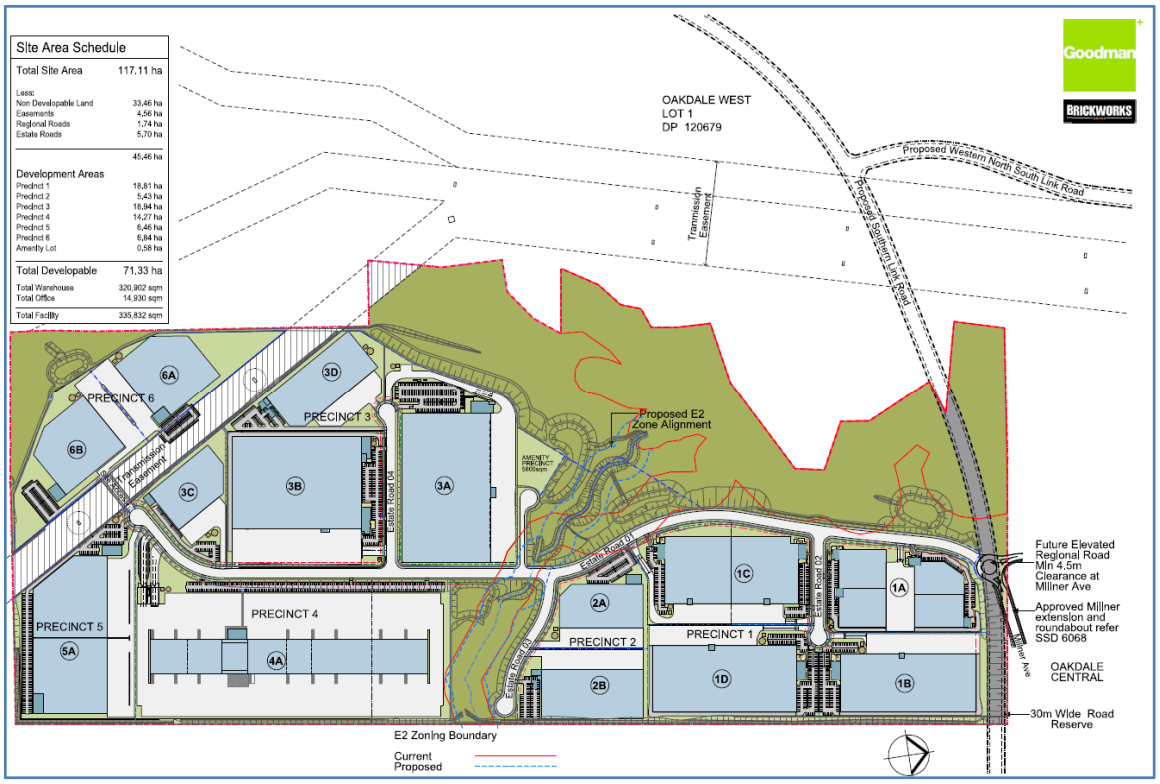
Oakdale South Estate

Lot 3A SIGMA Warehouse and Distribution Facility



Stormwater Management Report

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Approver: Anthony McLandsborough

Report no: 16-388-R001 **Revision:** 02 **Date:** August 2016

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Finalisation signatures

The design described in this report is considered to have been finalised.

	Signature	Date
Andrew Tweedie Senior Civil Engineer (Author)		24/08/2016
Frank Xie Lead Designer / Civil Engineer		24/08/2016
Anthony McLandsborough Director		24/08/2016

Notes: The finalisation signatures shown above do not provide evidence of approval to the design. Approval signatures are shown on the title sheet of the design plans.

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Abbreviations

OSE	Oakdale South Estate
OEH	Office of Environment and Heritage
EP	Equivalent Persons
ET	Equivalent Tenancy
IWM	Integrated Water Management
MG	Goodman Property Services (Aust) Pty Ltd
STP	Sewerage Treatment Plant
SWC	Sydney Water Corporation
WELS	Water Efficiency Labelling
EIS	Environmental Impact Statement
SSDA	State Significant Development Application

1 Executive Summary

Goodman Property Services (Aust) Pty Ltd are developing the Oakdale South Estate (OSE) site for the purposes of providing a warehouse and distribution complex. The Oakdale South site is a precinct within the wider 'Oakdale' Estate development and forms part of a progressive development designed to make 'Oakdale' a regional distribution park of warehouses, distribution centres and freight logistics facilities.

The Oakdale South project is a staged development including bulk earthworks, civil works, and services infrastructure and stormwater management.

This development application encompasses the planned phase of civil works on the Oakdale South site Lot 3A Sigma site which includes:

- Proposed associated cut to fill and importing fill for bulk earthworks to construct the pad levels.
- Proposed associated stormwater quality and quantity design.
- Proposed associated pavement design.
- Erosion and Sedimentation Control plan.

The site is located in the Penrith City Council Local Government area. In order to meet the council requirements for Hydraulic Design and Water Sensitive Urban Design, DRAINs and MUSIC modelling software has been used to calculate the required output results.

Lot 3A stormwater catchments fall into Oakdale South development Catchment C. The Precinct based bio-retention basins have been designed and constructed to both attenuate stormwater flows and treat the nutrients to Penrith City Council reduction targets. The Precinct On Site Detention Basin are designed to mitigate post development flows to pre-developed flows for peak Average Recurrence Interval (ARI) events and have been sized to ensure that for all storm events up to and including the 1:100 ARI event the development does not increase stormwater flows in any downstream areas.

2 Introduction

AT&L was commissioned by Goodman to prepare a Stormwater Management Report for a proposed industrial warehouse development on Lot 3A, Sigma Lot at Oakdale South Estate (OSE), Oakdale.

The subject site is situated within the Penrith City Council local government area. The aim of the report is to assess the potential impacts of the proposed development with respect to the Civil and Infrastructure. It has been prepared in accordance with Penrith City Council current design guidelines, the relevant Australian Standards and the relevant Austroad Guidelines.

2.1 Scope of Report

Summary

This report discusses the design philosophy and how stormwater is managed within Lot 3A of Oakdale South development. It includes:

- Earthworks
- Stormwater Management
  - On Site Detention (OSD)
  - Piped and Overland Flows
  - Water Sensitive Urban Design (WSUD)
- Sedimentation and Erosion Control

The proposed site plan covering the entire Oakdale South development along with the proposed Lot 3A layouts are attached within Appendix A.

Site Description

2.2 Existing Site

The subject site is located within the Oakdale South Estate Precinct 3 and comprises a total area of approximately 70,383m^2 (7.04 ha). Refer Site Plan within Appendix A.

The site is bounded by existing a Transgrid Easement to the south west and west and industrial allotments to the north, south and east (all subject to separate approvals).

Currently the site comprises farmland and is classified as a “greenfield” with an entire coverage of pervious areas. However for this DA it is assumed the estate roads, infrastructure and bulk earthworks for the pads have been undertaken. These works are part of a separate approval however are assumed to be completed prior to commencing this DA.

As such all reference to the existing site will be in regards to the bulk earthworked pads assuming the roads and associated infrastructure have been constructed.

The site is currently bulk earthworked with a crest in the middle falling at an average grade of approximately 0.5% to the boundaries. This is to ensure runoff flows off the site. Refer to the drawings within Appendix B for bulk earthworks drawings.

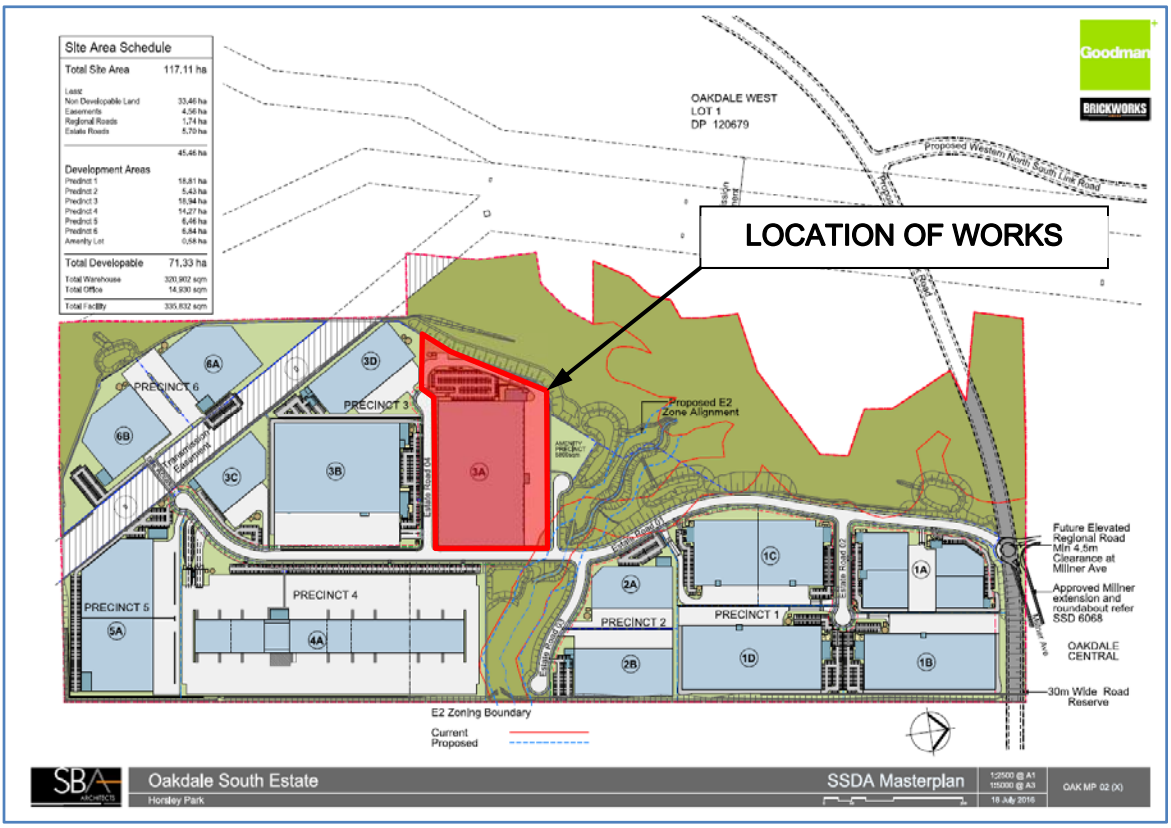


Figure 1 Oakdale South Estate Plan

2.3 Proposed Development

The proposed development comprises a single large industrial warehouse facility with up to 41,562m^2 of building area including warehouses and adjoining office space, loading docks, access roads, carparking and landscaping.

Refer to Figure 3 for Architectural Warehouse Plan prepared by SBA Architects for full Development Area Schedule.

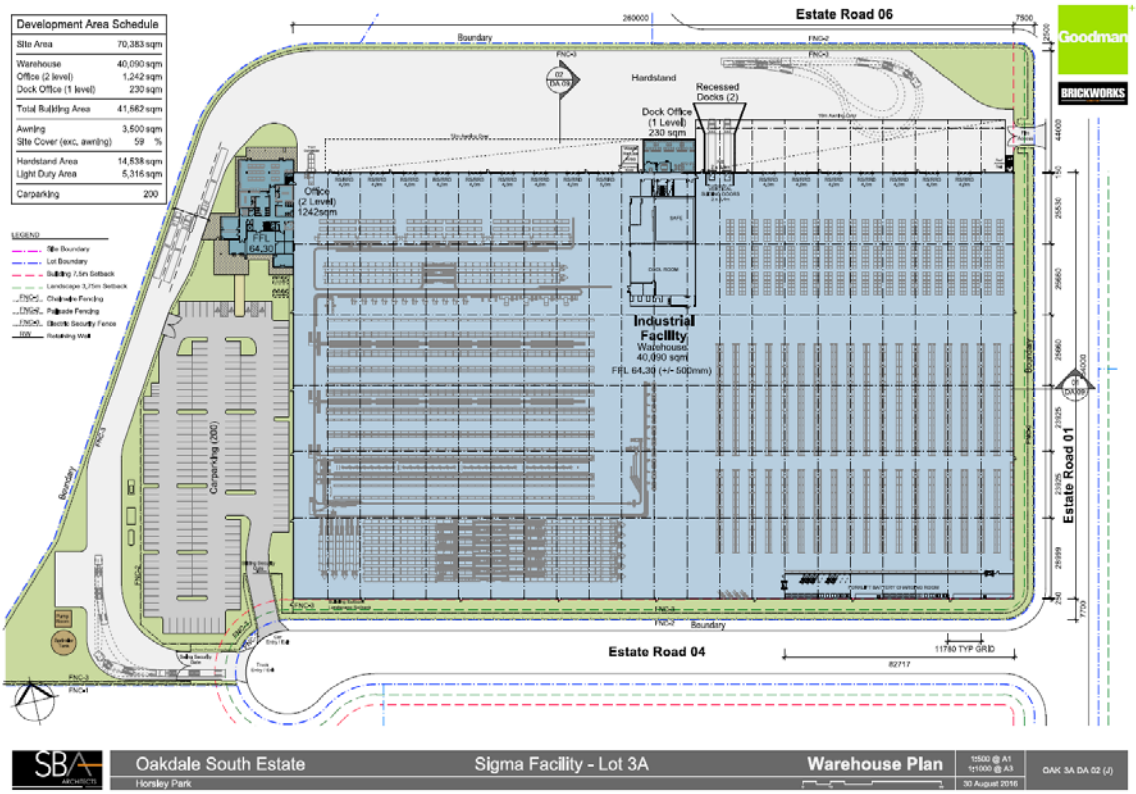


Figure 2: Proposed Lot 3A Development Layout

3 Stormwater Management

3.1 The Site (Lots 3A)

The stormwater catchment associated with this lot is:

- Lot 3A = 7.04 Ha

A development area schedule for each lot is shown in Appendix A within the Architectural Warehouse Plan.

The site is located in the Penrith City Council Local Government area and is bound by Estate Road No. 04 to the south, Estate Road No 01 to the east and Ropes Creek corridor to the north and west.

3.2 Council & Precinct Requirements & Recommendations

All stormwater drainage for Lot 3A within OSE development is designed to comply with the following:

- Penrith City Council Design Guidelines for Engineering Works
- Penrith City Council Water Sensitive Urban Design (WSUD) Policy December 2013
- C3 Water Management DCP.

A summary of the design requirements adopted is listed below:

- Precinct based basins will serve the development as detention and bio-retention basins. No on-lot detention basin/tank is required
- A Stormwater drainage network within lot to discharge into a dedicated OSD / bio-retention basin
- WSUD to achieve target reductions:
  - 85% Total Suspended Solids (TSS)
  - 60% Total Phosphorus (TP)
  - 45% Total Nitrogen (TN)
  - 90% Gross Pollutants (GP)
- Finished Floor Levels (FFL) to have minimum 500mm freeboard to 100 year overland flows.
- A gross pollutant trap (GPT) will be installed within the development site on the final downstream stormwater pit prior to discharging off site. As an alternative to GPT, trash screen inserts (eg. Enviropods or equivalent) to be provided to all surface inlet pits. GPTs or trash screen inserts will be owned and maintained by the individual property owner.

Rainwater tanks are desirable for re-use for irrigation, toilet and other non-potable water uses. Rainwater tank size is determined in accordance with the Penrith City Council C3 Water Management DCP.

3.3 Modelling Software

DRAINs modelling software has been used to calculate the Hydraulic Grade Line (HGL) of the estate level stormwater pipes. DRAINs is a computer program used for designing and analysing

urban stormwater drainage systems and catchments. It is widely accepted by Council's across NSW as the basis for stormwater design and has been confirmed by Penrith City Council as the preferred stormwater software analysis package. DRAINs data files and output results are attached in Appendix C.

MUSIC modelling software has been used to evaluate pollutant loads from each developed lot. MUSIC data files and output results are attached in Appendix D.

3.4 Hydrology

- Pipe drainage shall be designed to accommodate the 20-year ARI storm event.
- The combined piped and overland flow paths shall be designed to accommodate the 100-year ARI storm event.
- Where trapped low points are unavoidable and potential for flooding private property is a concern, an overland flowpath capable of carrying the total 100-year ARI storm event shall be provided. Alternatively the pipe and inlet system may be upgrade to accommodate the 100 year ARI storm event.
- Rainfall intensities shall be as per the Intensity-Frequency-Duration table in accordance with the Australian Rainfall and Runoff (AR&R) volume 2.
- Times of concentration for each sub catchment shall be determined using the kinematic wave equation.
- Runoff coefficients shall be calculated in accordance with AR&R. The fraction impervious shall be determined from analysis of the sub catchments.
- Flow width in gutter shall not exceed 2.5m for the minor design storm event.
- Velocity depth ratios shall not exceed 0.4 for all storms up to and including the 100 year ARI event.
- Inlet pits to be spaced so that flow width shall not exceed 80l/sec
- Bypass from any pit on grade shall not exceed 15% of the total flow at the pit
- Blockage factors of 20% and 50% shall be adopted for pits on grade and at sags respectively.

3.5 Hydraulics

- A hydraulic grade line HGL design method shall be adopted for all road pipe drainage design. The HGL shall be shown on all drainage long sections.
- The minimum pipe size shall be 375mm diameter RCP.
- Maximum spacing between pits shall not exceed 75m.
- The minimum pipe grade shall be 0.5%.
- All pipes shall be Rubber Ring Jointed unless noted otherwise.
- The minimum cover over pipes shall be 450mm in grassed areas and 600mm within carriageways.
- Where minimum cover cannot be achieved due to physical constraints the pipe class shall be suitably increased.
- All trafficable shall be Reinforced Concrete Pipes or Fibre Reinforced Cement equivalent.

- The pipe friction coefficients to adopted shall be:

Materials	Mannings – n	Colebrook-White – k	Min. Pipe Class
RCP	0.012	0.6	3
FRC	0.01	0.15	3

Table 1 - Pipe Details

- All pipes classes shall be designed for the ultimate service loads and where applicable, construction loads will be designed for.
- Pipes discharging to the overland flow path shall adopt a minimum tailwater level equivalent to respective overland flow level.
- Pit Loss coefficients shall be calculated in accordance with Missouri Charts.
- A minimum 150mm freeboard shall be maintained between pit HGL and pit surface levels.
- Overland flowpaths shall maintain a minimum of 300mm freeboard to all habitable floor levels.
- Pits deeper than 1.2m shall contain step irons at 300 mm centers.

3.6 Catchments

A Stormwater Catchment Plan for each Catchment and the overall site is shown in Appendix A. As indicated all stormwater runoff from Lot 3A drains via on Lot & estate roads underground drainage networks into the bioretention Basin C north of the Amenity Precinct. The Lot 3A total catchment area draining into bio-retention Basin C is 7.04 Ha.

3.7 On-Site Detention (OSD)

As discussed in Section 4.2, OSD is required within the development to mitigate post developed flows to pre-developed flow rates for peak Average Recurrence Intervals (ARIs).

A summary of the OSD requirements for each catchment is as follows:

All stormwater runoff will drain into an OSD / Bio-retention Basin C to the north of the lot via on Lot & estate roads underground drainage network. This basin has been designed and sized to take into account an entire catchment which includes the development of Lot 3A. As a result, no further OSD is required for this lot.

3.8 Overland Flows

Overland flows within the batter areas, access roads, carparks and hardstanding areas have been designed to be safely conveyed downstream.

Overland flow from the major storm event which exceeds the piped network capacity will be directed towards the eastern boundary of the site to flow into the road carriageway and ultimately into Bio-retention Basin C.

3.9 Water Sensitive Urban Design (WSUD)

Water Sensitive Urban Design encompasses all aspects of urban water cycle management, including water supply, wastewater and stormwater management. WSUD is intended to minimise the impacts of development upon the water cycle and achieve more sustainable forms of urban development.

Stormwater quality treatment will ultimately be provided by the proposed bio-retention basin C to the east. The bio-retention Basin C was constructed as part of the early works/ bulk earthworks for the overall Oakdale South Development.

Refer to Appendix D for MUSIC modelling results for Basin C. Also attached within Appendix D is the Oakdale South Estate overall Stormwater Catchment Plan. This indicates Lot 3A within Catchment C drains into Bio-retention basin C. The treatment rates achieved by Basin C are as follows:

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	26,400	3,990	85	85
Total Phosphorus	53.8	18.7	65.3	60
Total Nitrogen	347	183	47.2	45
Gross Pollutants	4,420	4.46	99.9	90

Table 2 - Basin C Treatment Rates

Gross Pollutant Traps (GPT) will be installed in the north-west and north east corner of the site, prior to discharging off lot. Refer to Civil drawings for location of the GPTs. To this extent, no additional Stormwater Quality Improvements Devices (SQIDs) are proposed.

3.10 Conclusion

The proposed stormwater management strategy outlined above for Lot 3A generally meets the previous objective of the site wide strategy previously prepared by AT&L State Significant Development Application civil design documents. The already approved and constructed OSD / bio-retention basin will provide both water quality and quantity control of Lot 3A and achieve the desired and improved outcomes.

4 Secretary's Environmental Assessment Requirements

SSD approval for the entire Oakdale South Industrial Estate SSD 15_6917 was issued by Ministry of Planning on August 2016. It should be noted that the development of Lot 3A complies with the "Civil, Stormwater and Infrastructures Services Strategy, rev 5, report no 14-193-R001" as required within Schedule C of this SSD.

A separate application was submitted for the Proposed Sigma Warehouse and Distribution Facility, Lot 3A Oakdale South Industrial Estate. The Secretary's Environmental Assessment Requirements (SEARs) for State Significant Development SSD 7719 was granted for Lot 3A by the Ministry of Planning on 21st of July 2016.

It should be noted that a subsequent Section 96 modification to the masterplan will be lodged concurrently with the Sigma SSD which reflects the revisions to the masterplan necessary to accommodate the development of Lots 3A and 3B.

Under the Key Issues section within the Secretary's Environmental Assessment Requirements (SSD 7663) are conditions which apply for the civil stormwater management of Lot 3A.

Table 2 below indicates how the relevant conditions within the Key Issues have been meet.

Key Issue	Response
Soils and Water	
A description of the water demands, and a breakdown of water supply for the site	A Water Balance section has been included in this report. Refer Section 6 for all site water balance details, water supply source, usage calculations and efficiency measures
A description of the measures to minimise water use	Refer Section 6 of this report
A detailed water balance	Refer Section 6 of this report
A description of the proposed erosion and sediment controls during construction and operation	A Sediment and Erosion Control section has been included within Section 7 of this report
A description of the surface and stormwater management system, including on-site detention, and measures to treat or re-use water	Stormwater management systems for Lot 3A has been described within Section 4 of this report
An assessment of potential surface and groundwater impacts associated with the development	All surface water generated from the development will be directed into a stormwater pit and pipe system and drain into a Gross Pollutant Traps before discharging into the road stormwater network to ultimately discharge into Bio-retention Basin C.

	Refer to Civil Drawings for all stormwater drainage networks along with Sediment and Erosion Control Plans. A Geotechnical and Hydrological Investigation undertaken by Pells Sullivan Meynink (PSM) in September 2015 for the entire Oakdale South Estate highlighted the only groundwater encountered within the entire site is adjacent Ropes Creek. As Lot 3A is located approximately 150m to the south of Ropes Creek and minimal cut is required to develop the site, the likelihood of encountering groundwater is negligible.
An assessment of the impact of flooding on the proposed development for the full range of flood events up to the probable maximum flood	A Flood Impact Assessment for the Proposed Oakdale South Estate has been undertaken by Cardno in May 2016. This assessment concluded the entire development did not have any adverse impacts on adjoining properties from a flood perspective. Lot 3A was included within this assessment. As such it is deemed the development of Lot 3A has no flooding impacts for all storm events up to the PMF within the surrounding area.
An assessment of the impact of the proposed development on flood behaviour	A Flood Impact Assessment for the Proposed Oakdale South Estate has been undertaken by Cardno in May 2016. This assessment concluded the entire development did not have any adverse impacts on adjoining properties from a flood perspective. Lot 3A was included within this assessment. As such it is deemed the development of Lot 3A has no flooding impacts for all storm events up to the PMF within the surrounding area.
Details of impact mitigation, management and monitoring measures	A management and monitoring program has been described within Section 7 of this report
Infrastructure Requirements	

A detailed written and/or geographical description of the existing infrastructure on-site	As a result of consultation with Sydney Water a Local Area Servicing Plan (LASP) for both sewer and potable water has been prepared to ensure that future Sydney Water infrastructure could ultimately service future developments within the Sydney Employment Area (WSEA) Precinct No. 8 Area South of Pipeline which includes Oakdale South and subsequently Lot 3A. This LASP was prepared by GHD and endorsed by Sydney Water. Within the LASP it is stated for potable water OSE (and subsequently Lot 3A) will be supplied via an extension of the existing 250mm diameter water main within Millner Avenue to the north. For sewer the LASP proposes sewer for OSE will be supplied via a proposed 375mm diameter sewer to be installed along the western boundary of OSE. It is proposed Lot 3A will drain into this sewer to the west. Telecommunications will be available into Lot 3A via a pit and pipe network proposed within the main road verge. Provision for gas within OSE has been made via installation of a spare conduit to facilitate the installation of gas by Jemena should this be required in the future. Consultation with Endeavour Energy has indicated OSE lots can be serviced with power from either the existing 11kV reticulation within Millner Avenue to the north or the existing Eastern Creek Zone Substation located at the corner of Old Wallgrove Road and Roberts via new 11kV feeders that would be pulled through existing ducts within Milner Avenue and Old Wallgrove Road.

Identification of any infrastructure upgrades required to facilitate the development, and describe any arrangements to ensure the upgrades will be implemented in a timely manner and maintained	Refer to response above.
Water NSW Requirements	
WaterNSW therefore requests that the EIS considers any potential for works on the subject site to impact downstream lands such as the Pipeline corridor through the alteration of flood behaviour.	The Flood Impact Assessment undertaken by Cardno for OSE highlights the development does not result in flood levels within the Warragamba Pipeline Corridor increasing. This is for all storms inclusive of the PMF
WaterNSW requires upstream development to not result in an increase in current stormwater levels that currently enter the Warragamba Pipeline corridor	The Flood Impact Assessment undertaken by Cardno for OSE highlights the development does not result in flood levels within the Warragamba Pipeline Corridor increasing. This is for all storms inclusive of the PMF

Table 3 - Summary of Civil Stormwater Conditions in Development Consent

5 Water Balance

5.1 General

The water balance was simulated using a water cycle management model as part of the MUSIC Model to allow the evaluation of various elements of the water cycle to be assessed at differing stages in the development.

5.2 Water Balance Objective

Potable water supplies in the Sydney area are in recognised short supply with projected population increases, potential climate change and periods of extended drought and any development in sources of the Sydney region places increasing demands on an already scarce water supply. As a result, government bodies, together with Sydney Water have encouraged sustainable development by the implementation of an integrated approach to water cycle management (potable water, sewage, stormwater and rainwater) to minimise demands of potable water supplies.

Whilst opportunities for Water Reuse include such initiatives as regional stormwater harvesting, black water recycling and recycled water, this development is limited to rainwater collection and reuse on an individual lot by lot basis.

As such, we have used MUSIC to establish an estimated tank size for each lot within the development and demonstrated the volume of water reuse possible and provide a more sustainable servicing solution.

5.3 Water Balance End Uses

AT&L has identified the following water demand end uses to be required across the development:

- toilet and urinal flushing, hand basin washing, showering;
- kitchen (food preparation, washing), drinking;
- air conditioning cooling;
- internal cleaning;
- leaking water devices;
- external cleaning; and
- watering (outdoor garden use).

End Use (Water Demand)	Water Demand* (L/day for a total development)	Percentage of Total Water Demand	Assumptions
Toilet and Urinal Flushing	586	12%	Based on '3-star' toilet and urinal fittings. Based on being flushed
Hand Basin Washing	348	7%	Based on 3 uses of the hand basin per person/day for 15 seconds each time using a 3-star tap fitting (8.5 L/min).
Showering	698	14%	20% of staff have showers each day for 8 minutes each time using a 3-star shower head (8L/min)
Kitchen (washing& drinking)	164	3%	3 L / EP/ day
Air Conditioning Cooling	496	10%	10% of total water consumption-of which 88% evaporates.
Leaking Water Devices	Negligible	0%	Traditionally 0.7% of total water consumption in residential dwellings is attributed to leaks (SWC, 2005). However, as the new dwellings will be fitted with efficient, correctly installed and appropriately maintained fittings- the water consumption attributed to leaking water devices was assumed to be negligible.
Unaccounted for Water	499*	10%*	Unaccounted for water accounted for 10% of overall water demand in 2005 (SWC, 2005). *It has been assumed that "unaccounted for water" is equivalent to 10% of pressurised water demands. In reality this will be made up from a portion of both the potable and non-potable demands. This results in an overall "unaccounted for water" demand, except in the case where rainwater tanks are used to supplement end uses. In this case the total "unaccounted for water" demand will be less than 10%.
Internal Cleaning	74	1.5%	Based on the assumption that cleaning involves toilet flushing (8 toilet flushes- 24L) and mopping (5 buckets each 10 L- 50L).

External Cleaning	20	0.4%	Assuming each bucket of water requiring for mopping contains 10 L
Watering (Outdoor Garden use)	1,777	36%	Using subsurface irrigation (and other water efficient watering methods)- the watering required during an 'average' rainfall year was assumed to be 0.88 mm/day (source unavailable).
Total (L/day/ Generic Warehouse (or per 2.04 net hectares)	4,662	100%	
Total (L/day/ net hectare)	2,285	-	

Table 4 – Summary of Adopted End Use Assumptions within the Development

Note * the water demand rates indicated in this table are based on the Oakdale Concept Plan Water Balance Options Report prepared by GHD in December 2007.

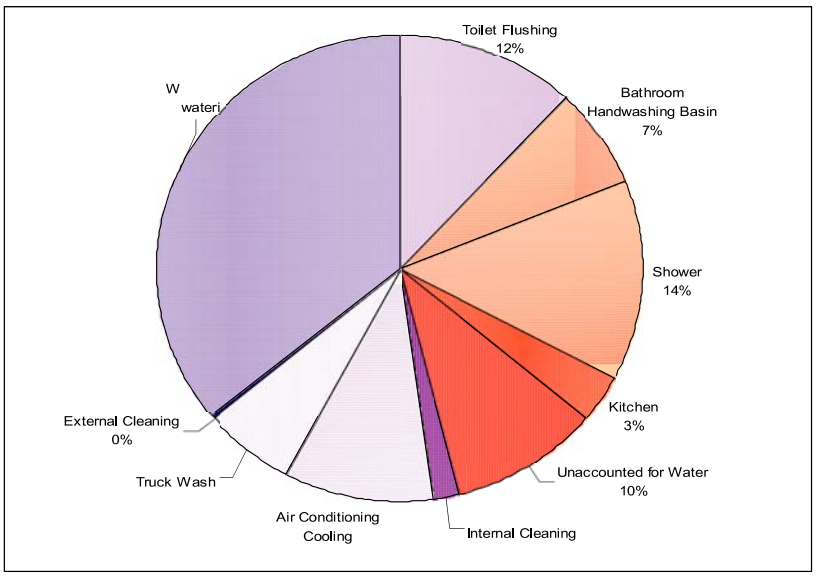


Table 5 – Water Demand Breakdown by End Use within the Development

Table 5 shows the proportion of total water demands for irrigation and toilet flushing within the development could be as much as 50% of total water demands across the development that may be potentially substituted for by rainwater reuse.

The remaining 50% of the Development's water demands require a potable water supply.

As such, maximising the substitution of end use demands that do not require a potable water source would result in a maximum achievable potable water saving in the order of 50%

5.4 Total Site Demands

Portion of Proposed Warehouse Facility	**3A Area (m2)**
Warehouse (including dock office lower level)	41,838
Office	1,600
Hardstand (including internal circulation roads, footpaths, car parks)	20,069
Garden / Landscape Area (including courtyards)	8,490
Total Area of Proposed Warehouse Facility	70,383
Total Number of Toilets	23
Daily Water Usage (based on 2.285kL/day/ net Hectare) as per Table 18	9.56kL/day

Table 5 - Total Site Demands and Daily Usage

5.5 Rainwater Reuse

The use of rain water collected in rainwater tanks from runoff on the roofs of the warehouse roofs provides a valuable alternative to potable water for a variety of non-potable end uses, such as vehicle washing, air conditioning cooling, and toilet flushing and watering.

We have assumed for this development, irrigation and toilet flushing will be plumbed to the rainwater tanks. Other uses such as truck washing maybe considered at the detailed design stage.

A rainwater tank model was constructed to simulate the rainwater tank operations and select the optimal rainwater tank size, in doing so, the following considerations were made:

- Rainfall received;
- Roof area or runoff area;
- Roof Wetting;
- First Flush; and
- Rainwater demands (by end use).

5.6 Rainwater Tank Model Assumptions

The rainwater tank model assumptions built into the scenarios assumed thefollowing:

Rainfall received

The rainfall runoff that could potentially be captured by the rainfall tank from the roof of each building was simulated individually for the 'dry', 'wet' and 'average' rainfall year within each scenario run.

Roof Wetting, First Flush Diversions and Overflow

While it is assumed that rainfall runoff has the potential to runoff 100% of the area of the roof into the rainwater tank, the proportion of rainfall that actually reaches the rainwater tank is affected by four factors:

- It is assumed that the initial 2mm of rainfall that falls on the roof is considered 'wetting', that is, potential rainfall runoff that is not captured by the rainwater tank, but is rather 'lost runoff' as evaporation or other;
- To prevent sediment and other pollutants entering the rainwater tank, a portion of the initial runoff from the roof is transferred to stormwater, this is known as the 'first flush'. The portion of water diverted as part of the first flush differs for each facility depending on the amount of pollution each roof is susceptible to.
- As the development is located in a predominantly light industrial area, where there may be potential for some roof pollution, a standard first flush volume of 1mm of runoff from across the roof area has been adopted.
- Any roof runoff that exceeds the rainwater tank capacity is 'overflow', and is directed to the stormwater drainage system.

5.7 Rainwater Tank Modelling

5.7.1 General

For the MUSIC analysis the following parameters are assumed:

- An allowance for 20% loss in rainwater tank size volume to allow for anaerobic zones, mains water top up levels and overflow levels
- Approximately 30% of the total roof area can drain into the rainwater harvest tank
- The daily usage is calculated based on 2.285kL/day/ building area as per the requirements from Table 4.

5.7.2 Rainwater Tank Modelling Results

The use of a rainwater tank was simulated for 'average' rainfall conditions to service three differing combinations of end uses for each Facility being:

Lot Number	Total Roof Area (m^2)	Roof Area draining to tank (m^2)	Size of Tank(kL)	% of total non-potable water used from tank (based on MUSIC modelling)
3A	41,838	12,551	75	50.3

Table 6 – Percentage of Non-Potable Water Used from Tank

5.8 Conclusion

The use of rainwater harvest tanks and the design basis to size the tanks to ensure as a minimum 50% of all non-potable water on Lot 3A can be sourced from the tank, demonstrates a commitment to water recycling and minimising the usage of mains water.

This is in line with the industry best practise and the NSW Stage Government's objective of reducing the amount of potable (drinking) water consumed for non-potable uses.

6 Sedimentation and Erosion Control

6.1 Sedimentation and Erosion Control (Construction)

Soil and Water Management Plans (SWMP) has been prepared in accordance with the NSW Department of Housing Publication titled: Managing Urban Stormwater- Soils and Construction (2004) for the whole site. Refer to AT&L Civil drawings within Appendix E of the EIS.

6.2 Sources of Pollution

The activities and aspects of the works that have potential to lead to erosion, sediment transport, siltation and contamination of natural waters include:

- Earthworks undertaken immediately prior to rainfall periods
- Work areas that have not been stabilised
- Extraction of construction water from waterways during low rainfall periods
- Clearing of vegetation and the methods adopted, particularly in advance of construction works
- Stripping of topsoil, particularly in advance of construction works
- Bulk earthworks and construction of pavements
- Works within drainage paths, including depressions and waterways
- Stockpiling of excavated materials
- Storage and transfer of oils, fuels, fertilisers and chemicals
- Maintenance of plant and equipment
- Ineffective implementation of erosion and sediment control measures
- Inadequate maintenance of environmental control measures
- Time taken for the rehabilitation / revegetation of disturbed areas

6.3 Potential Impacts

The major potential impacts on the riparian environment relate to erosion of distributed areas or stockpiles and sediment transportation. Potential adverse impacts from erosion and sediment transportation can include:

- Loss of topsoil
- Increased water turbidity
- Decreased levels of dissolved oxygen
- Changed salinity levels
- Changed pH levels
- Smothering of stream beds and aquatic vegetation
- Reduction in aquatic habitat diversity
- Increased maintenance costs
- Decrease in waterway capacity leading to increased flood levels and durations

6.4 Construction Methodology

The following construction methodology will be followed to minimise the impact of sedimentation due to construction works:

- Diversion of “clean” water away from the disturbed areas and discharge via suitable scour protection.
- Provision of hay bale type flow diverters to catch drainage and divert to “clean” water drains.
- Diversion of sediment-laden water into temporary sediment control basins to capture the design storm volume and undertake flocculation (if required).
- Provision of construction traffic shaker grids and wash-down to prevent vehicles carrying soils beyond the site.
- Provision of catch drains to carry sediment-laden water to sediment basins.
- Provision of silt fences to filter and retain sediments at source.
- Where future construction and building works are not proposed, the rapid stabilisation of disturbed and exposed ground surfaces with hydro-seeding

6.5 Site Inspection and Maintenance

The inspection and maintenance requirements outlined in this section will need to be carried out as long as either earthworks or quarrying is being conducted and all areas re-established.

The Contractor’s site Superintendent will inspect the site after every rainfall event and at least weekly, and will:

- Inspect and assess the effectiveness of the SWMP and identify any inadequacies that may arise during normal work activities or from a revised construction methodology. Construct additional erosion and sediment control works as necessary to ensure the desired protection is given to downstream lands and waterways
- Ensure that drains operate properly and to effect any repairs
- Remove spilled sand or other materials from hazard areas, including lands closer than 5 metres from areas of likely concentrated or high velocity flows especially waterways and paved areas
- Remove trapped sediment whenever less than design capacity remains within the structure
- Ensure rehabilitated lands have affectively reduced the erosion hazard and to initiate upgrading or repair as appropriate
- Maintain erosion and sediment control measures in a fully functioning condition until all construction activity is completed and the site has been rehabilitated
- Remove temporary soil conservation structures as the last activity in the rehabilitation

6.6 Conclusion

The erosion control measures proposed for the site will comply with the requirements of Penrith City Council and The Department of Environment, Climate Change and Water (DECC).

The proposed SWMP will ensure that the best management practice is applied to the development site in controlling and minimising the negative impacts of soil erosion.

Appendix A

Proposed Site Plans, Staging and Catchment Plans

Development Area Schedule	
Site Area	70,383 sqm
Warehouse	40,090 sqm
Office (2 level)	1,242 sqm
Dock Office (1 level)	230 sqm
Total Building Area	41,562 sqm
Awning	3,500 sqm
Site Cover (exc. awning)	59 %
Hardstand Area	14,538 sqm
Light Duty Area	5,316 sqm
Carparking	200

LEGEND

- Site Boundary
- Lot Boundary
- Building 7.5m Setback
- Landscape 3.75m Setback
- FNC-1 Chainwire Fencing
- FNC-2 Palisade Fencing
- FNC-3 Electric Security Fence
- RW Retaining Wall

Estate Road 06

260000

7500

2500

Boundary

FNC-2

FNC-3

02 DA 09

Hardstand

Recessed Docks (2)

Dock Office (1 Level) 230 sqm

19m Awning Over

12m Awning Over

Fire Access

Trash Compactor

Waste Refuse Area

Compresso Room

RS 2 x 3.0m

Roof Access Stair

RS/RRD 4.0m

RS/RRD 5.0m

VERTICAL SLIDING DOORS 2 x 2.4m

Office (2 Level) 1242sqm

FFL 64.30

Electrical Substation

SAFE

COOL ROOM

Industrial Facility

Warehouse 40,090 sqm

FFL 64.30 (+/- 500mm)

Carparking (200)

Boundary

FNC-3

FNC-2

Sliding Security Gate

Pump Room

Sprinkler Tank

Swing Security Gate

Car Entry / Exit

Truck Entry / Exit

Building Setback

Landscape Setback

FORKLIFT BATTERY CHARGING ROOM

Boundary

FNC-2

FNC-3

FNC-1

Estate Road 04

11780 TYP GRID

82717

44000

150

25530

25660

25660

34000

01 DA 09

23925

Estate Road 01

28999

250

7700

Goodman

BRICKWORKS LIMITED

SBA ARCHITECTS

Oakdale South Estate	Sigma Facility - Lot 3A	**Warehouse Plan**	1:500 @ A1 1:1000 @ A3	OAK 3A DA 02 (J)
Horsley Park		0 10 50	30 August 2016	

Site Area Schedule

Total Site Area	**117.11 ha**
Less:	
Non Developable Land	33.46 ha
Easements	4.56 ha
Regional Roads	1.74 ha
Estate Roads	5.70 ha
	45.46 ha
Development Areas	
Precinct 1	18.81 ha
Precinct 2	5.43 ha
Precinct 3	18.94 ha
Precinct 4	14.27 ha
Precinct 5	6.46 ha
Precinct 6	6.84 ha
Amenity Lot	0.58 ha
Total Developable	**71.33 ha**
Total Warehouse	320,902 sqm
Total Office	14,930 sqm
Total Facility	335,832 sqm

OAKDALE WEST
LOT 1
DP 120679

Proposed Western North South Link Road

Proposed Southern Link Road

Tranmission Easement

PRECINCT 6

6A

6B

3D

PRECINCT 3

3C

3B

3A

Transmission Easement

Site Access

Estate Road 04

AMENITY PRECINCT 5800sqm

Proposed E2 Zone Alignment

PRECINCT 5

5A

PRECINCT 4

4A

Estate Road 01

Estate Road 03

2A

PRECINCT 2

2B

1C

PRECINCT 1

1D

Estate Road 02

1A

1B

Future Elevated Regional Road Min 4.5m Clearance at Millner Ave

Approved Millner extension and roundabout refer SSD 6068

Millner Ave

OAKDALE CENTRAL

30m Wide Road Reserve

E2 Zoning Boundary

Current

Proposed

SBA ARCHITECTS

Oakdale South Estate

Horsley Park

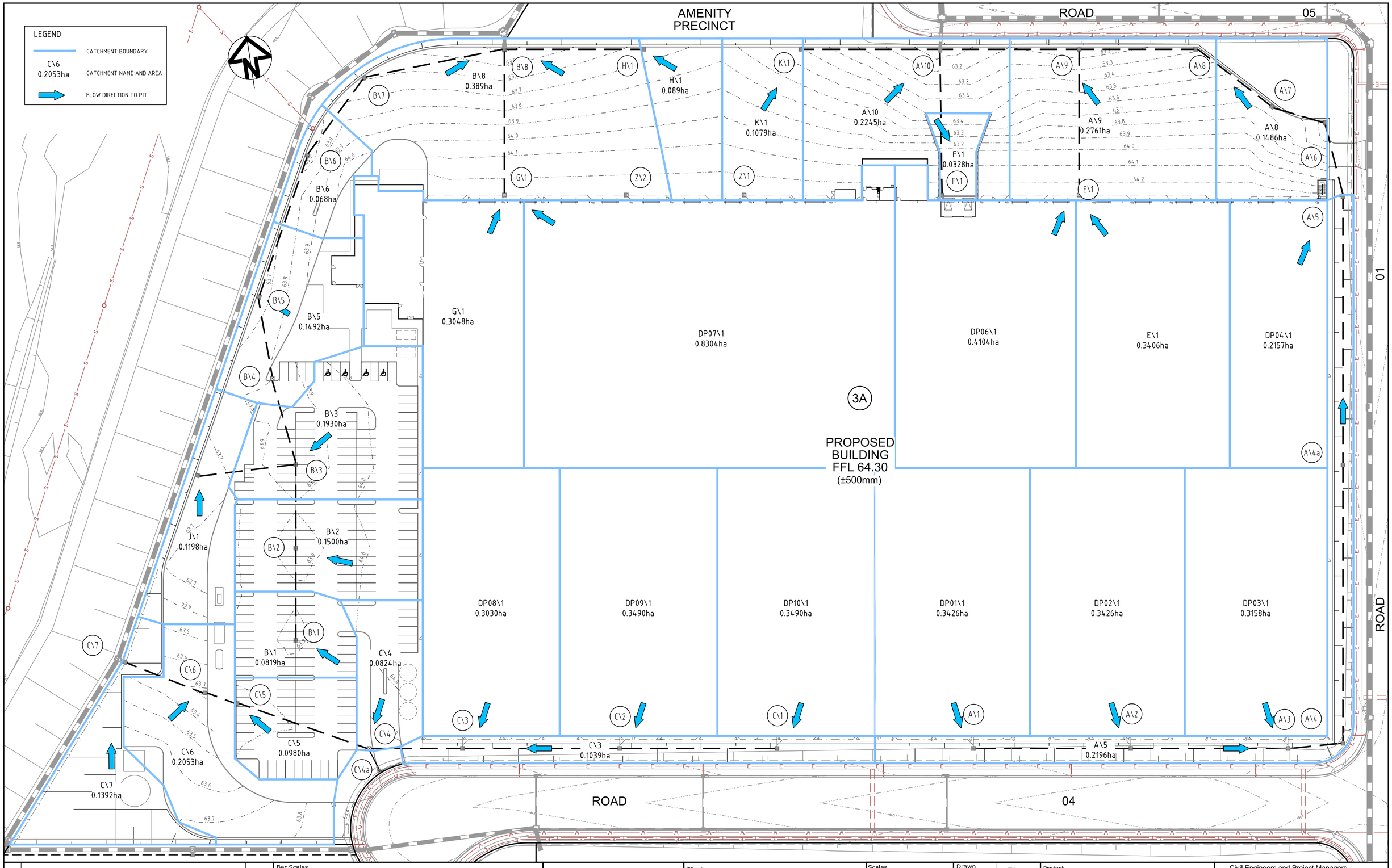
SSDA Masterplan

0 50 250

1:2500 @ A1
1:5000 @ A3

18 July 2016

OAK MP 02 (X)



Issue	Description	Date
C	ISSUED FOR DA APPROVAL	30-08-16
B	ISSUED FOR DA APPROVAL	30-08-16
A	ISSUED FOR DA APPROVAL	18-08-16

100mm on Original

Bar Scales

0 10 20 30 40 50m

1 : 500 @ A1 1 : 1000 @ A3

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Client: Goodman

Scales	1 : 500
Grid	MGA
Height Datum	AHD
Drawn	FX
Designed	FX
Checked	MM
Approved	

Project: OAKDALE SOUTH ESTATE - LOT 3A SIGMA

Title: STORMWATER DRAINAGE CATCHMENT PLAN

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney NSW 2060
ABN 96 130 882 405
Tel: 02 9439 1777
Fax: 02 9923 1055
www.atl.net.au
info@atl.net.au

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Project - Drawing No.: 16-388-DAC026

Issue: C

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Appendix B

AT&L – List of Civil Works & Erosion and Sediment Control Drawings

DRAWING LIST

DWG NO.	DRAWING TITLE
16-379-DAC001	COVER SHEET AND LOCALITY PLAN
16-379-DAC002	GENERAL NOTES
16-379-DAC005	GENERAL ARRANGEMENT PLAN
16-379-DAC006	TYPICAL SECTIONS
16-379-DAC010	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 1
16-379-DAC011	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 2
16-379-DAC012	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 3
16-379-DAC013	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 4
16-379-DAC020	SITEWORKS DETAILS
16-379-DAC025	STORMWATER DRAINAGE DETAILS
16-379-DAC026	STORMWATER DRAINAGE CATCHMENT PLAN
16-379-DAC030	BULK EARTHWORKS CUT/FILL PLAN
16-379-DAC031	PAVEMENT PLAN
16-379-DAC032	EROSION AND SEDIMENTATION CONTROL PLAN
16-379-DAC033	EROSION AND SEDIMENTATION DETAILS

NOTES:

1. FOR EROSION AND SEDIMENTATION CONTROL DETAILS REFER DWG DAC033
2. FOR EROSION AND SEDIMENTATION CONTROL NOTES REFER DWG DAC002
3. ALL SEDIMENT AND EROSION CONTROL MEASURES TO BE IN ACCORDANCE WITH 'MANAGING URBAN STORMWATER, SOIL AND CONSTRUCTION VOLUME 1 (2004) BY LANDCOM.
4. WHERE PRACTICAL ALL PERMANENT BATTERS ARE TO BE TEMPORARILY STABILISED UNTIL COMPLETE WITH JUTE MESH. FINAL LANDSCAPE TO BE SCHEDULED WITHIN 6 WEEKS OF BATTERS BEING FORMED
5. EXISTING BASIN WEST OF LOT 3B TO BE MAINTAINED OVER THE COURSE OF CONSTRUCTION.
6. EXISTING CATCH DRAIN AND SEDIMENT FILTER MEASURES TO BE MAINTAINED DURING CONSTRUCTION.

LEGEND

- SEDIMENT FENCE (SD 6-8)
- CATCH DRAIN
- EXISTING CATCH DRAIN
- BARRIER FENCE
- STRAW BALE FILTER (SD 6-7)
- MESH AND GRAVEL INLET FILTER (SD 6-11)
- GEOTEXTILE INLET (SD 6-12)
- STABILISED SITE ACCESS AND TRUCK WASH DOWN AREA (SD 6-14)
- PROPOSED SITE ACCESS GATE

BASIN C

BIODIVERSITY LOT 1

AMENITY PRECINCT

2A

ROAD 03

ROAD 05

HAYBALE AND GEOTEXTILE SEDIMENT FILTER AT 30m SPACING (TYP.)

PROVIDE MESH AND GRAVEL INLET FILTER (TYP.)

PROVIDE SEDIMENT FENCE (TYP.)

PROVIDE GEOTEXTILE INLET (TYP.)

3A

PROPOSED BUILDING RL 64.3

01

BASIN E

ROAD

EXISTING SEDIMENT BASIN TO BE MAINTAINED DURING EARTHWORKS

HAYBALE AND GEOTEXTILE SEDIMENT FILTER AT 30m SPACING (TYP.)

PROVIDE STABILISED SITE ACCESS AND TRUCK WASH DOWN AREA (TYP.)

PROVIDE SEDIMENT FENCE (TYP.)

PROVIDE GEOTEXTILE INLET (TYP.)

ROAD

PROVIDE MESH AND GRAVEL INLET FILTER (TYP.)

04

Issue	Description	Date
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B	ISSUED FOR DA APPROVAL	30-08-16
A	ISSUED FOR DA APPROVAL	18-08-16

Bar Scales

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1 : 750 @ A1 1 : 1500 @ A3

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Client: Goodman

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Height Datum	AHD
Drawn	FX
Designed	FX
Checked	MM
Approved	

Project: OAKDALE SOUTH ESTATE - LOT 3A SIGMA

Title: EROSION AND SEDIMENTATION CONTROL PLAN

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Status: FOR APPROVAL
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Project - Drawing No.: 16-388-DAC032

Issue: C

100mm on Original

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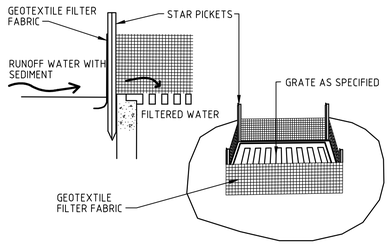
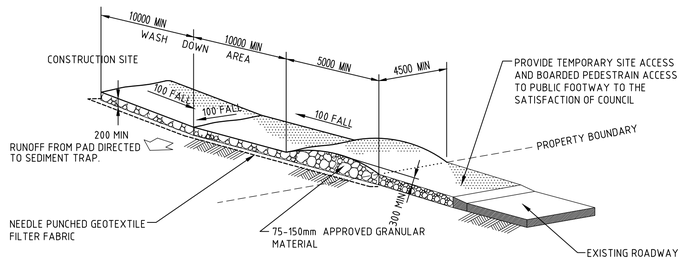


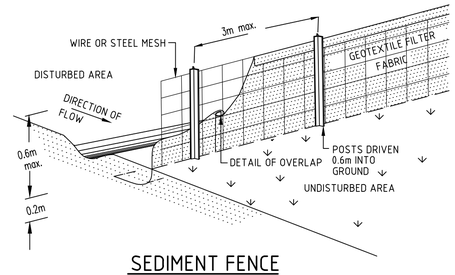
GEOTEXTILE FILTER PIT SURROUND

NTS



STABILISED SITE ACCESS AND TRUCK WASH DOWN AREA

NTS



SEDIMENT FENCE

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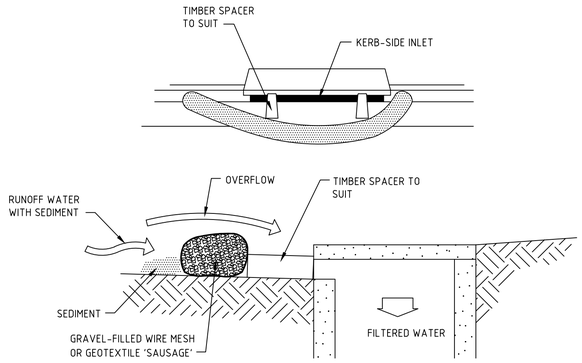
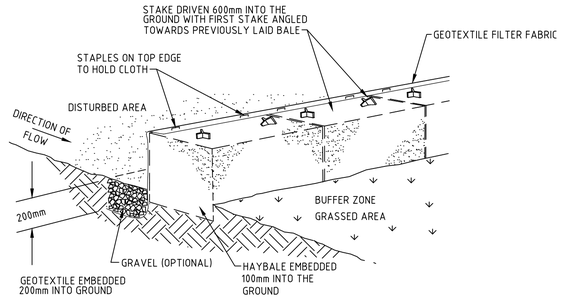


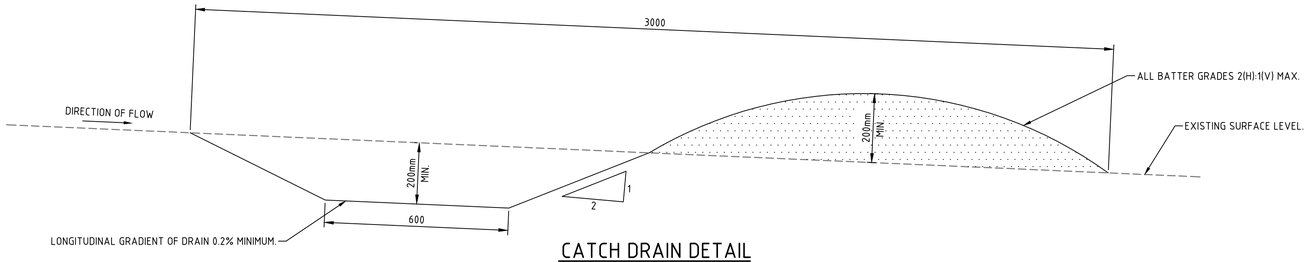
MESH AND GRAVEL INLET FILTER

NTS



HAYBALE AND GEOTEXTILE SEDIMENT FILTER

NTS



CATCH DRAIN DETAIL

SCALE 1:10

Issue	Description	Date
A	ISSUED FOR DA APPROVAL	18-08-16

Bar Scales

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1 : 10 @ A1 1 : 20 @ A3

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Client: Goodman

Scales	AS SHOWN
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Height Datum	AHD
Drawn	FX
Designed	FX
Checked	MM
Approved	

Project: OAKDALE SOUTH ESTATE - LOT 3A SIGMA

Title: EROSION AND SEDIMENTATION DETAILS

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Status: FOR APPROVAL
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A1

Project - Drawing No.: 16-388-DAC033

Issue: A

100mm on Original

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Appendix C

DRAINs Model

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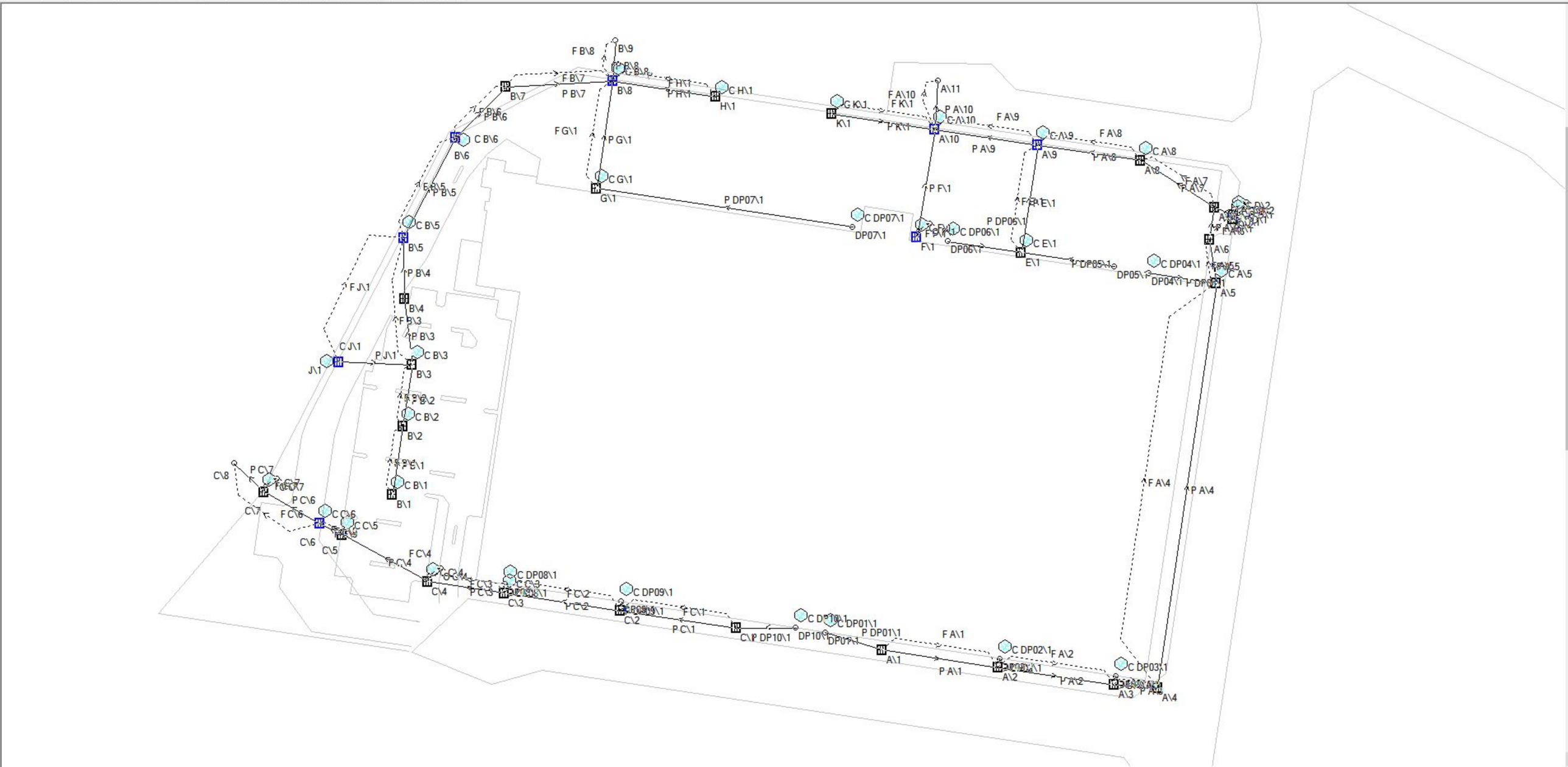
File Edit Project View Draw Run Help



16-07-27-DESIGN CHECK AT.drn - DRAINS

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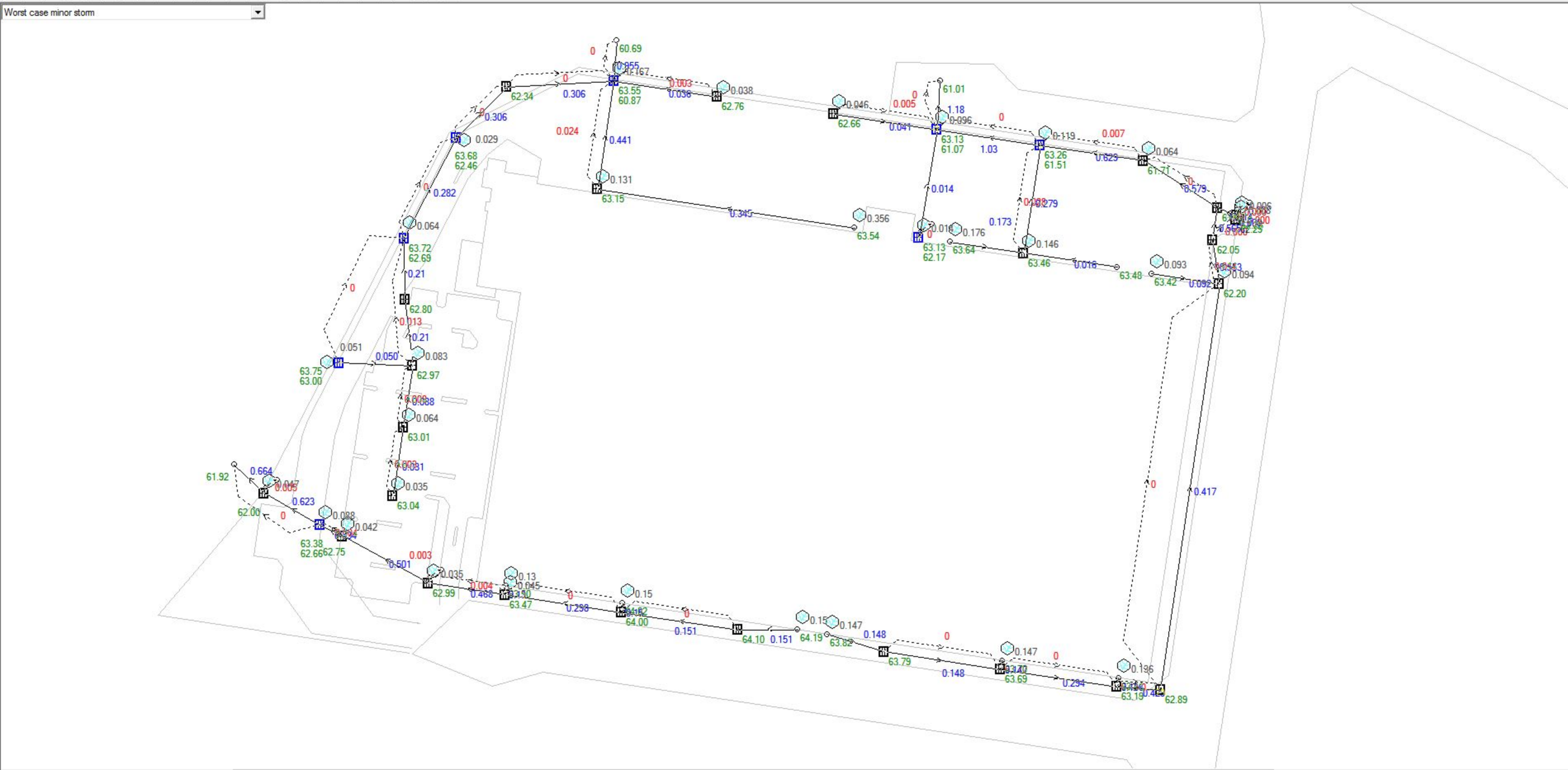
Worst case minor storm



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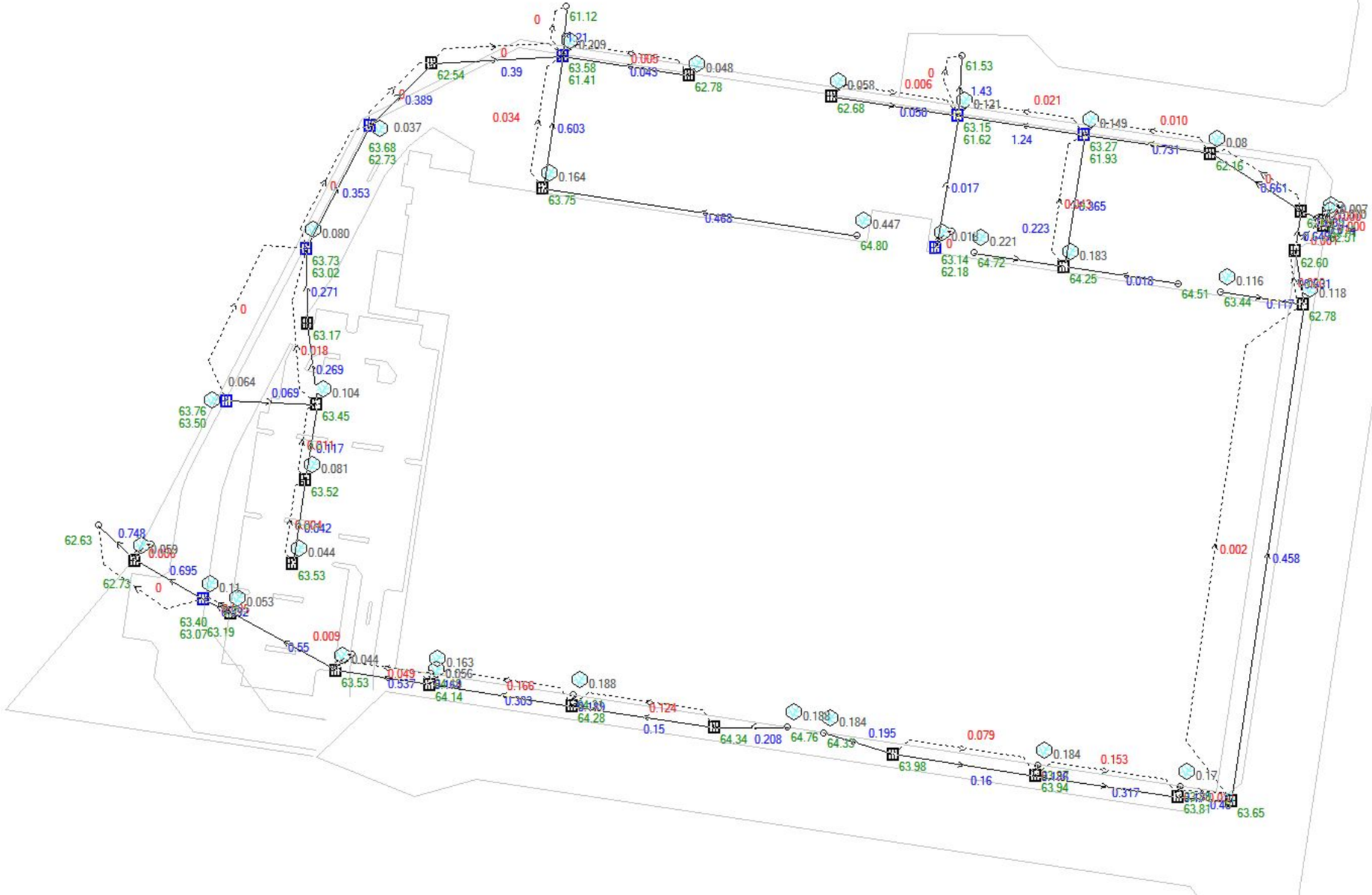
File Edit Project View Draw Run Help

Worst case major storm



Appendix D

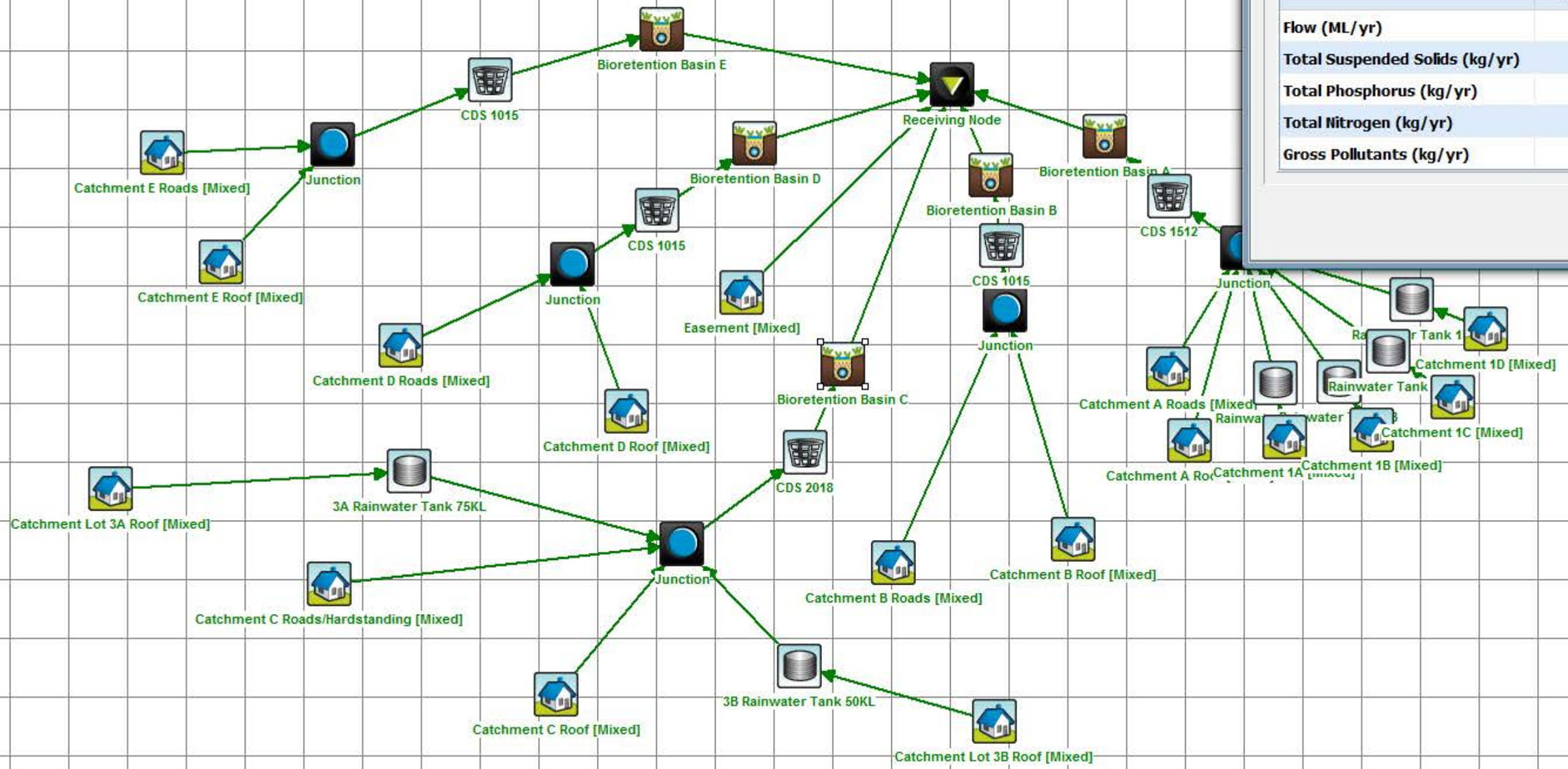
MUSIC Model & Results

MUSIC (6.2.0) - Model for Urban Stormwater Improvement Conceptualisation - [Overall Site 16-08-02 (with additional basin)]

Create Model | Run and Analyse | MUSIC-link | Settings | Help

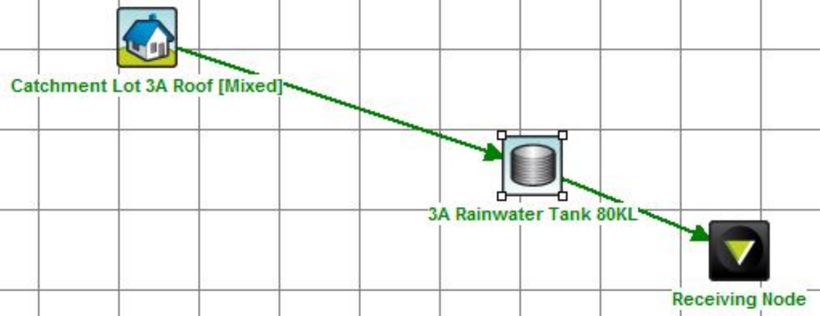
Pan | Zoom | Navigation | Run (F5) | Properties | Edit | Drainage Link: Primary, Secondary | Source Node: Urban | Treatment Node: Wetland | Other Node: Junction | Nodes and Links | Background | Import / Export

Site 16-08-02 (wi...



Treatment Train Effectiveness - Bioretention Basin C

	Sources	Residual Load	% Reduction
Flow (ML/yr)	152	145	4.9
Total Suspended Solids (kg/yr)	26400	3990	84.9
Total Phosphorus (kg/yr)	53.8	18.7	65.3
Total Nitrogen (kg/yr)	347	183	47.4
Gross Pollutants (kg/yr)	4420	4.46	99.9



Node Water Balance - 3A Rainwater Tank 80KL

	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	GP (kg/yr)
Flow In	7.73	200.06	1.17	17.07	226.33
ET Loss	0.00	0.00	0.00	0.00	0.00
Infiltration Loss	0.00	0.00	0.00	0.00	0.00
Low Flow Bypass Out	0.00	0.00	0.00	0.00	0.00
High Flow Bypass Out	0.00	0.00	0.00	0.00	0.00
Pipe Out	1.43	34.94	0.21	3.12	0.00
Weir Out	4.52	111.95	0.68	9.95	0.00
Transfer Function Out	0.00	0.00	0.00	0.00	0.00
Reuse Supplied	1.79	32.15	0.25	3.73	0.00
Reuse Requested	3.44	0.00	0.00	0.00	0.00
% Reuse Demand Met	51.92	0.00	0.00	0.00	0.00
% Load Reduction	23.01	26.58	23.63	23.41	100.00

Decimal Places 2