It is at this stage that suspended solids and other construction activity associated pollutants can be washed into the receiving stormwater network and subsequently the downstream waterways. The strategies that are implemented to prevent potential soil degradation and pollution of waterways include the adequate provision of sedimentation and erosion control measures. Generally, the measures outlined in this report form a minimum basis that should be considered and further documented by the contractor prior to commencement of the works through a Soil and Water Management Plan (SWMP). The temporary controls that are proposed in the concept plans by TTW will limit the displacement of sediment caused by runoff from disturbed areas, and are designed to remove sediment prior to discharging from site.
Permanent	For the permanent water quantity and quality measures refer to Section 4 of the report.

Table 1 - Temporary & Permanent Strategies

This section of the report addresses the temporary strategies and outlines the minimum short term measures required to reduce the impacts of the construction activities. For permanent strategies and long term measures (i.e. post construction phase) water quality control is achieved by implementing the recommendations outlined in Section 4.

3.2 Proposed Measures

The proposed measures are documented on the concept Erosion and Sediment Control Plan attached to this report under **Appendix A**.

3.3 Installation of Measures

The measures are to be installed as per the requirements outlined below:

- Clearly visible barrier, site fencing and hoarding shall be installed at the discretion of the Superintendent to ensure site security, safety of the public, manage traffic control and prohibit any unnecessary site disturbance. Vehicular access to the site shall be limited to only what is essential for the construction activities and shall enter the site only through the stabilised access points.
- All disturbed areas are to be stabilised within 14 working days of the completion of earthworks. All disturbed areas are to be protected so that the land is permanently stabilised within six months.
- Proprietary silt fencing shall be installed by the Contractor in accordance with the final approved Sedimentation and Erosion Control Plan and elsewhere at the discretion of the site Superintendent to contain sedimentation to as near as possible to the original source.
- Sediment removed from any sediment trapping device shall be relocated where further pollution to downslope lands and waterways cannot occur.
- Stockpiles shall be located by the Contractor in accordance with the final approved Sedimentation and Erosion Control Plan and elsewhere at the discretion of the Project Manager and/or Superintendent. Where stockpiles are to be in place longer than 30 days they shall be stabilised.
- Water shall be prevented from entering the permanent drainage system unless it is sediment free. Drainage pits are to be protected in accordance with the final approved Sedimentation and Erosion Control Plan.
- Temporary sediment traps located at pits shall be retained throughout the early works stage and until the appropriate replacement measures for the subsequent stages are installed.

3.4 Land Disturbance

Where practicable, the soil erosion hazard shall be kept as low as possible. Limitations to access are to be in accordance with the following table:

Land Use	Limitation
Access areas	Access is to be limited to the designated work zones via the stabilised site access.
Truck cleaning areas	Any truck exiting out of the site shall be thoroughly cleaned and limit the exportation of soil and sediment on public roads.
Remaining undisturbed areas	Access to any undisturbed areas and remaining lands is only permitted with permission from the Project Manager and/or Superintendent.

Table 2 - Limitations to Access

4.0 Stormwater Design

4.1 Local Authority Requirements

The proposed stormwater elements have been designed in accordance with the following:

Water Quantity Guidelines: Sutherland Shire Council; DCP 2015; Chapter 38

The consequence associated with increases in imperviousness is the potential to increase stormwater flows due to the reduction in available pervious and landscaped areas to absorb initial rainfall runoff. To mitigate the impact of increased site discharge on downstream properties it is essential to design the site stormwater system to attenuate the increased runoff and safely convey storm flows through the site and within the capacity of the receiving drainage network. Council's development services engineer identified that On-Site Stormwater Detention would be necessary to limit the Permissible Site Discharge to the existing flow rates for the 10, 20 and 100 year Annual Recurrence Interval storm events to ensure flows leaving the site are within the capacity of the existing trunk drainage network.

Water Quality Guidelines: Sutherland Shire Council; DCP 2015; Chapter 38

Increases to impervious area often results in the increase of gross pollutants, total suspended solids, and phosphorus and nitrogen nutrients. These pollutants are washed away into the stormwater network during rainfall events and transported from their site of origin into downstream waterways. To limit the impact on the receiving water, quality control measures have been designed within the site stormwater management system in the form of a treatment train that reduces pollutant loads prior to discharging into the drainage network.

4.2 Stormwater Design Objectives

The objective is to provide stormwater controls that ensure that the proposed development does not adversely impact on the quantity or quality of stormwater flows within, adjacent and downstream of the site. The table below outlines the objectives and targets compatible with the relevant authority legislations, policies and requirements:

DESIGN ELEMENT	OBJECTIVES
STORMWATER QUANTITY	• The existing flow regimes and discharge for the full range of storm events should be maintained. • A safe stormwater conveyance system should be provided for the major storm events. • Any existing flows from external catchments will be safely mitigated through the site. • Existing stormwater runoff should be maintained. • Safe mitigation measures should be provided to minimise any potential flooding impact on the site. • Downstream properties are not to be adversely affected by the development.
STORMWATER QUALITY	• Stormwater leaving the site should meet the full range of pollutant reduction targets of the relevant authority. • Site discharge should achieve natural dry and wet weather concentrations for the given catchment.

Table 3 - Objectives of the Stormwater System

4.3 Strategies

The proposed stormwater measures to manage runoff and ensure no detriment to the receiving environments have been divided into temporary and permanent strategies as summarised below:

STRATEGY	DESCRIPTION
Temporary	For the temporary sediment and erosion control details refer to Section 3 of the report.
Permanent	Permanent strategies generally refer to the installation of a number of permanent treatment measures to remove gross pollutants, total suspended solids, and phosphorus/nitrogen nutrients effectively in order to maintain stormwater quality discharged from the site.

Table 4 - Temporary & Permanent Strategies

This section of the report addresses the permanent strategies and outlines the long term measures required to reduce the impacts of development. For temporary strategies and short term measures (i.e. excavation and construction stage) water quality control is achieved by implementing the recommendations outlined in **Section 3**.

5.0 Stormwater Quantity Control

5.1 Introduction

The main goal for the stormwater quantity control measures is to ensure that the post-developed peak storm flows do not exacerbate flow regimes within Council's receiving drainage network and cause detriment to the downstream waterways, especially Towra wetlands.

5.2 Proposed Drainage System

The site stormwater system for the development has been designed to capture flows from impermeable surfaces including courtyards open to the sky. The proposed stormwater management system for the development includes:

- Pit and pipe drainage network to collect runoff from areas;
- Stormwater flows up to the 5% annual exceedance probability event are conveyed by a minor drainage system; and
- Stormwater flows above the 5% annual exceedance probability event are conveyed by a major drainage system consisting of overland flow paths.

It is to be noted that the flowrates generated to size the internal pit and pipe network are based off Australian Rainfall and Runoff – A Guide to Flood Estimation 2016.

The existing site catchment and stormwater flow have been investigated with regards to area and flow direction. The proposed development catchment areas and discharge points are aligned with the existing. Catchment plans of the existing site and proposed development are shown in **Appendix D.**

A reduced set of the concept stormwater management plans are included in **Appendix B**.

5.3 On-Site Stormwater Detention Requirements

Sutherland Shire Council is the responsible body for determining the Onsite Stormwater Detention (OSD) Permissible Site Discharges (PSD) and site storage required. The DCP 2015 Chapter 38 Clause 5.3 states that the volume of stormwater to be detained on-site shall be calculated from the volume of water from a 1% AEP event less the volume of runoff established by Clause 1.2, less any volume infiltrated on-site and a third of the volume of any tanks used for rainwater reuse.

Bio retention/infiltration basins is proposed to satisfy OSD requirements. Based on the aerial imagery, ground survey, and site investigations, it has been calculated that the pre-development catchment is approximately 79% pervious area and 21% impervious area.

As per the requirements identified in Section 4.1, an OSD volume of 4500m^3 has been modelled to attenuate post development flows to pre-development conditions for the 10%, 5% and 1% AEP storm events. It is to be noted that rainwater tank offsets have not yet been incorporated into the design and as such the final detention volumes are able to be reduced during the detailed design phase. Refer to **Appendix C** for the results.

Storm Event Annual Exceedance Probability	Pre-Development Flow Rates, Q (m^3/s)	Attenuated Post-Development Flow Rates, Q (m^3/s)
10% AEP (10 year ARI)	0.634	0.273
5% AEP (20 year ARI)	0.764	0.329
1% AEP (100 year ARI)	1.04	0.596

Table 5 – Pre vs. Post-development flow rates

The results shown above are based on infiltration rates as provided by Douglas Partners (shown in **Figure 3**) and include a tailwater level of RL2.13 for all storms.

6.0 Stormwater Quantity Control

6.1 Introduction

The quality of site stormwater runoff depends upon a number of factors including land use, degree of imperviousness, population size, sanitation and waste collection methods, topography, geotechnical characteristics of the soil and the amount of rainfall based on climate. Litter, garbage, sediment, soils, nutrients, oils, hydrocarbons, grease, and heavy metals are all examples of pollutants that are typically transported off site by runoff. Whilst these pollutants have an adverse impact on the overall quality of the receiving water body it is gross pollutants, suspended solids and the nutrients phosphorus/nitrogen which are the most detrimental to the environment. Litter, garbage, oils, hydrocarbons and other pollutants that typically float on the surface generally have a bigger aesthetic impact to water quality.

Activities associated with development and urbanisation include the disturbance of vegetation/topsoil, earthworks, construction, services, and building works. It is during the earthworks and construction phase that sediment transportation is greatest with loadings up to six times higher than the pre development state. At the cessation of construction activities sediment loading may eventually return to pre development levels or remain slightly higher depending on land management practices and maintenance strategy.

As with every development, sediment runoff and site erosion during the excavation and construction phase represents the largest potential risk to water quality levels. It is during this period that exposed earthworks are highly susceptible to being washed downstream by site runoff, carrying suspended solids and associated construction related pollutants.

This report addresses the permanent water quality measures to be implemented. For the temporary measures and short term effects (i.e. during the construction phase) water quality is managed by implementing the measures covered in the Sedimentation & Erosion Control Plan shown in **Appendix A.**

The site specific water quality targets specified by the Sutherland Shire Council are outlined in the table below:

Pollutant Type	Pollutant Reduction Target (Average Annual Load)
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	40%
Total Nitrogen (TN)	40%

Table 6 - Reduction Targets

6.2 Stormwater Quality Control Measures

There are a number of measures that can reduce pollutant loadings with their effectiveness varying depending on the targetted pollutant, land use type, maintenance access or requirements and site topography. The proposed combination of measures aims to provide the most efficient and manageable measures suited to the site.

The individual elements of the proposed treatment train are summarised in the following table.

Element	Description
Gross Pollutant Litter Baskets: **SW360 EnviroPod**	• An EnviroPod is a filter basket insert that is installed within grated service inlet pits. It is an effective preliminary measure for removing trash, debris and other larger pollutants from runoff. • EnviroPods proposed for the treatment train utilise a 200 micron filter system. • These filter baskets will be installed in all grated inlet pits servicing the open to sky courtyard areas, including at the base of all downpipes.
Rainwater Tanks: **Refer to hydraulic plans for details**	• Rainwater tanks are an effective measure as they can remove pollutant loads at source. • The pollutant removal process occurs through harvesting roof runoff for reuse, thereby reducing the nutrients that are discharged into the stormwater network. • It is proposed to provide a rainwater reuse tank plumbed for landscape irrigation as detailed on the hydraulic engineer's plans. We have been advised by the hydraulic engineer that a 350kL rainwater tank is being provided with an average daily demand for water closet and urinal flushing of 3kL/day and landscape irrigation of 9.7kL/day. • The rainwater tank shall receive a mains top up from a potable water source.

Buffers: **Landscape strip**	• Landscape strips and buffers typically consist of pervious area over which stormwater runoff from an adjacent impervious area can traverse prior to entering the drainage network. • Buffer strips are provide a discontinuity between paved surfaces and the drainage network. They receive water from impervious areas in a distributed manner before treating stormwater by filtering pollutants and nutrients.
Swales	• Swales are open vegetated or grass lined channels that can be used as an alternative stormwater conveyance system to typical kerbs or channel drains in roadways. Surface flows are flowed by the vegetation in a swale which facilitates an even distribution of flow and the settlement of particles.
Bio-retention: Basins	• A bio-retention basin is a vertical filtration system that filters stormwater through a prescribed media (e.g. sandy loam) before being discharged into the underlying sandy subgrade. • The filtration media should have a permeability of at least one order of magnitude higher than the surrounding soils to ensure that the pathways stormwater through the system is well defined and directed at the perforated pipe underlain.

Table 7 - Proposed Water Quality Measures

6.3 MUSIC Modelling

The effectiveness of the combination of treatment train measures has been assessed using numerical modelling within MUSIC (Model for Urban Stormwater Improvement Conceptualisation version 6). The results of the modelling were compared against the Council's pollutant reduction targets to determine the effectiveness of the proposed measures.

MUSIC simulates the performance of a group of stormwater management measures, configured in series or in parallel to form a "treatment train" against historic rainfall event data sets. It is the industry standard water quality modelling software developed by the MUSIC Development Team of the Cooperative Research Centre for Catchment Hydrology (CRCCH).

The MUSIC User Manual suggests that the time-step should not exceed the time of concentration of the smallest sub-catchment, however due consideration must also be made regarding the shortest detention time of nodes within the treatment train.

The historical 6-minute rainfall and monthly evapotranspiration data used in the model was:

- Rainfall Station 66037 Sydney Airport AMO;
- 6 Minute Time Step 1994 To 2004;

6.4 Event Mean Concentration

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted within MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ). The EMC values used in the MUSIC models for this project were based on the Sydney Catchment Management Authority (CMA) Source Node(s) utilising modified % impervious area, rainfall threshold, soil properties & pollutant concentrations. Given the industrial nature of the site the mean storm flow concentration for road areas was conservatively increased to Log_{10} 2.43 mg/L to better simulate the potential generation of suspended solids. The following table summarises the parameters used for the development site.

NODE TYPE	MEAN BASE FLOW CONCENTRATIONS Log_{10} (mg/L)			MEAN STORM FLOW CONCENTRATIONS Log_{10} (mg/L)		
	TSS	TP	TN	TSS	TP	TN
Roof	Not Applicable*Note			1.300	-0.890	0.300
Road	1.200	-0.850	0.110	2.430	-0.300	0.340
Pervious	1.200	-0.850	0.110	2.150	-0.600	0.300

Table 8 - EMC Inputs for MUSIC

*Note – Impervious areas do not have base flows.

6.5 Catchment Breakdown

The catchments were split into roof, road and pervious areas with varying imperviousness ratios to replicate the development condition. The catchment breakdown is attached to this report as **Appendix D**.

The table on the following page provides a breakdown of the catchment areas and the respective impervious percentages used in the MUSIC model:

CATCHMENT	AREA (ha)	IMPERVIOUSNESS RATIO (%)	PERCENTAGE OF SITE (%)
Roof to bioretention	2.947	100	24.1
Road to bioretention	0.875	90	7.2
Pervious to bioretention	1.308	0	10.7
Office Roof to rainwater tank to OSD	0.08	100	0.7
Warehouse roof to OSD	1.083	100	8.9
Road to OSD	1.383	90	11.3
Pervious to OSD	0.447	0	3.7
Roof to pond	0.642	100	5.3
Road to pond	0.939	90	7.7
Pervious Bypass	2.523	45	20.6
Sub Total	12.227	72	100

Table 9 - Catchment Breakdown

6.6 Treatment Train Devices

The final number of Stormwater Quality Improvement Devices (SQID) within the treatment train are listed in the following table:

DEVICE	NO. OF UNITS
Gross Pollutant Litter Baskets	60 x Enviropods in stormwater pits & at the base of downpipes
Rainwater Tanks	1 x 350kL
Landscape Buffer	Landscape buffering bypass area
Grass Swale	250 metres at 0.5% bed slope
Bio retention basin	2000m^2 filter area

Table 10 - Stormwater Quality Improvement Devices (SQID)

6.7 Results

The results of the modelling are summarised below with the pollutant loads expressed in kilograms per year. The reduction rate is expressed as a percentage and compares the pollution from the post developed site to that of the existing developed state of the site to determine whether the reduction targets have been achieved.

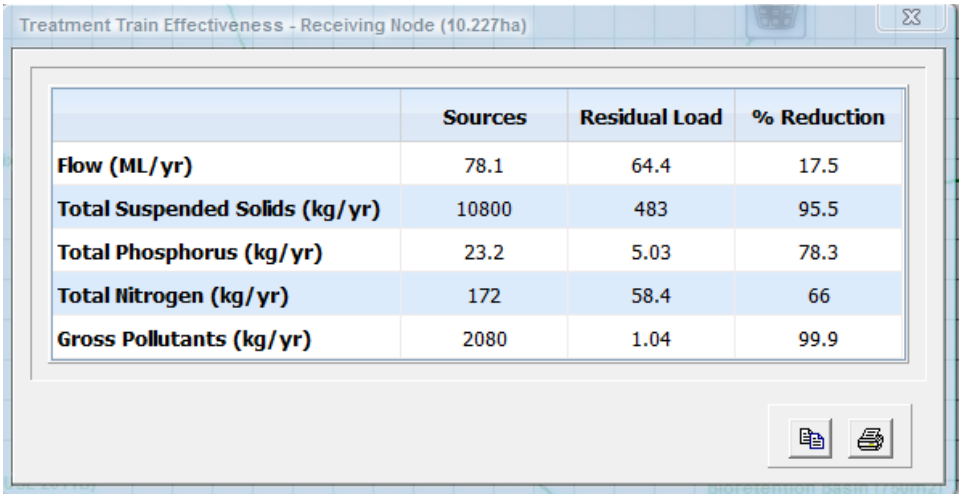

Table 11 - MUSIC Results

GP = Gross Pollutants TSS = Total Suspended Solids

TP = Total Phosphorus TN = Total Nitrogen

The final MUSIC model layout is attached to this report as **Appendix E**.

From the above results table it can be seen that the proposed treatment train will achieve the reduction targets for the full range of pollutants. Through the implementation of the proposed water quality measures stormwater discharge from the site can be effectively managed to ensure that there is no detrimental effect to the water quality downstream of the subject site.

7.0 Permanent Stormwater Recommendations

The key strategies to be adopted for this development include the following:

1. A pit and pipe network to collect all minor stormwater runoff up to the 5% AEP event with overland flow paths conveying major stormwater runoff up to the 1% AEP event.

2. Onsite Stormwater Detention shall be addressed by the combined provision of 4500m^3 of site storage. It is proposed to address this requirement through underground storage (pits and pipes), bio-retention basins, and swales. Council's DCP allows a reduction to OSD volume through infiltration and rainwater tank offsets. Offsets to the site storage volume have not yet been proposed and as such the final arrangement of detention may be reduced during the detailed design phase.

3. EnviroPod gross pollutant litter baskets at all inlet pits and at the base of all downpipes will form part of the water quality treatment train, removing pollutants and nutrients that are detrimental to downstream waterways.

4. A 350kL total rainwater harvesting and retention system is currently proposed to reduce the reliance on potable water whilst providing an improvement to the quality of stormwater discharge and a level of stormwater detention. The harvested rainwater will be connected for reuse as per the hydraulic engineer's details.

5. Landscape buffers are to be provided as detailed on the architectural plans.

6. A vegetated swale will direct run off from impervious areas towards the bio-retention basin, effectively reducing the concentration of pollutants.

7. A bio-retention and detention basins with a filter media area of 2000m^2 will filter pollutants and provide a level of stormwater attenuation.

The results from the investigations and modelling summarised in this report indicate that the development can provide a safe and ecologically sustainable environment with the proposed stormwater network and water sensitive urban design management strategy.

8.0 Conclusions

Development has the potential to lead to significant adverse changes in water quantity and quality leaving the site if a water sensitive urban design management strategy is not adopted during the design and development stage of the project. The measures outlined in this report consider the overall impact of the development on the surrounding man-made and natural environments. Best practices must encompass the effects of flooding, water quality and maintenance of these items to develop an appropriate water management strategy to ensure that development occurs in an ecologically sustainable way.

Prepared by
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PAUL YANNOULATOS
Technical Director

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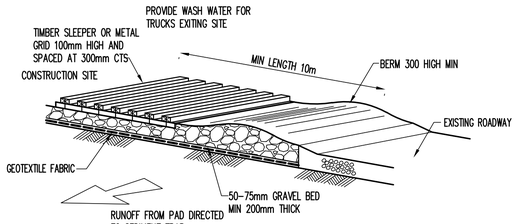
Appendix A

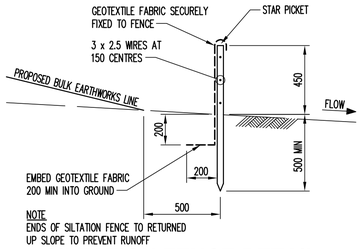
Sedimentation and Erosion Control Plan

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C01



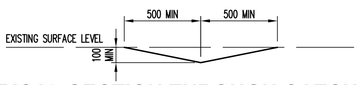
TEMPORARY CONSTRUCTION VEHICLE EXIT

NTS



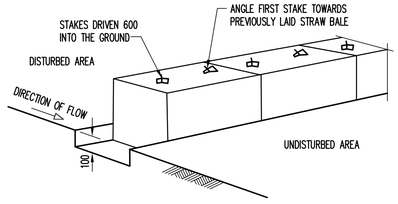
SILTATION FENCE DETAIL

SCALE 1: 20



TYPICAL SECTION THROUGH CATCH DRAIN

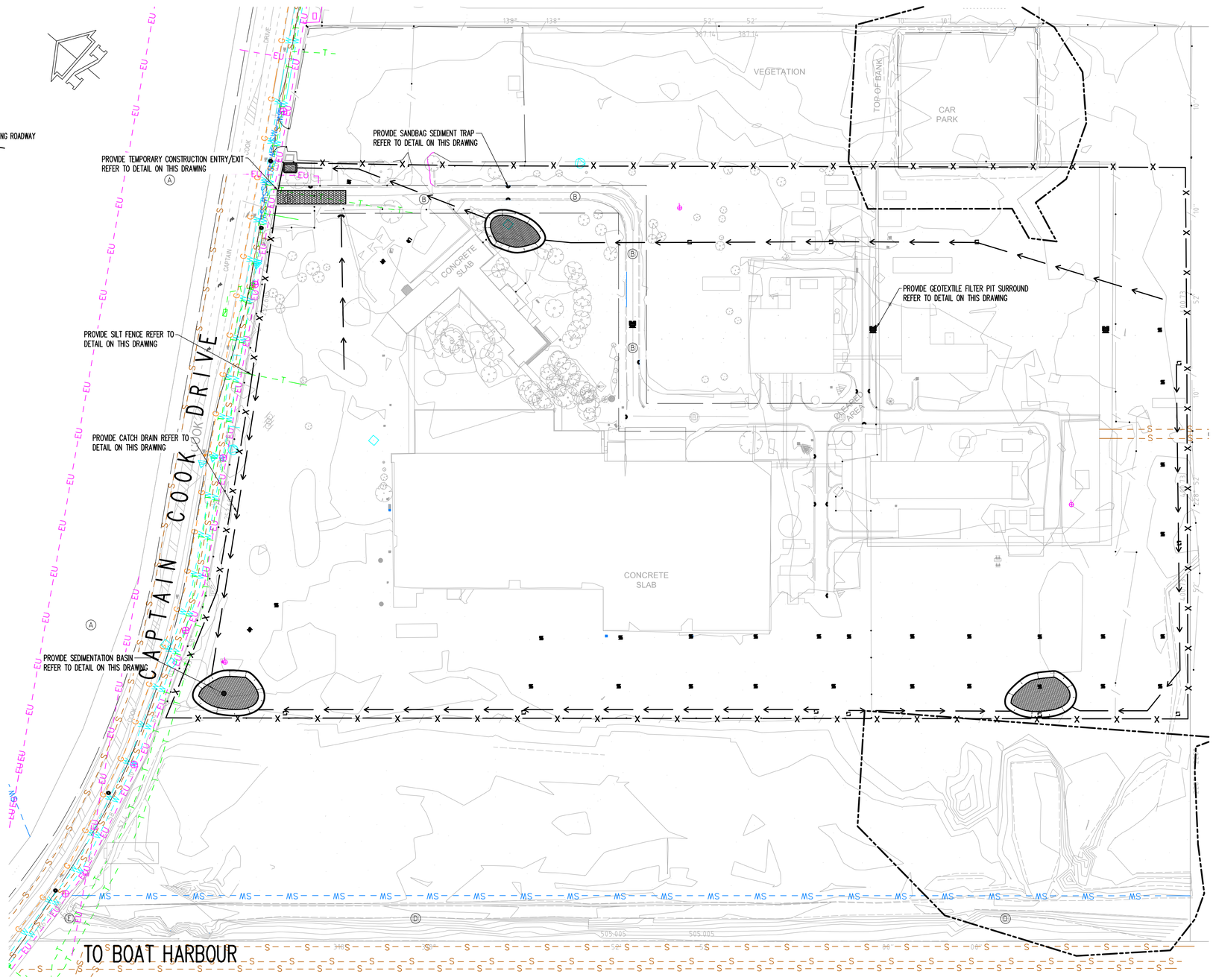
SCALE 1: 20

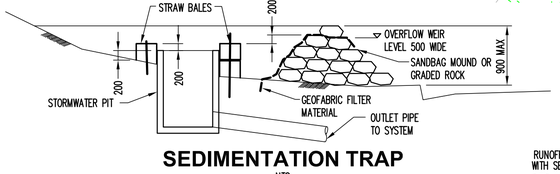


HAY BALE SEDIMENT FILTER

NTS

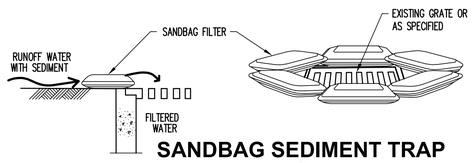
NOTE: STAKE TO BE EITHER TAR COATED STAR OR 50 x 50 HARDWOOD





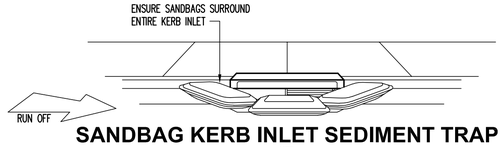
SEDIMENTATION TRAP

NTS



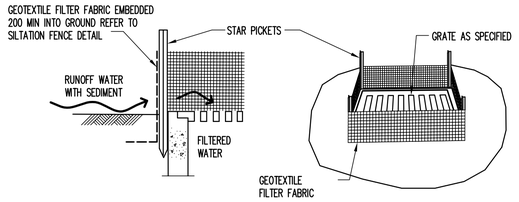
SANDBAG SEDIMENT TRAP

NTS



SANDBAG KERB INLET SEDIMENT TRAP

NTS



GEOTEXTILE FILTER PIT SURROUND

NTS

EROSION AND SEDIMENT CONTROL NOTES

1. All work shall be generally carried out in accordance with
   (A) Local authority requirements,
   (B) EPA – Pollution control manual for urban stormwater,
   (C) LANDCOM NSW – Managing Urban Stormwater: Soils and Construction ("Blue Book").
2. Erosion and sediment control **drawings and notes are** provided for the whole of the works. Should the Contractor stage these works then the design may be required to be modified. Variation to these details may require approval by the relevant authorities.
   The erosion and sediment control **plan** shall be implemented and adopted to meet the varying situations as work on site progresses.
3. Maintain all erosion and sediment control devices to the satisfaction of the superintendent and the local authority.
4. When stormwater pits are constructed prevent site runoff entering the pits unless silt fences are erected around pits.
5. Minimise the area of site being disturbed at any one time.
6. Protect all stockpiles of materials from scour and erosion. Do not stockpile loose material in roadways, near drainage pits or in watercourses.
7. All soil and water control measures are to be put back in place at the end of each working day, and modified to best suit site conditions.
8. Control water from upstream of the site such that it does not enter the disturbed site.
9. All construction vehicles shall enter and exit the site via the temporary construction entry/exit.
10. All vehicles leaving the site shall be cleaned and inspected before leaving.
11. Maintain all stormwater pipes and pits clear of debris and sediment. Inspect stormwater system and clean out after each storm event.
12. Clean out all erosion and sediment control devices after each storm event.

Sequence Of Works

1. Prior to commencement of excavation the following soil management devices must be installed.
1.1. Construct silt fences below the site and across all potential runoff sites.
1.2. Construct temporary construction entry/exit and divert runoff to suitable control systems.
1.3. Construct measures to divert upstream flows into existing stormwater system.
1.4. Construct sedimentation traps/basin including outlet control and overflow.
1.5. Construct turf lined swales.
1.6. Provide sandbag sediment traps upstream of existing pits.
2. Construct geotextile filter pit surround around all proposed pits as they are constructed.
3. On completion of pavement provide sand bag kerb inlet sediment traps around pits.
4. Provide and maintain a strip of turf on both sides of all roads after the construction of kerbs.

WATER QUALITY TESTING REQUIREMENTS

Prior to discharge of site stormwater, groundwater and seepage water into council's stormwater system, contractors must undertake water quality tests in conjunction with a suitably qualified environment consultant outlining the following:

- Compliance with the criteria of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)
- If required subject to the environmental consultants advice, provide remedial measures to improve the quality of water that is to be discharged into Councils storm water drainage system.This should include comments from a suitably qualified environmental consultant confirming the suitability of these remedial measures to manage the water discharged from the site into Councils storm water drainage system. Outlining the proposed, ongoing monitoring, contingency plans and validation program that will be in place to continually monitor the quality of water discharged from this site. This should outline the frequency of water quality testing that will be undertaken by a suitably qualified environmental consultant.

EROSION AND SEDIMENT CONTROL LEGEND

- Batter
- Siltation fence
- Stormwater pit with Geotextile filter surround
- Hay bale barriers
- Sandbag sediment trap
- Catch drain
- Overland flow path
- Temporary construction vehicle exit
- Stockpile location
- Sedimentation Trap
- Sedimentation basin
- Future stormwater works

FileName: SK01.dwg – USER: rockyg – Plot File Created: Feb 12, 2018 - 11:03am

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A1 0 1 2 3 4 5 6 7 8 9 10

Rev	Description	Eng	Draft	Date
P4	–	KH	JH	–
P3	ISSUE FOR APPROVAL	KH	JH	30.01.18
P2	PRELIMINARY FOR SSD	WW	AI	22.12.17
P1	ISSUE FOR COMMENT	KH	JH	16.11.17

Client: DCI Projects, L1 346-348 Kent St Sydney NSW 2000, G1, 1-15 Barr Street Balmain NSW 2041

Civil Engineer: Taylor Thomson Whitting, 612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project: DICKER DATA OFFCE & WAREHOUSE DEVELOPMENT CAPTAIN COOK DRIVE, KURNELL

Sheet Subject: CONCEPT EROSION & SEDIMENT CONTROL PLAN AND DETAILS

Scale : A1: 1:1000 U.N.O | Drawn: JH | Authorised:

Job No: 171516 | Drawing No: SKC01 | Revision: P3

Plot File Created: Feb 12, 2018 - 11:03am

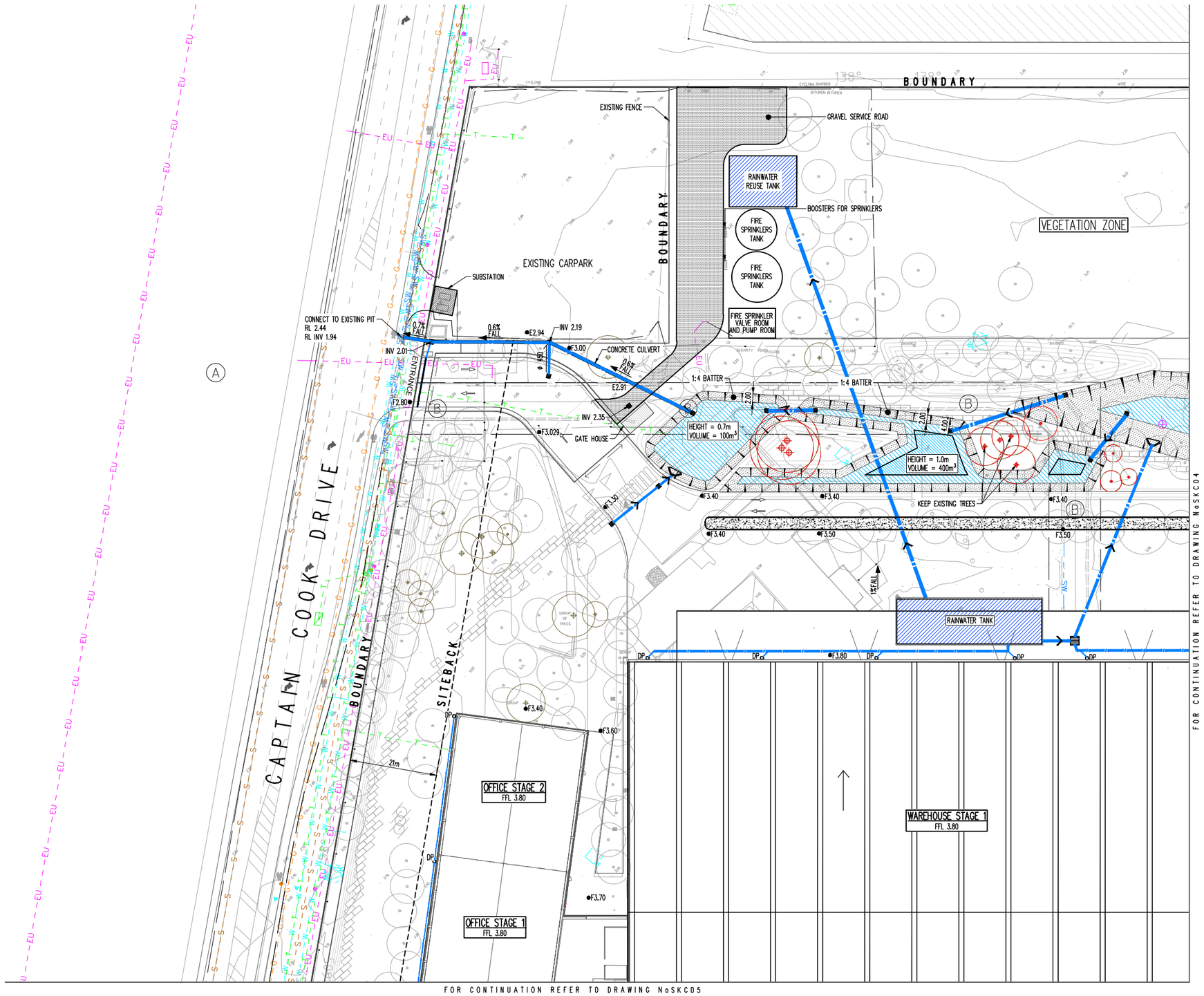
Appendix B

Concept Stormwater Management Plan

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C01

SITEWORKS LEGEND

- ø XX — Stormwater pit, flow direction and line with pipe size
- GD — Grated drain
- DP — Down pipe



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P5	ISSUE FOR APPROVAL	KH	JH	08.02.18
P4	ISSUE FOR APPROVAL	KH	JH	07.02.18
P3	ISSUE FOR APPROVAL	KH	JH	30.01.18
P2	PRELIMINARY FOR SSD	WW	AI	22.12.17
P1	ISSUE FOR COMMENT	KH	JH	16.11.17
P8	ISSUE FOR APPROVAL	KH	JH	03.09.18
P7	ISSUE FOR APPROVAL	KH	JH	15.02.18

Client
DCI Projects
L1 346-348 Kent St Sydney NSW 2000
G1, 1-15 Barr Street Balmain NSW 2041

Civil Engineer
Taylor Thomson Whitting
612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project
DICKER DATA OFFICE & WAREHOUSE DEVELOPMENT
CAPTAIN COOK DRIVE, KURNELL

Sheet Subject
CONCEPT STORMWATER MANAGEMENT PLAN SHEET 1 OF 4

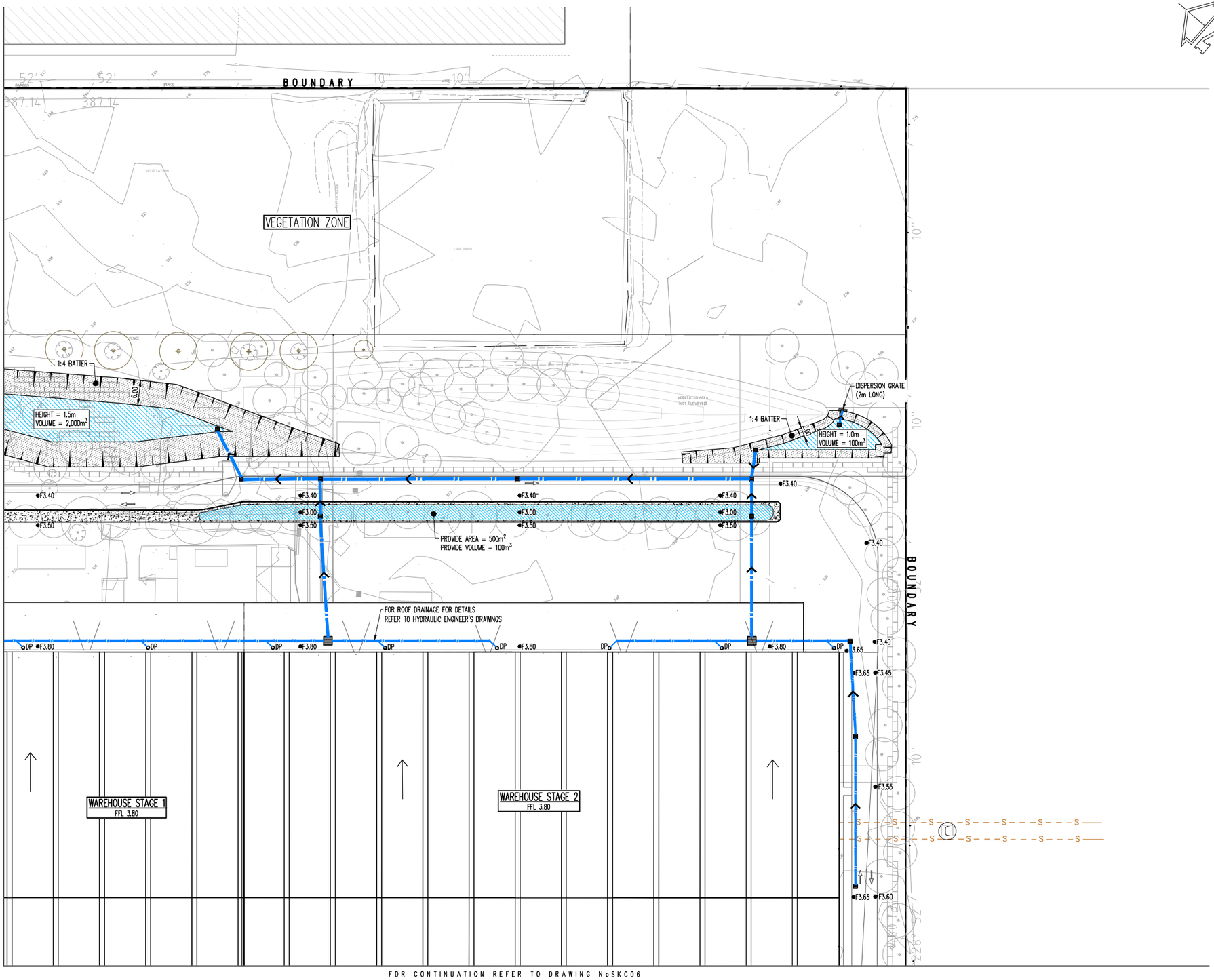
Scale : A1	Drawn	Authorised
1:500	JH	

Job No	Drawing No	Revision
171516	SKC03	P8

Plot File Created: Sep 03, 2018 - 11:17am

SITEWORKS LEGEND

- ø XX — Stormwater pit, flow direction and line with pipe size
- GD — Grated drain
- DP — Down pipe



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P5	ISSUE FOR APPROVAL	KJ	JH	08.02.18
P4	ISSUE FOR APPROVAL	KJ	JH	07.02.18
P3	ISSUE FOR APPROVAL	KJ	JH	30.01.18
P2	PRELIMINARY FOR SSD	WW	AI	22.12.17
P1	ISSUE FOR COMMENT	KH	JH	16.11.17
P8	ISSUE FOR APPROVAL	KJ	JH	03.09.18
P7	ISSUE FOR APPROVAL	KJ	JH	15.02.18

Client: DICKER DATA PTY LTD

Civil Engineer: Taylor Thomson Whitting
612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project: DICKER DATA OFFICE & WAREHOUSE DEVELOPMENT CAPTAIN COOK DRIVE, KURNELL

Sheet Subject: CONCEPT STORMWATER MANAGEMENT PLAN SHEET 2 OF 4

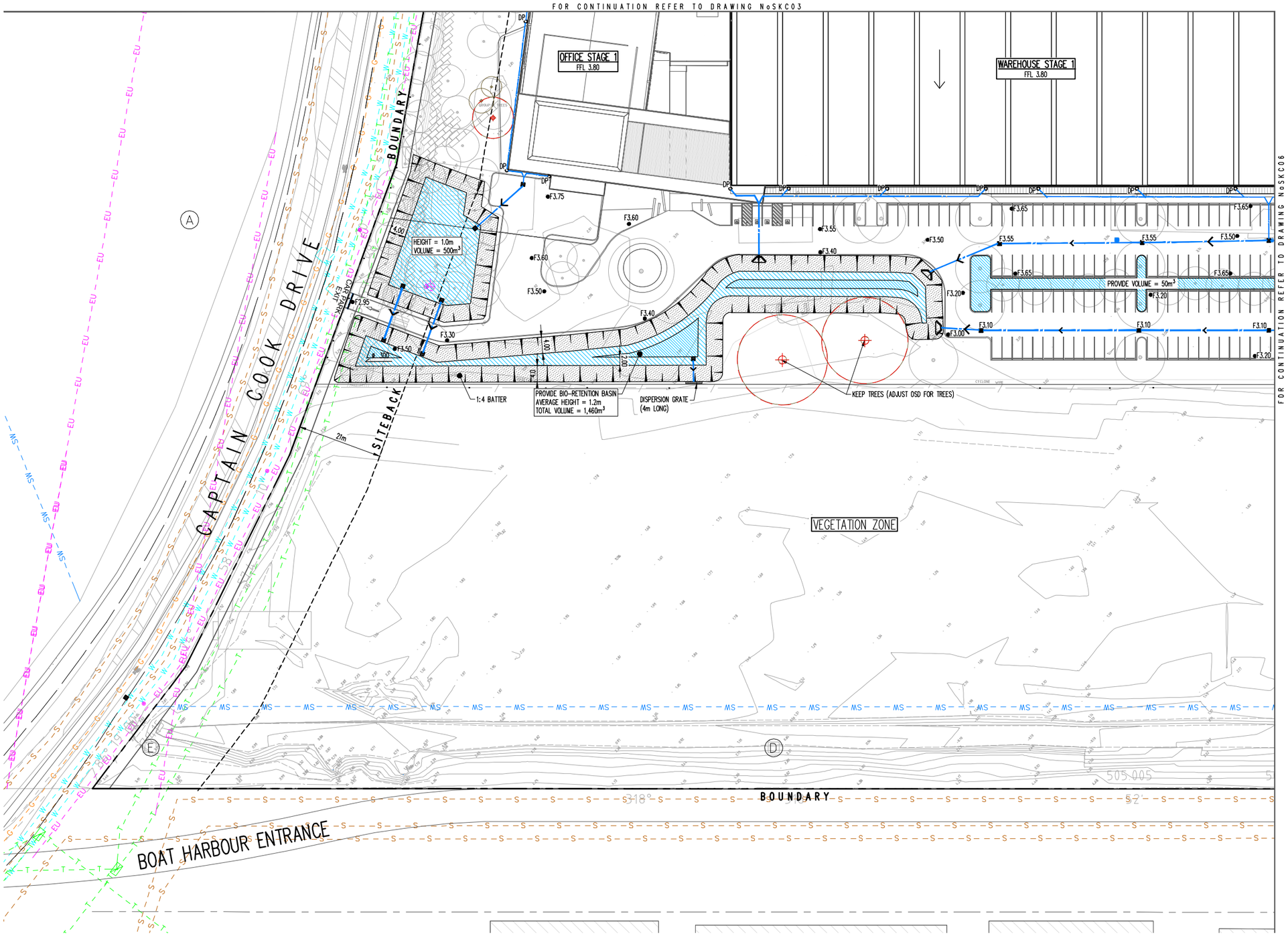
Scale : A1	Drawn	Authorised
1:500	JH	

Job No	Drawing No	Revision
171516	SKC04	P8

Plot File Created: Sep 03, 2018 - 11:18am

SITEWORKS LEGEND

- ø XX — Stormwater pit, flow direction and line with pipe size
- GD — Grated drain
- DP — Down pipe



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P5	ISSUE FOR APPROVAL	KJ	JH	08.02.18
P4	ISSUE FOR APPROVAL	KJ	JH	07.02.18
P3	ISSUE FOR APPROVAL	KJ	JH	30.01.18
P2	PRELIMINARY FOR SSD	WW	AI	22.12.17
P1	ISSUE FOR COMMENT	KH	JH	16.11.17
P8	ISSUE FOR APPROVAL	KJ	JH	03.09.18
P7	ISSUE FOR APPROVAL	KJ	JH	15.02.18

Client: DICKER DATA PTY LTD

Civil Engineer: Taylor Thomson Whitting
612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project: DICKER DATA OFFICE & WAREHOUSE DEVELOPMENT CAPTAIN COOK DRIVE, KURNELL

Sheet Subject: CONCEPT STORMWATER MANAGEMENT PLAN SHEET 3 OF 4

Scale : A1	Drawn	Authorised
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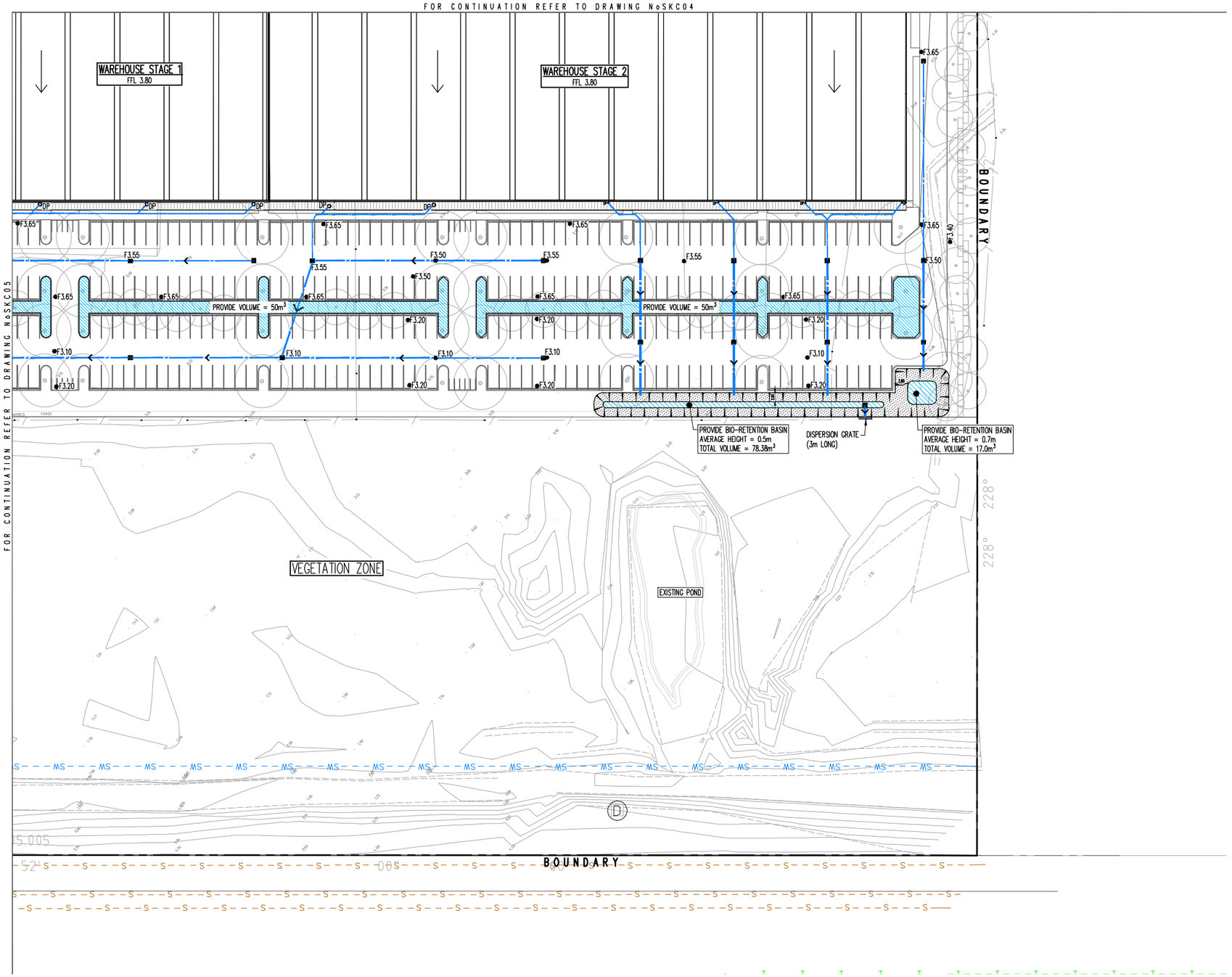
Job No	Drawing No	Revision
171516	SKC05	P8

Plot File Created: Sep 03, 2018 - 11:20am

SITEWORKS LEGEND

- ø XX — Stormwater pit, flow direction and line with pipe size
- GD — Grated drain
- DP — Down pipe



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Rev	Description	Eng	Draft	Date
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P5	ISSUE FOR APPROVAL	KH	JH	08.02.18
P4	ISSUE FOR APPROVAL	KH	JH	07.02.18
P3	ISSUE FOR APPROVAL	KH	JH	30.01.18
P2	PRELIMINARY FOR SSD	WW	AI	22.12.17
P1	ISSUE FOR COMMENT	KH	JH	16.11.17
P8	ISSUE FOR APPROVAL	KH	JH	03.09.18
P7	ISSUE FOR APPROVAL	KH	JH	15.02.18

Client: DICKER DATA PTY LTD

Civil Engineer: Taylor Thomson Whitting
612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project: DICKER DATA OFFICE & WAREHOUSE DEVELOPMENT CAPTAIN COOK DRIVE, KURNELL

Sheet Subject: CONCEPT STORMWATER MANAGEMENT PLAN SHEET 4 OF 4

Scale : A1	Drawn	Authorised
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Job No	Drawing No	Revision
171516	SKC06	P8

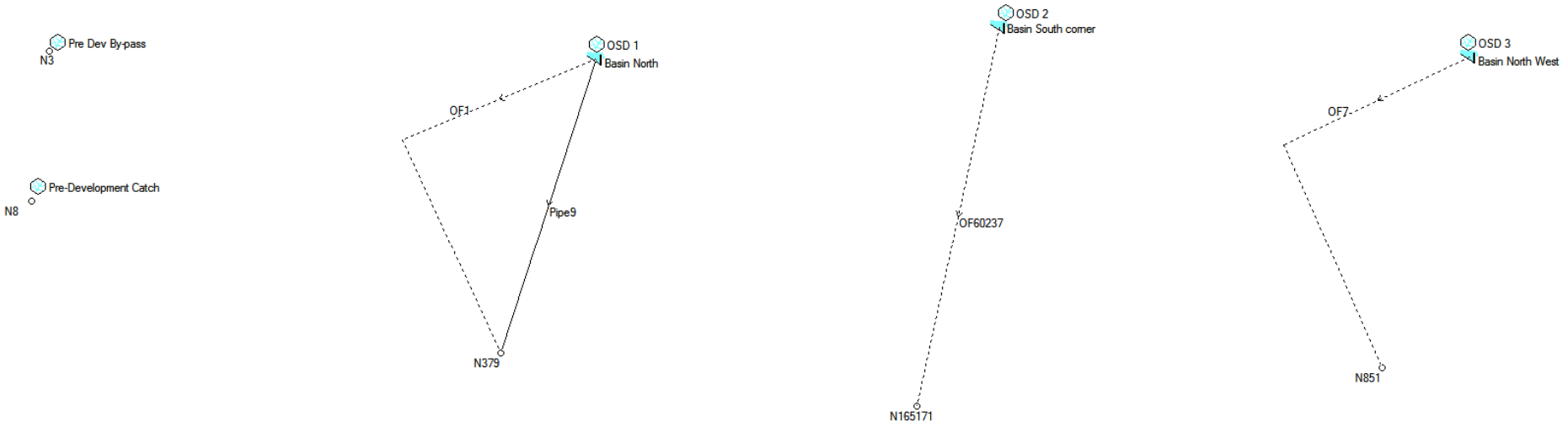
Plot File Created: Sep 03, 2018 - 11:20am

File Name: SKC06.dwg - USER: jhewitt - Plot File Created: Sep 03, 2018 - 11:20am

Appendix C

DRAINS Modelling

Model Setup



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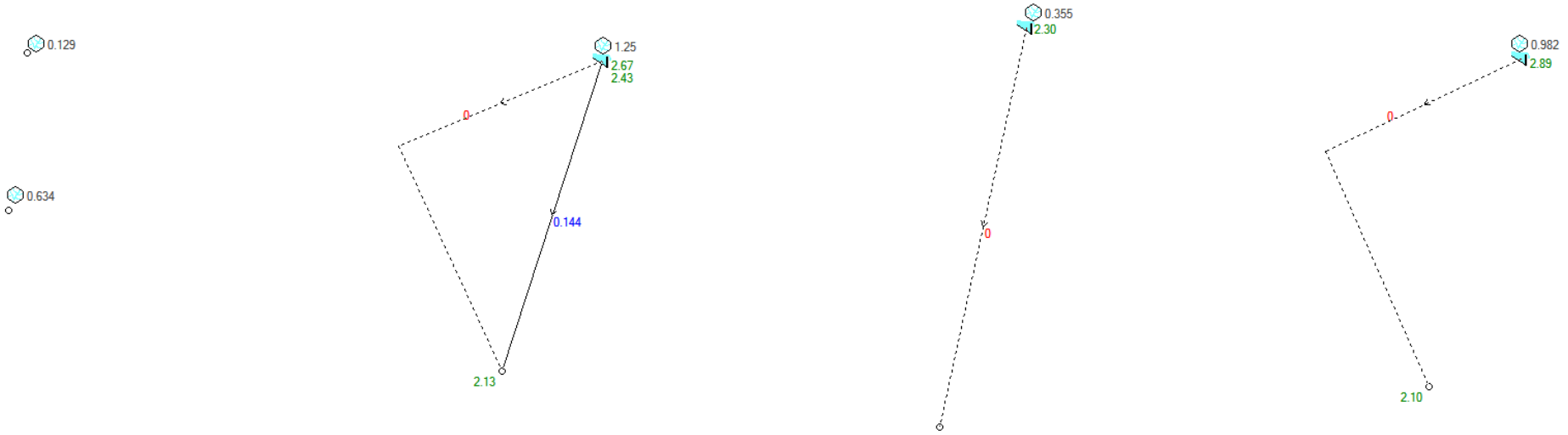

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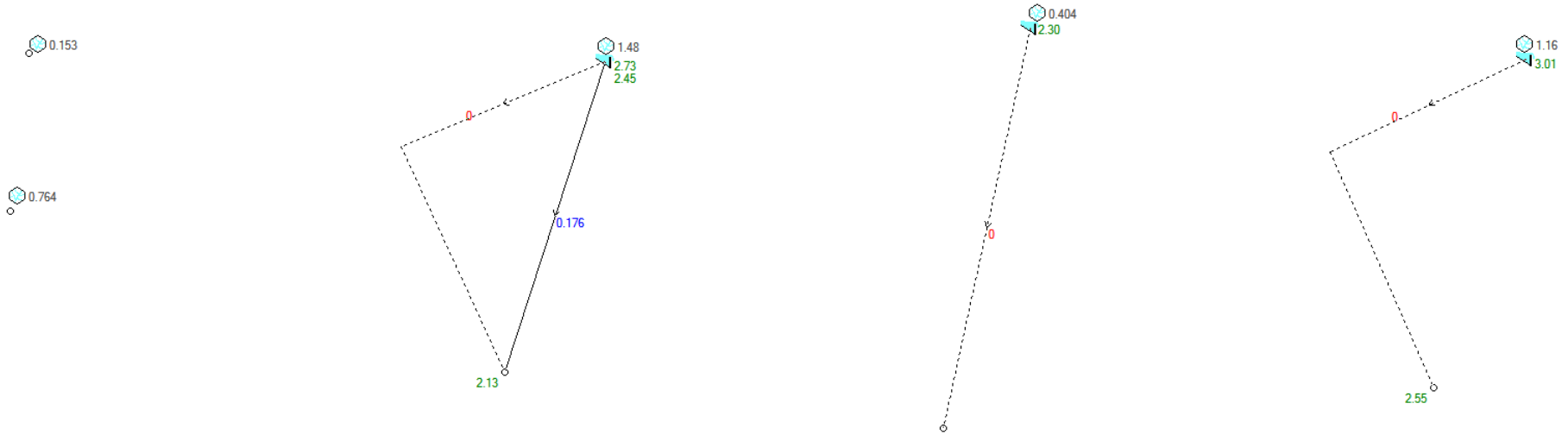

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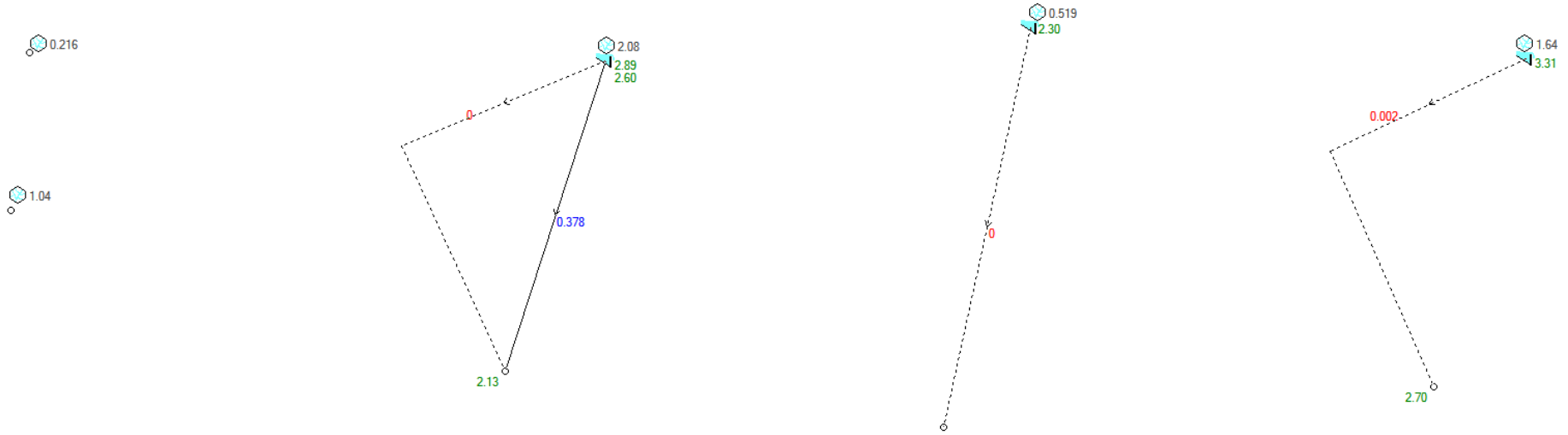
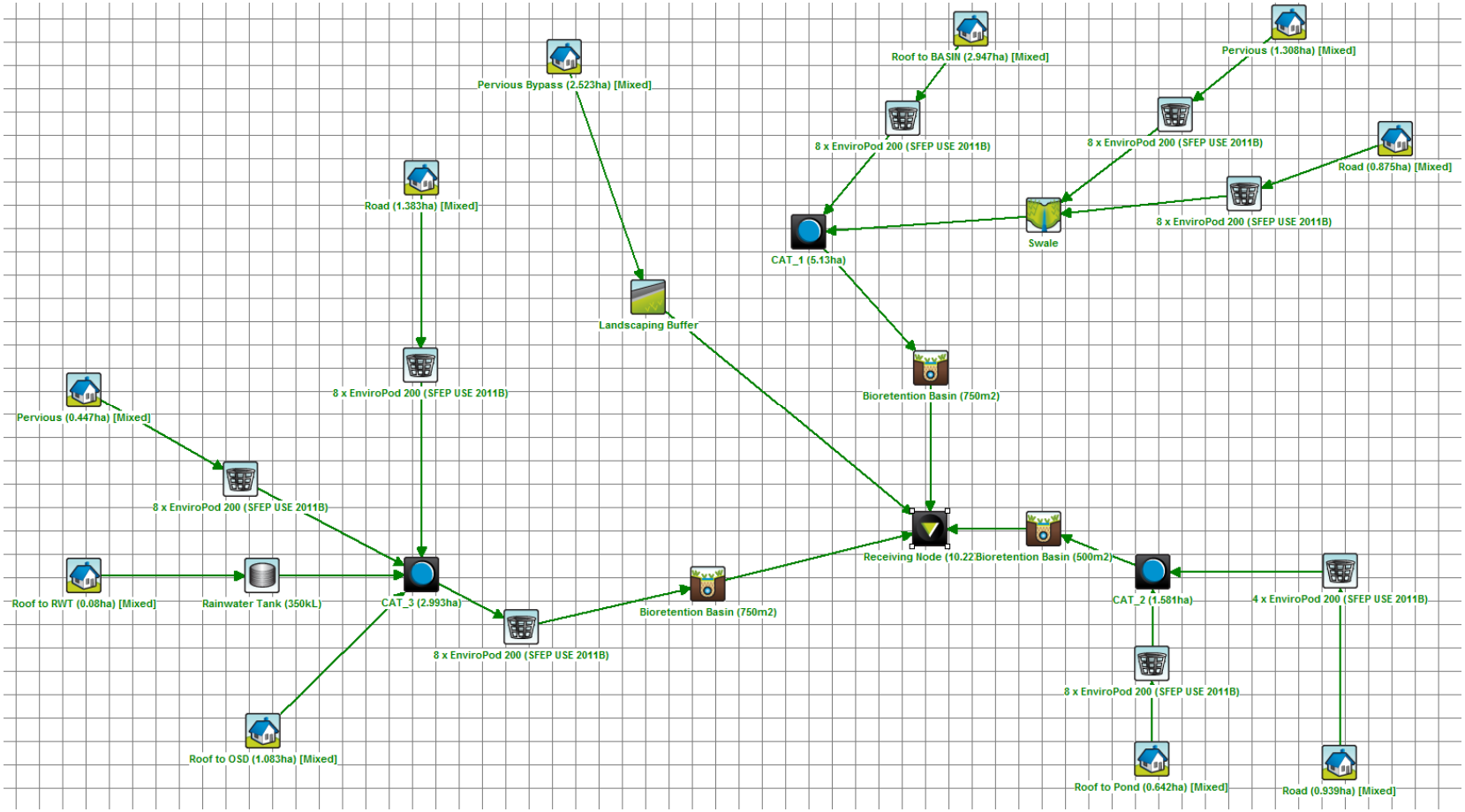


Appendix D

Catchment Plans

Appendix E

Music Model



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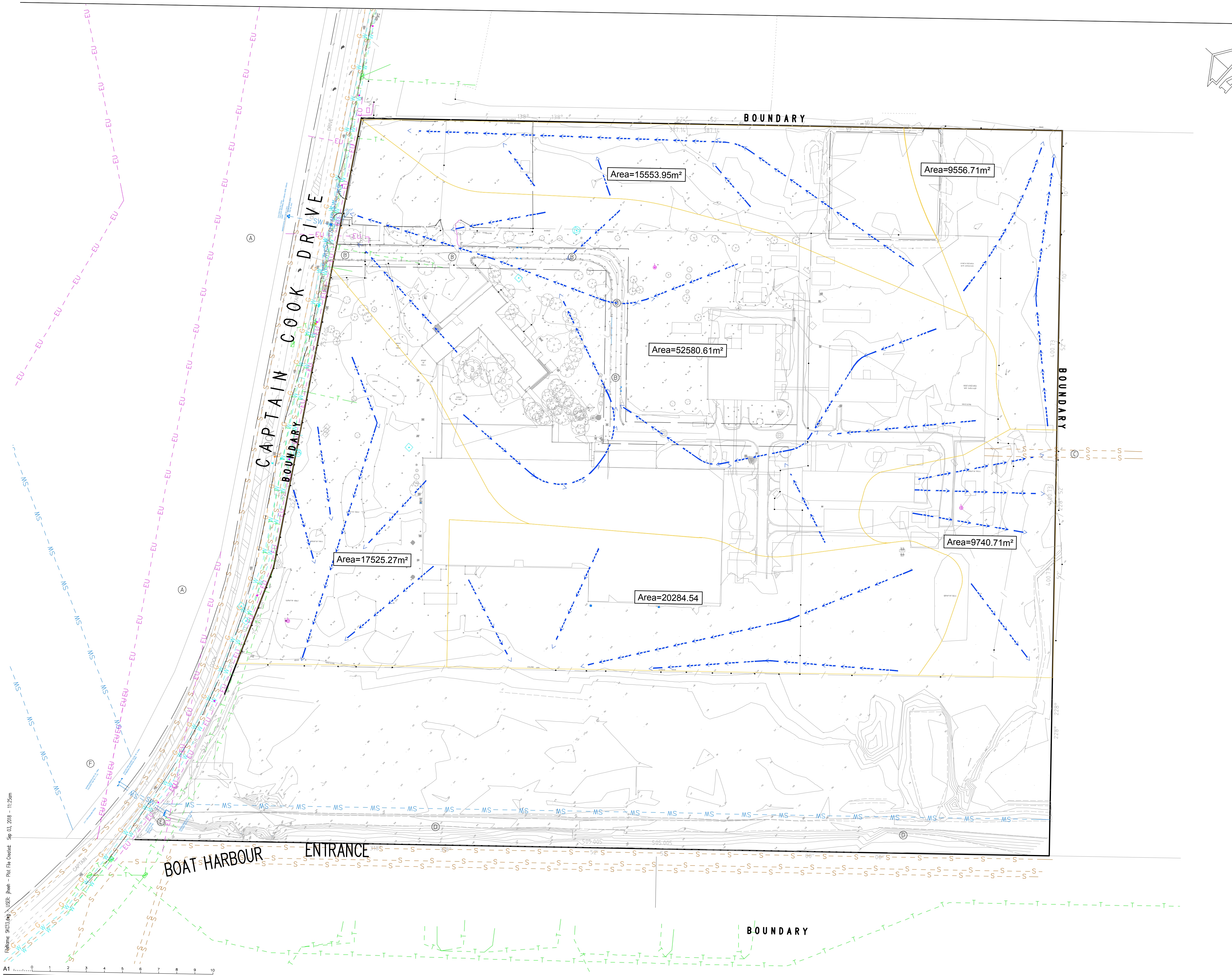

Rev	Description	Eng	Draft	Date
P1	ISSUE FOR INFORMATION	KH	JH	03.09.18

Client: DICKER DATA PTY LTD

Civil Engineer: Taylor Thomson Whitting — 612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project: DICKER DATA OFFICE & WAREHOUSE DEVELOPMENT CAPTAIN COOK DRIVE, KURNELL

Sheet Subject: EXISTING CATCHMENT PLAN

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Scale : A1	Drawn	Authorised
1:1000	JH	

Job No	Drawing No	Revision
171516	SKC13	P1

Plot File Created: Sep 03, 2018 - 11:25am

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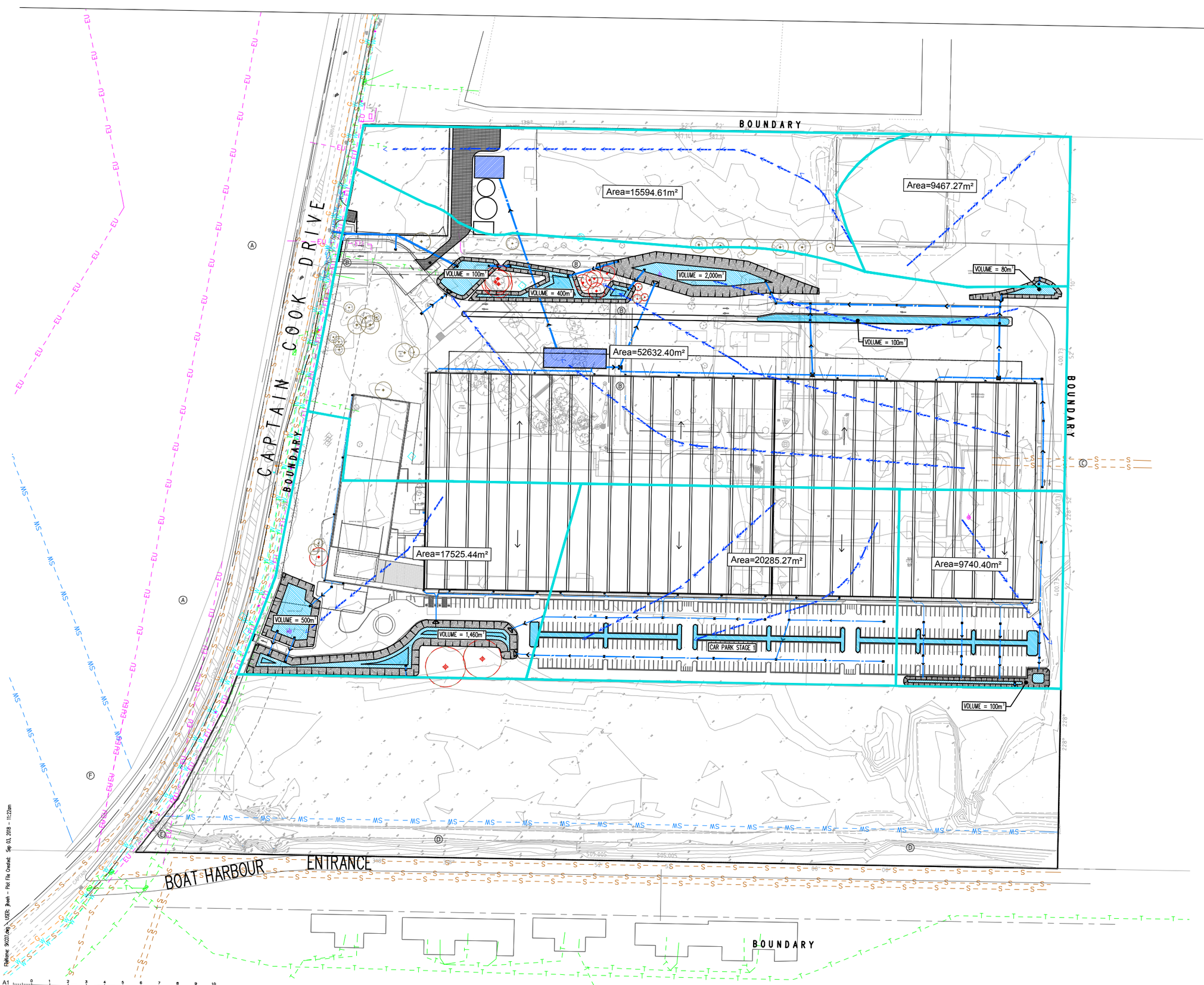

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P3	ISSUE FOR INFORMATION	KH	JH	03.09.18
P2	PRELIMINARY FOR SSD	WW	AI	22.12.17
P1	ISSUE FOR DA	WW	AI	20.12.17

Client: DICKER DATA PTY LTD

DICKER DATA

Civil Engineer: Taylor Thomson Whitting

612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project: DICKER DATA OFFICE & WAREHOUSE DEVELOPMENT CAPTAIN COOK DRIVE, KURNELL

Sheet Subject: PROPOSED CATCHMENT PLAN

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Scale : A1	Drawn	Authorised
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Job No	Drawing No	Revision
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Plot File Created: Sep 03, 2018 - 11:22am

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