Oakdale West Development – Kemps Creek

Civil, Stormwater and Infrastructure Services Report

CLIENT/ GOODMAN

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Abbreviations

OWE	Oakdale West Estate
WNSLR	Western North South Link Road
TfNSW	Transport for NSW
OEH	Office of Environment and Heritage
EP	Equivalent Persons
ET	Equivalent Tenancy
IWM	Integrated Water Management
GPS	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
RMS	Roads and Maritime Service
EPLR	Erskine Park Link Road

Executive Summary

Goodman Property Services (Aust) Pty Ltd is developing the Oakdale West site for the purposes of providing a warehouse and distribution complex. The Oakdale West 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.

Purpose of Report:

This report was originally prepared to address the Secretary's Environmental Assessment Requirements (SEARs) for the project relevant to earthworks, stormwater, roadworks and infrastructure servicing. This revision of the report covers the civil, stormwater and infrastructure, revised in response to the Submissions from the Department of Planning and Environment.

The report outlines the proposed components of the design including, Civil Design and Infrastructure, Road geometry and pavement design and Sedimentation and Erosion Control, Stormwater Management (On Site Detention, Piped and Overland Flows, Water Sensitive Urban Design) and Construction.

The Stage 1 SSDA (15_7348) for the OWE seeks approval for:

- A Concept Proposal for the warehouse and distribution estate comprising of 22 building envelopes, including a development master plan, development controls;
- Landscape concept plan and biodiversity offsets;
- Stage 1 Development Application, including:
    - Bulk earthworks across the entire site including retaining wall and acoustic barrier or noise wall construction;
    - Bio-retention and detention basins across the entire site;
    - Staged trunk infrastructure for the site;
    - Staged subdivision of the estate;
    - Landscaping and public domain works;
    - Development comprising the construction and operation of three warehouse and distribution facilities in Precinct 1;
    - Road and Stormwater infrastructure associated with Road No.1, Road No.2, Road No.6 and part Road No.7;
    - A Services lot for a Future Zone Substation serviced lot
    - Western North South Link Road (WNSLR) connecting the site northward to the Erskine Park Link Road including associated bridge works, utilities, stormwater drainage and bio-retention basins; and
    - Lead in services including power communications, potable and waste water.

For Stage 1 Development Application civil infrastructure works extent, refer to civil drawings C0004 and C0005.

Original exhibition for the Oakdale West Estate (OWE) (SSD 7348) commenced 16/11/2017 and ended 20/12/2017. As part of the collation of Authority Submissions, Transport for NSW (TfNSW) advised of the planning proposal to secure a corridor along the Northern boundary of Oakdale West to provision for a potential 40m wide future rail freight corridor. Following this discussion, TfNSW, advised their intent to widen the provisioned corridor a further 20m to allow for a 60m wide future rail freight corridor.

As a result of the abovementioned TfNSW proposed rail freight corridor, amendments have been made to the OWE documentation to accommodate the corridor in the future.

The overall development will be constructed over multiple stages with each construction stage consisting of the construction of the estate roads, bio-retention basin, lead-in services and utility reticulation as required to service each civil stage.

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

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.

The Precinct based bio-retention basins have been designed to both attenuate stormwater flows and treat the nutrients to Penrith City Council treatment rates. The Precinct based Site Detention is designed to mitigate post development flows to pre-developed flows for peak Average Reoccurrence Interval (ARI) events and has 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.

The original post-development Site Catchment plan was separated into six areas (1-6) and the southern and northern WNSLR catchments into two areas (7 and 8), with all areas draining into bio-retention basins. Since the last submission, the following changes have been made:

- The six site catchment areas have been consolidated into four areas
- The Northern WNSLR Catchment drains into the existing Stormwater networks within Lenore Drive. This network ultimately discharges into an existing basin located in Fitzpatrick land within their northern lot.
- The Southern WNSLR Catchment is consolidated within the north-eastern catchment of OWE draining into Basin 1.

This report also identifies the strategy for infrastructure services required to service the site including potable water, waste water (sewer), high, medium and low voltage power, telecommunications and gas. The infrastructure to service this development forms part of an overall strategy for infrastructure to the 'Oakdale' Estate which in most cases requires the infrastructure to be extended into Oakdale West to service the required Precinct area based on the staged construction.

This report also details the proposed estate road and pavement construction methodology along with the typical retaining wall details for both cut and fill construction.

This report, the design drawings and the calculations form the response to the relevant Secretary's Environmental Assessment Requirements with respect to the overall Masterplan and the staged construction works as documented in the Staging Plan shown in Appendix A.

We do finally conclude by recognising the SSD design is at a 60% completion stage and whilst the fundamental design principals and arrangement have been resolved, additional design will be necessary to ready the project for construction. As such, changes to the SDD design documentation are expected although the intent of the SSD design will be consistent with the final design documentation.

Compliance with Secretary's Environmental Assessment Reports (SEARs)

This report responds to the SEAR's issued by the NSW Planning and Environment in November 2015. Table 1 below summaries all key civil / infrastructure issues raised in the SEAR's and how they have been dealt with.

Key Issue	Response
Soils and Water	
A detailed and consolidated site water balance	A Water Balance section has been included in this report. Refer Section 7 for all site water balance details, water supply source, usage calculations and efficiency measures.
Related infrastructure, watercourses, riparian land and measures proposed to reduce and mitigate those impacts	
Describe surface and stormwater management measures designed in accordance with Water Sensitive Urban Design principles, including on-site detention, measures to treat or reuse water, and proposed and uses of potable and non-potable waters	A detailed description of all Stormwater Management including WSUD design principles is included within Section 6 of this report.
Full technical details and data of all surface and groundwater modelling	A detailed description of all surface drainage is included within Section 6 of this report.
Proposed surface and groundwater monitoring activities and methodologies	Refer to Section 3 for all monitoring activities and methodologies.
Description of proposed erosion and sediment controls during construction and operation	A detailed description of the Erosion and Sediment Control measures is included within Section 3 of this report. Note also a full set of Erosion and Sediment Control plans has been provided for implementation at completion of the works. Refer EIS.
Proposed cut and fill works associated with the development, and measures to minimize the extent of cut and fill	Refer to Section 2 of this report and the EIS.
Flooding	
A comprehensive assessment of the impact of flooding on the development for the full range of flood events up to the probable maximum flood. This assessment should address any relevant provisions of the NSW Floodplain Development Manual (2005) including the potential effects of climate change, sea level rise and an increase in rainfall intensity	Refer to Section 8 for Flood Modelling Report which is a summary of an overall site flood report undertaken by Cardno.
Assessment of the impact of the development on flood behavior (ie levels, velocities and duration of flooding) and on adjacent, downstream and upstream areas	Refer to Section 8 for Flood Modelling Report.
Detail proposed flood levels for all proposed habitable structures on the site having considered the full range of flood events up to the probable maximum flood	Refer to Section 8 for Flood Modelling Report.
Detail an emergency response plan for the site, which includes consideration of a floor-free access to or from the development site in extreme flood	Refer to Section 8 for Flood Modelling Report.

events	
Infrastructure Requirements	
A detailed written and/or geographical description of infrastructure required on the site	Refer to Section 9 within this report for a description of all proposed infrastructure services to the site.
Identification of any infrastructure upgrades required off-site to facilitate the development, and describe any arrangements to ensure that the upgrades will be implemented in a timely manner and maintained	Refer to Section 9 within this report
An infrastructure delivery and staging plan, including a description of how infrastructure on and off-site will be coordinated and funded to ensure it is in place prior to the commencement of construction	Refer to Section 9 and Appendix E for infrastructure delivery and staging plan
An assessment of the impacts of the development (construction and operation) on existing infrastructure surrounding the site	Refer to Section 9 and Appendix E for infrastructure delivery and staging plan

Table 1 - SEARS Compliance

Agency Consultation

This report summarises all consultation and correspondence undertaken with the relevant authorities during the design phase. The following table summarises these consultations and the relevant correspondence. It should be noted not all authorities were consulted during the initial design phase.

Agency Consulted	Correspondence
Penrith City Council	• 08.03.16 - Telephone call to Kate Smith (Penrith Council) to discuss OWE proposal. • 08.03.16 & 09.07.13 – Email to Kate Smith suggesting dates to meet to discuss proposal. • 11.03.16 - Kate Smith responses by telephone stating they didn't have availability at the moment for a meeting to discuss OWE and would prefer we email draft plans and summary of the proposal • 21.07.16 – Guy Smith (Goodman) emailed draft plans and summary of OWE proposal to Robert Craig at Penrith Council. Requested confirmation whether a meeting was required or satisfied to review plans and provide comments. • Council confirmed by email 26.07.16 that they will attend a meeting with GPS following lodgment but before exhibition of the proposal. This will allow a run through of any potential issues and their preparation of their Referral response. • A meeting was held on 21.08.18 with DP&E, RMS and PCC in relation to the ultimate ownership of the road. After further consultation with the authorities it was determined that the ultimate ownership of the road would be with Penrith Council. • In addition, it was understood that RMS would not support a signalised intersection at the WSNLR intersections with Lockwood Rd and Estate Road 1. As a result, PCC acknowledged if RMS wouldn't approve signals, roundabouts would be the next best solution.
Fairfield City Council	• Emailed Edward Saulig on 22.07.16 inviting comment / meeting • Emailed again 18.08.16 • Further email seeking response sent 30.08.16 • Email received from Edward Saulig on 30.08.16 confirming: "Andrew Mooney, Strategic Planning Coordinator (9725 0214) is following up on the submitted information and hopes to provide a response before the 2 September deadline"
Blacktown City Council	• Emailed Judith Portelli on 22.07.16 inviting comment / meeting • Judith responded on 22.07.16 seeking dates for meeting to discuss proposal. • Email sent to Judith Portelli, 29.08.16 seeking meeting time to discuss OWE. • Meeting scheduled with Judith Portelli to discuss proposal on 06.09.16.
Sydney Water	AT&L has undertaken extensive consultation with Sydney Water during the development of the OWE SSD proposal. As a result of the ongoing development within the Western Sydney Employment Area (WSEA) Precinct No.8 – Area South of Pipeline, Sydney Water requested that a Local Area Servicing Plan (LASP) for both sewer and potable water infrastructure was prepared to ensure that future Sydney Water infrastructure could ultimately service future developments within the WSEA Precinct No.8 – Area South of Pipeline. The LASP for sewer and potable water (GHD 2016) identifies the servicing strategy for the WSEA Precinct No.8 – Area South of Pipeline. At the request of Sydney Water, GHD were engaged to prepare the LASP for both sewer and potable water. During preparation of these documents, extensive consultation was undertaken with Sydney Water to ensure compliance with Sydney Water's performance requirements for both sewer and potable water. For further details on the LASP for potable water and sewer refer to Section 9.1. and Appendix F.

	AT&L met with Sydney Water (Jim Price) on the 2nd May 2018 to discuss the potential sewer connections to the neighboring school. Following further investigations, it was noted the school could not be sewered into the proposed main by gravity and as such a pump out system was proposed.
Endeavour Energy	Over the past 18 months' numerous meetings have been held with Endeavour Energy (EE) in relation to servicing the proposed development site. Currently EE have indicated that a new Zone Substation will be required to service the development. EE have advised that a new Zone Substation will be provided within Oakdale West in the future. Interim supply to Oakdale South can be made via connection to the Eastern Creek Zone Substation or alternative zone substation. Connection subject to Endeavour Energy detailed requirements. AT&L and Goodman met with Endeavour Energy delivery team on 09.04.2018 regarding the proposed new Zone Substation within Oakdale West Estate. Design / documentation of the proposed Zone Substation is understood to commence by Endeavour Energy post OWE determination.
TransGrid	Meeting Held with Tim Cowdroy of Transgrid and AT&L to discuss both OWE and OSE and the impacts of the development on the existing easements. The meeting was held on the 25.11.15. This was a briefing on what was proposed and Tim indicated at the time he was generally happy with the proposal subject to detailed design. AT&L met with TransGrid (Tim Cowdroy and Michael Platt) on the 21.03.2018 to discuss the proposed amendments to the OWE masterplan as a result of the proposed Transport for NSW rail freight corridor. The key amendment concerning TransGrid was the addition of an On Site Detention basin within the TransGrid easement. Following review, TransGrid confirmed the following in writing: • *As this review is in regard to the onsite detention basis only, please be advised that we have no issue with the proposal and TransGrid's access for maintenance works* • *Proposed detention basin is located around mid-span of 105 – 106, approx. 150m from Str 105 which is compliant as per TransGrid easement guidelines. No concern from Transmission Line & Cable design point of view.*
Transport for NSW	As part of the Response to Submissions, Goodman were informed by TfNSW of the planning proposal to secure a 40m wide corridor along the Northern boundary of Oakdale West to provision for a potential future rail freight corridor. AT&L met with TfNSW and WaterNSW on the 10th April 2018 to discuss the proposed rail freight corridor and the interface with the proposed Western North South Link Road. At the meeting it was agreed by all parties that final bridge design would be developed in consultation with WaterNSW and TfNSW and finally subject to RMS / PCC requirements. During further discussions, TfNSW advised they wish to increase the width of the provisioned 40m wide corridor to 60m.
Water NSW	Prior to OWE exhibition, significant consultation with WaterNSW was undertaken. Responses to WaterNSW's submissions have been provided within the RTS. Post exhibition, AT&L /Goodman have met with WaterNSW on multiple occasions to discuss the maintenance requirements for the Warragamba pipelines within the vicinity of the proposed bridge. AT&L /Goodman have also met with TfNSW and WaterNSW on the 10th April 2018 to discuss the proposed rail freight corridor, the interface with the proposed Western North South Link Road and WaterNSW maintenance requirements for the Warragamba Pipelines. At the meeting it was agreed by all parties that final bridge design would be developed in consultation with WaterNSW and TfNSW and finally subject to RMS / PCC requirements.

Table 2 – Agency Consultation

1 Introduction

This report has been prepared to inform a State Significant Development Application (SSDA) for the staged development of the Oakdale West Estate (OWE).

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

The report responds to the Secretary's Environmental Assessment Requirements (SEARs) as they relate to Civil and Infrastructure, specifically as outlined in the SEAR Compliance Table above.

This report supports an Environmental Impact Statement (EIS) prepared in respect of the proposal and should be read in conjunction with the EIS and development plans submitted with the SSDA.

The Stage 1 SSDA (15_7348) for the OWE seeks approval for:

- A Concept Proposal for the warehouse and distribution estate comprising of 22 building envelopes, including a development master plan, development controls;
- Landscape concept plan and biodiversity offsets;
- Stage 1 Development Application, including:
    - Staged bulk earthworks across the whole site including retaining wall and noise construction;
    - Staged trunk infrastructure for the site;
    - Staged subdivision;
    - Landscaping and public domain works;
    - Development comprising the construction and operation of three warehouse and distribution facilities in Precinct 1;
    - Road and Stormwater infrastructure associated with Road No.1, Road No.2, Road No.6 and part Road No.7;
    - Western North South Link Road (WNSLR); and
    - Lead in services.

For Stage 1 Development Application civil infrastructure works extent, refer to civil drawings C0004 and C0005.

1.1 Scope of Report

Objective of Report

The objective of this civil, stormwater and infrastructure services report is to outline the design criteria used for the Engineering design of all components of the development and compare to the requirements of the Penrith City Council Development Control Plans (DCP).

This report should be read in conjunction with the AT&L Civil Engineering drawings as indicated within Appendix B.

In respect to the WNSLR, and additional design report "15-272-R002 – Western North South Link Road Design Report" should be referred to. While the design report will outline design

parameters in respect the requirements of the RMS Design guidelines, the associated stormwater design forms part of this report.

Summary

This report generally discusses the design philosophy behind the following components of the design for Oakdale West Estate (OWE):

- Earthworks;
- Sedimentation and Erosion Control;
- Retaining Walls;
- Road Design;
- Stormwater Management;
    - On Site Detention (OSD)
    - Piped and Overland Flows
    - Water Sensitive Urban Design (WSUD)
    - Water Balance across the site
- Flood Modelling;
- Servicing;
    - Water
    - Sewerage
    - Communications
    - Gas
    - Electrical
- Infrastructure Staging; and
- Construction
    - Clearing and Grubbing
    - Demolition
    - Earthworks
    - Roadworks and Services
    - Program
    - Plant and Equipment

Supporting documentation that is referenced and commented on within the report include the following sections;

- Flooding (Cardno)
- Geotechnical review (PSM)
- Salinity Management Report (PSM)

The proposed site plan covering the entire Oakdale West development along with all proposed lot layouts are attached within Appendix A.

Figure 1 – Locality Plan

2 Earthworks

2.1 Existing Geology

Based on a Geotechnical Report undertaken by Pells Sullivan Meynink (PSM) in November 2015 the following sub surface soils were encountered across the site:

- Topsoil – CLAY with grass roots Depth 0.0 -0.04m
- Natural Soil – CLAY : Depth 0.04 to 0.5m
- Bedrock – SANDSTONE and SHALE: Depth 0.7 to 5.0m

2.2 Cut/Fill Requirements

The site will require bulk and detail earthworks to be carried out across the various precincts due to the significant elevation changes.

It is noted that following an options analysis process was undertaken which included:

- Either maximising cut to fill and minimising import,
- Multiple smaller earthworks pads and minimising both cut / fill and retaining walls
- Maximising import and minimising cut and retaining walls

Ultimately in reviewing the various options and reviewing the cost benefit of each of the options and then taking into consideration the market availability of surplus fill, it was decided to minimise import and export of spoil from the site and optimise cut to fill across the site. By doing so we have maximised site utilisation creating large flat building pads.

This design limits the height of required retaining to a maximum of 5m for cut walls and maximum of 10m for fill walls (subject to detailed design). Unlike the neighbouring site Oakdale South Estate (OSE), the import has been dramatically reduced as the topography requires significantly more cut than OSE Refer to Drawing C1014 for Bulk Earthworks Cut/Fill Plan within Appendix A.

EARTHWORKS VOLUMES

	A	B	C	D	E = A+B+C+D	F
PRECINCT	EXISTING TOPSOIL STRIPPING VOLUME (cu.m) REFER NOTE No.1	EXCAVATION OF EXISTING CREEKS AND DAMS (cu.m) REFER NOTE No.3	NET CUT (cu.m)	NET FILL (cu.m)	BALANCE (cu.m)	APPROXIMATE VOLUME OF SELECT MATERIAL IMPORT FOR RETAINING WALLS
1	-29,128	-25,591	-427,121	540,767	58,927	7,706
2	-19,315	-13,164	-155,869	856,226	667,878	47,289
3	-29,501	0	-949,380	210,343	-768,538	0
4	-19,582	-14,084	-230,354	735,334	471,314	35,985
5	-4,868	-15,917	-2,891	175,625	151,950	925
SLR	-8,091	-1,362	-106,686	22,258	-93,881	0
WNSLR	-5,707	0	-8,592	22,482	8,183	0
TOTAL	-116,192	-70,118	-1,880,892	2,563,035	495,833	91,905

Table 3 – Cut/Fill Summary

Note these volumes are based on the current design, further detailed design may alter these. – (Negative) balance indicates net cut whilst + (positive) balance indicates import required.

No importation of general fill will be undertaken via Bakers lane. Fill importation will be completed via the WNSLR (once completed) in accordance with a Construction Traffic Management Plan (CTMP) to be prepared and approved by the Secretary prior to commencement of construction.

Any import of material will be classified as either Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) or as specified by in the Geotechnical Engineering Specification for the project.

Topsoil is only proposed to be stripped from cut areas and or areas that have less than 1 metre of filling over. In all other areas, topsoil is to be left in-situ with filling to occur directly over. Where topsoil has been stripped, the topsoil will be blended with the either cut material or imported material and used as general fill.

Prior to commencement of works, it envisaged the entire work zone would sprayed to limit grow back of the grasses within the work zone.

It is not proposed to export any topsoil from the site.

3 Sedimentation and Erosion Control

3.1 Sedimentation and Erosion Control (Construction)

A Soil and Water Management Plan (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.

The key objective of the SWMP are:

- Acknowledging the activities on a construction site which may contribute to erosion, sedimentation and water quality impacts;
- The implementation of industry best management practices to minimise adverse water quality and sedimentation impacts brought about through construction activities on waterbodies surrounding the work; and
- Establishment of processes that effectively manage erosion, sedimentation and water quality practices during the life of the project.

3.1.1 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; and
- Time taken for the rehabilitation / revegetation of disturbed areas.

3.1.2 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; and

- Decrease in waterway capacity leading to increased flood levels and durations;

3.2 RUSLE Analysis

Prior to the design of the SWMP, a Revised Universal Soil Loss Equation (RUSLE) has been undertaken in accordance with the "Blue Book". This analysis has been undertaken to predict the long term, average and annual soil loss from sheet and rill flow from the site under specified management conditions.

Estimating soil loss for a proposed development has four important applications to soil and water management. These are to:

1. Assess the erosion risk at a site;
2. Identify suitable measures to overcome the erosion risk;
3. Estimate the required capacity of sediment retarding basins; and
4. Compare the effectiveness of various erosion control measured.

Refer to Table 4 – RUSLE Analysis

4 below for the RUSLE analysis undertaken for this site.
It should be noted the following parameters/assumptions were used for the analysis of this site:

- Rainfall Erosivity Factor (R) = 2,413.51 from (Equation 2, Appendix A2 Blue Book);
- Soil Erodibility Factor (K) = 0.05 (from Appendix C, Table C19 of Blue Book);
- Slope Length (LS): Is assumed to not exceed 80m immediately before forecast rainfall or during shutdown periods and a maximum grade of 5%;
- Erosion Control Factor (P): Is the ratio of soil loss with a nominated surface condition ploughed up and down the slope (from Appendix A5, Blue Book); and
- Cover Factor (C): Is the ratio of soil loss from land under specified crop or mulch conditions to the corresponding loss from continuously tilled, bare soil. With the proposed ESC measures being installed post bulk earthworks, it is assumed that all soil is recently disturbed, thus a C factor of 1 is chosen.

Parameter	Item (Blue Book Reference)
Rainfall Erosivity Factor, R	2,413.51
Soil Erodibility Factor, K (Table C20, Blue Book)	0.05
Slope Length/Gradient Factor, LS	1.19
Erosion Control Practice Factor, P	1.20
Ground Cover and Management Factor, C	1
Computed Soil Loss (tonnes/ha/year), (A = R x K x LS x P x C)	**172.32**
Soil Loss Class	2 (Table 4.2)

Table 4 – RUSLE Analysis

The erosion hazard potential of the site is considered low, due to the calculated soil loss lying in the range of 151 to 225 tonnes/ha/year as per Table 4.2 of the Blue Book.

Table 4.2 The Soil Loss Classes (adapted from Morse and Rosewell, 1996)

Soil Loss Class	Calculated soil loss (tonnes/ha/yr)	Erosion hazard
1	0 to 150	very low
2	151 to 225	low
3	226 to 350	low-moderate
4	351 to 500	moderate
5	501 to 750	high
6	751 to 1,500	very high
7	>1,500	extremely high

Figure 2 – Table 4.2 from the Blue Book

3.3 Soil and Water Management Plan

3.3.1 Overall Strategy

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;
- Rapid stabilisation of disturbed and exposed ground surfaces with hydro-seeding areas where future construction and building works are not currently proposed;
- All temporary sediment basins will be located clear of the 100yr ARI flood extent from Ropes Creek and all associated tributaries;
- The weir levels of temporary sediment basins will be located above the 100yr ARI flood event levels from Ropes Creek and tributaries; and
- Bio-retention basins are to be utilised as temporary sediment control basins. The bio-retention basins shall not be converted into the final/ultimate basins until such time as all building and construction works within the relevant stage has been completed and 90% of the site is stabilised.

Refer to AT&L Drawings C1090-1096 for Erosion and Sediment Control Plans, for all proposed control and protection measures across the site until completion of on lot works.

Suitable erosion and sediment controls shall be designed, provided and maintained by the contractor throughout all stages of works, including at completion of the bulk earthworks where shown on AT&L drawings or where directed by the Superintendent or Penrith City Council's engineers.

Such controls shall be in accordance with the relevant requirements in the latest version of the managing urban stormwater: soils and construction guideline (landcom).

3.3.2 Design of Sediment and Erosion Control Measures

Suitable erosion and sediment controls shall be provided by the Contractor and maintained throughout all stages of works, including at completion of the bulk earthworks.

All design, documentation, installation and maintenance of sediment and erosion controls will be in accordance with the requirements of:

- Protection of the Environment Operations Act;
- Penrith City Council's specifications; and
- Office of Environment and Heritage's 'Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) (The "Blue Book") Volume 1 and Volume 2.

Ultimately, the final temporary sediment basin locations and sizes will be provided to suit development staging requirements and will be sized and maintained in accordance with the requirements of the above-mentioned authority documents.

With the proposed site being larger than 2,500m^2 in disturbed area, sediment basins are required. The following temporary sediment basins are to be in-place at the commencement of demolition works. Refer to drawings in Appendix B and 'Earth Basin Wet' SD6-4 for details, and Table 6 below for basin sizes.

Parameter	**Item (Blue Book Reference)**
Soil Type	Type F (Appendix C, Table C19, Blue Book)
Design Rainfall Depth (Days)	5
Design Rainfall Depth (Percentile)	85
x-day, y-percentile rainfall event	35.00 (Table 6.3a)
Rainfall Intensity: 2-year, 6-hour storm	10.10
Rainfall Erosivity (R-factor)	**2,413.51**

Table 5 – Site Data

Parameter	Basin 1	Basin 1A	Basin 1B	Basin 1C	Basin 2A	Basin 2B	Basin 2E	Basin 3a+3b	Basin 3B	Basin 3D
Volumetric Runoff Coefficient, C_v	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Contributing Area, A (ha)	26.23	3.9	3.8	13.7	4.1	5.1	10.9	43.5	10.4	8.1
$R_{(85\ \%ile,\ 5\ day)}$	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Settling Zone Volume, (m^3)	4,590	678	672	2,399	712	894	1,900	7,613	1,821	1,416
Sediment Storage Zone Volume, (m^3)	2,295	339	336	1,199	356	447	950	3,806	910	708
Total Sediment Basin Volume, (m^3)	**6,885**	**3,969**	**1,008**	**3,598**	**1,067**	**1,340**	**2,851**	**11,419**	**2,731**	**2,125**
Parameter	**Basin 4A**	**Basin 4B**	**Basin 4E**	**Basin 5**	**Basin 5A**	**Basin Rd 3**	**Basin SLR A**	**Basin SLR B**	**Basin SLR C**	**Basin Rd 7**
Volumetric Runoff Coefficient, Cv	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Contributing Area, A (ha)	4.9	3.0	5.8	25.72	6.7	2.7	0.6	1.3	2.9	0.7
$R_{(85\ \%ile,\ 5\ day)}$	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Settling Zone Volume, (m3)	849	520	1,010	4,501	1,175	469	112	219	516	121
Sediment Storage Zone Volume, (m3)	424	260	505	2,251	588	235	56	109	258	61
Total Sediment Basin Volume, (m3)	**1,273**	**780**	**1,515**	**6,752**	**1,763**	**704**	**169**	**328**	**774**	**182**

Table 6 – Precinct Temporary Sediment Basins

3.4 Site Inspection and Maintenance

The inspection and maintenance requirements outlined in this section must be carried out while either earthworks or quarrying is being conducted, and all areas re-established.

The Contractor will be required to 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 affect 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.
- Inspect the sediment basin during the following periods:
    - During construction to determine whether machinery, falling trees, or construction activity has damaged and components of the sediment basin. If damage has occurred, repair it;
    - After each runoff event, inspect the erosion damage at flow entry and exit points. If damage has occurred, make the necessary repairs;
    - At least weekly during the nominated wet season (if any), otherwise at least fortnightly; and
    - Prior to, and immediately after, periods of 'stop work' or site shutdown.
- Clean out accumulated sediment when it reaches the marker board/post, and restore the original volume. Place sediment in a disposal area or, if appropriate, mix with dry soil on the site;
- Do not dispose of sediment in a manner that will create an erosion or pollution hazard;
- Check all visible pipe connections for leaks, and repair as necessary;
- Check all embankments for excessive settlement, slumping of the slopes or piping between the conduit and the embankment, make all necessary repairs;
- Remove the trash and other debris from the basin and riser; and
- Submerged inflow pipes must be inspected and de-silted (as required) after each inflow event.

3.4.1 Sediment Basin Maintenance

As stated in Section 3.3.2 above, the proposed development site contains 'Type F' soils, or soils that contain a significant proportion of fine grained (33% or more finer than 0.02mm) and require a much longer residence time to settle.

Stormwater within the settling zone should be drained or pumped out within 5 days (design time), if the nominated water quality targets can be met, to the satisfaction of the superintendent. Flocculation should be employed where extended settling is likely to fail to meet the objectives within the 5-day time period.

Flocculation is when flocculating agents are applied to the sediment basins causing the colloidal particles to clump into larger units or 'floc' that can either settle in a reasonable time or be filtered.

Refer to Appendix E4 of the Blue Book for flocculation methodologies and manufacturer's instructions for application rates, regarding the proposed sediment basins.

3.5 Conclusion

The erosion control measures proposed for the site will comply with the requirements of Penrith City Council Engineering Guidelines 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.

4 Retaining Walls

4.1 Retaining Walls

Where possible, batter slopes will be provided to accommodate level changes. Where this is not possible retaining walls will be constructed along the estate road, lots and basins based on the current civil and earthworks design. An Austral product or other similar face block will be adopted for all retaining walls as detailed on the civil drawings.

The proposed retaining walls will be built to the manufacturers design guideline requirements and verified by a structural engineer prior to construction. This practice was adopted on Oakdale Central and South and considered input from the geotechnical engineer, utility coordination as well as entry and exit points from proposed lots.

Retaining is required along the southern boundary where it is required to cut down from existing to create new building pads. Refer to Drawing C1070 for cut wall locations. Retaining walls will be designed and constructed using standard industry practises.

All retaining walls will be constructed on a staged basis and as required to suit the development earthworks and stormwater basin works. Where the walls are not constructed a batter of 1 in 4 will be maintained for stability purposes. Any batter steeper than 1 in 5 shall be vegetated.

All retaining walls will be located within private property and not within the road reserve areas, unless within the basins or adjacent to the basins.

All retaining walls will have pedestrian and vehicular safety barriers in accordance with Austroads Guidelines as required.

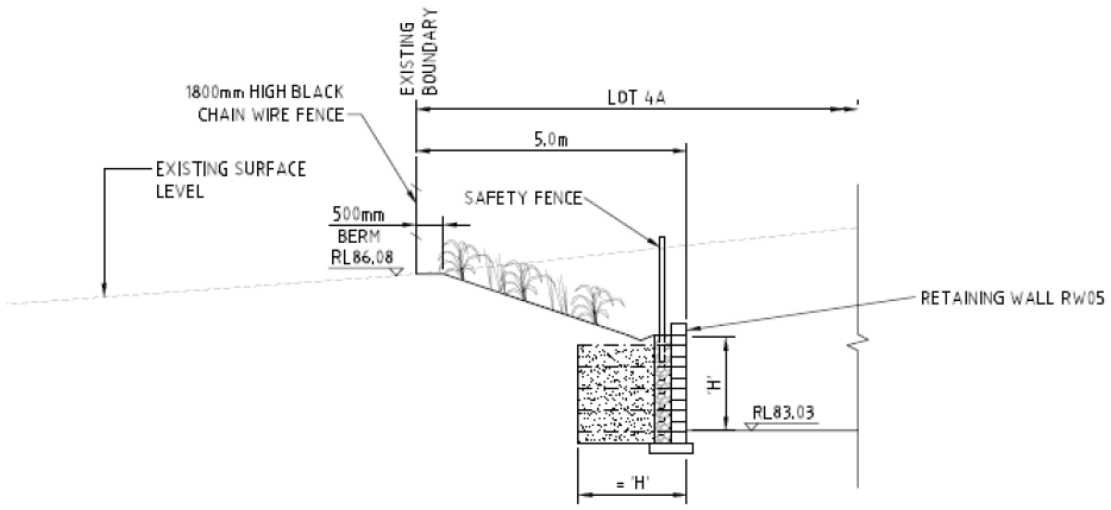


Figure 3 – Typical Section through Retaining Wall – Southern Boundary

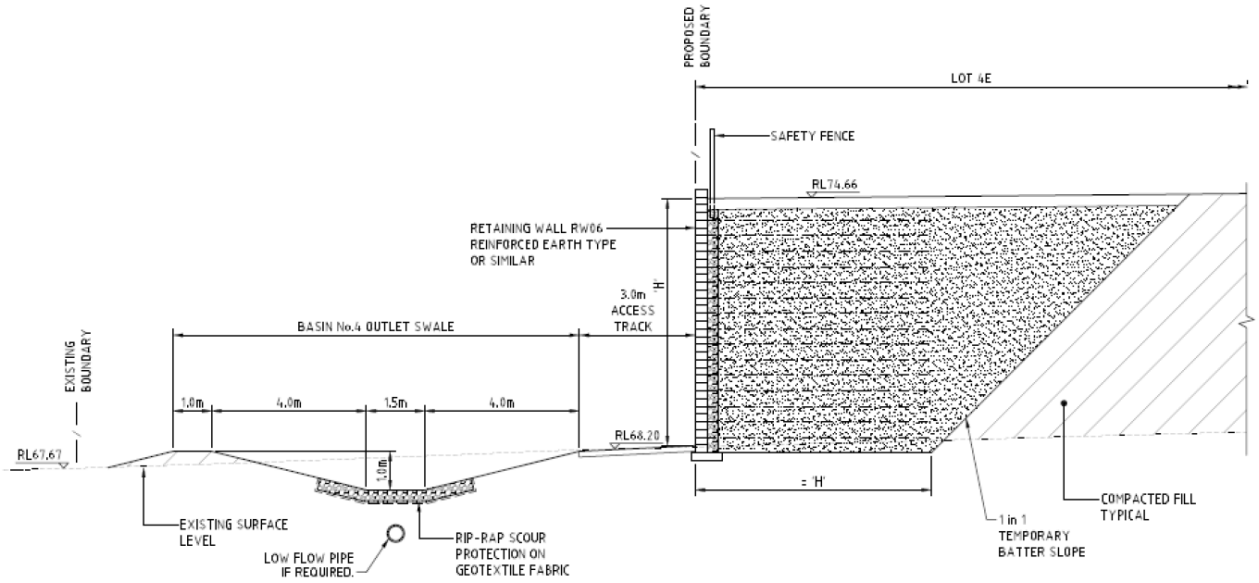


Figure 4 – Typical Section through Retaining Wall – Southern Boundary

5 Road Design

5.1 Horizontal and Vertical Geometry

The Estate Roads within Oakdale West Estate have generally been designed to meet Austroads requirements and Australian Standards to accommodate B-Double truck movements where possible.

The estate roads will connect into the proposed Future Southern Link Road which runs through the middle of the site and WNSLR in the north east corner of the site adjacent the WaterNSW Pipeline. In the north east corner of OWE the WNSLR will cross over the WaterNSW Pipeline via a proposed bridge and connect into the EPLR approximately 1km to the north.

See drawings within Appendix A for proposed Estate Road layout along with connections into Southern Link Road and WNSLR.

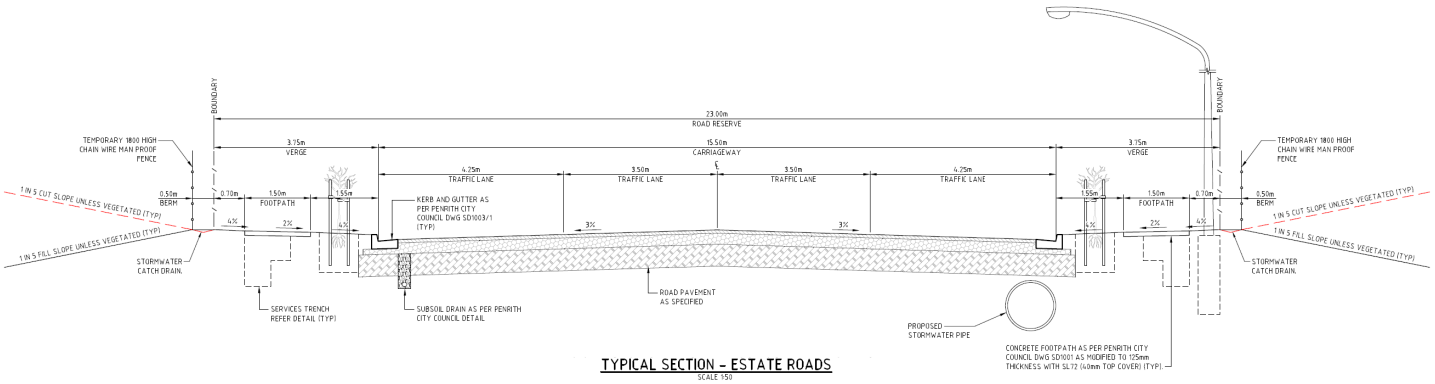
The proposed road reserve as described below does not conform to Penrith City Council's standard road reserves which requires a minimum 20.6m road reserve. This greater road reserve width has been adopted as it was used on the adjacent Oakdale Central and South development. To ensure consistency between the three developments the Oakdale Central road reserve alignment has been adopted for the design base for the OWE.

For details on the WNSLR refer the design report.

The Estate Road is designed as such:

- 23.0m wide Road Reserve
- 15.5m wide Carriageway comprising:
  - 2x 3.5m wide traffic lanes
  - 2x 4.25m wide traffic lanes adjacent kerb
- Verge 3.75m wide
- Cul-De-Sac have been shown at 30m Diameter to accommodate the largest design vehicle
- The largest design vehicle is a B-Double
- Design Speed of Road = 60km/hr
- No guard fences have been shown and these will be assessed at detailed design stage in accordance with Austroads.

Refer to Figure 5 indicating typical road section.



TYPICAL SECTION - ESTATE ROADS
SCALE 1:50

Figure 5 – Typical Estate Road Section for Roads No. 1 and No.2

5.2 Pavement

Pavement will be designed based on the requirements of Austroads Pavement Design Guide – A Guide to the Structural Design of Road Pavements and recommendations provided by Pells Sullivan Meynink (PSM) in report PSM1541-127L dated November 2015.

The basis of this design is:

- Design Traffic Loading: N =1x107 ESA
- Design subgrade CBR = 2% with a reduction if the subgrade is CBR 5%

Based on these parameters the pavement design is as follows:

- 70mm AC 14 320 Bitumen
- 7mm Spray Seal
- 250mm DGB 20 (placed in two layers)
- 500mm Select Sandstone Fill with minimum CBR= 35% (placed in three layers)

If the subgrade CBR = 5% the bottom 200mm of select sandstone fill can be replaced with select fill with minimum CBR of 5%.

CBR testing is proposed to the undertaken at the subgrade level to confirm this pavement design.

Polymer modified asphalt will be used within all cu-de-sacs.

5.3 Batter Design

Any batter's steeper than 1 in 5 will be vegetated and all external batters to the development have been limited to 1 in 4 as a minimum generally, with the maximum being 1 in 3.

Any temporary batters constructed during the works will be in accordance with the geotechnical report and ongoing advice from the Level 1 supervisor.

5.4 Conclusion

All road design as demonstrated above is in accordance with Austroads Standards and the requirements of Penrith City Council, as a minimum.

A professional geotechnical engineer will be engaged to design the structural pavement. This is also in accordance with Austroads Pavement Design Guide – A Guide to Structural Design of Road Pavements.

6 Stormwater Management

6.1 Existing Site Stormwater Drainage

Currently the site comprises rural land and is classified as a “greenfield” site with an entire coverage of pervious areas and farm dams.

The topography of the site is such that there is a ridge line running roughly north-south through the site. This ridge line is highlighted in Drawing C1068 in Appendix A. Existing overland flows generated to the east of the ridge line flows into farm dams and Ropes Creek to the east of OWE. Overland flows generated to the west of the ridge line flow into farm dams on the western and north west boundaries of the site and ultimately drain into existing creeks at the western boundary of OWE. These flows discharge into existing creeks north of Emmaus Catholic College and the Catholic Healthcare west of OWE.

Refer to Drawing C1068 within Appendix A for a pre-development stormwater catchment plan indicating the location of these catchments.

There are seven existing catchments draining the site via Discharge Points:

- Catchment 1 – area of 11.9 Ha draining to east into Ropes Creek via Discharge Point A;
- Catchment 2 – area of 28.36 Ha draining to north west adjacent WATERNSW pipeline via Discharge Point B.;
- Catchment 3 – area of 24.52 Ha draining to the west into existing dams and then over flowing into South Creek via Discharge Point C;
- Catchment 4 – area of 11.90 Ha draining to the south east of the site via Discharge Point D;
- Catchment 5 – area of 7.60 Ha draining to the east into an existing dam and then over flowing into Ropes Creek via Discharge Point E;
- Catchment 6 – area of 28.97 Ha draining to the east into Ropes Creek via Discharge Point F; and
- Catchment 7 – area of 3.21 Ha draining to south west corner of the site via Discharge Point H.

6.2 Proposed Site Stormwater Drainage

As discussed in Section 2.2 of this report, due to the existing steep grades across the site extensive cutting and filling is required to ensure level pads are created for proposed roads and on lot building pads.

The main objective for the stormwater drainage design of the proposed development is to ensure post-developed catchment flows do not exceed the pre-developed catchment flows. With OSD systems (described in Section 6.3.5) in place to limit discharges to pre-developed rates, this will ensure the downstream catchments will not be inundated with flows and cause adverse flooding affects downstream of the development. This is in accordance with the Penrith City Council Engineering guidelines.

Refer to Section 6.3.4 for a full description of each proposed catchment.

All stormwater on the lots and within the road reserve is proposed to be collected via pits and pipes and connect into On-Site Detention basins. All basins will have an outlet structure and overflow weir system to drain into the adjacent Ropes Creek to the east or the western creek

system eventuating into South Creek. Scour protection will be provided on these outlet structures to minimise the effects of scour and erosion on the existing creek systems.

Refer to the Civil Drawings for layout and details for the proposed stormwater network across the site.

6.3 Council Requirements & Recommendations

All estate level stormwater drainage for the OWE 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; and
- C3 Water Management DCP.

A summary of the design requirements adopted is listed below:

- Precinct based basins will serve the development as detention and bioretention basins (excluding Basins 1 and 2, which are not combined detention and bioretention basins);
- Penrith City Council have advised that they will not accept ownership of the detention and bioretention basins, nonetheless the design of these elements will generally comply with PCC standards.
- All drainage in the road reserves of roads dedicated to PCC will be to PCC requirements.
- Maintenance and repair works of the stormwater drainage network outside of the lot will be the responsibility of Goodman as PCC with not accept ownership.
- All stormwater drainage within the lots will be the responsibility of the individual property owners.
- OSD is to be sized to ensure that for all rainwater events up to and including the 1:100 ARI event, that new developments do not increase stormwater peak flows in any downstream areas;
- OSD is to mitigate post development flows to pre-developed flows for peak Average Reoccurrence Interval (ARI) events.
- All OSD basins have been designed with a 3.0m wide sprayed seal access road along the berm to ensure maintenance vehicles can access the entire exterior of the 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) of proposed buildings within the precinct (separate approval) to have minimum 500mm freeboard to 100 year overland flows; and
- A gross pollutant trap (GPT) will be installed within each development lot on the final downstream stormwater pit prior to discharging. As these GPT's will be located on-lot as they 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 to meet 80% of non-potable demand for irrigation and toilet flushing. Refer to Section 7 of this report for a more detailed description on rainwater harvest tanks.

6.3.1 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 and precinct. For a detailed description of the MUSIC modelling refer to Section 6.3.7 of this report. MUSIC data files and output results are attached in Appendix D.

6.3.2 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 upgraded 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; and
- Blockage factors of 20% and 50% shall be adopted for pits on grade and at sags respectively, with these blockage factors in-built to each pit within the DRAINs model.

6.3.3 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 7 – 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 for the minor storm event;
- Overland flowpaths shall maintain a minimum of 300mm freeboard to all habitable floor levels; and
- Pits deeper than 1.2m shall contain step irons at 300 mm centres.

6.3.4 Catchments

A Stormwater Catchment Plan for each Catchment and flow paths into the bio-retention basins are shown in Appendix A. As indicated in the Catchment Plan each of the basins are bio-retention basins designed to both attenuate stormwater flows and treat the nutrients to Penrith City Council treatment rates (excluding Basin 1 and 2 which is an OSD and bioretention basin respectively and not a combined system). These treatment rates are from the Penrith City Council C3 Water Management DCP.

A summary of each catchment and the outflow and overflow locations are described below:

Catchment 1

- Total Area = 27.77Ha;
  - Includes: Lot 1A, 1B and 1C. Road No. 1 and southern portion of WNSL Road
- Flow path to east of catchment into Basin 1; and
- Outlet and overland flow from Basin 1 drain to east into Ropes Creek via Discharge Point A.

Catchment 3a

- Total Area = 9.15Ha;
  - Includes: Lots 2A and 2B. Road No 4.
- Flow path to west of catchment into Basin 3b; and
- Outlet and overland flow from Basin 3b:
  - Outlet is drain to west into the existing creek north of Emmaus Catholic College via Discharge Point C.

Catchment 3b

- Total Area = 33.78Ha;
    - Includes: Lots 2E, 2F, 2G, 2H, 2J, 3A, 3B, 3C and 3D. Road No 3 and Road No 5
- Flow path to west of catchment into Basin 3a; and
- Outlet and overland flow from Basin 3a:
    - Outlet is to drain to the north-west into the existing drainage infrastructure through the existing Water NSW Pipeline via Discharge Point B.

Catchment 5

- Total Area = 26.96Ha;
    - Includes: Lots 4A, 4B, 4C, 4D, 4F+G and Service Lot. Road No 6 and Road No 7.
- Flow path to north-east of catchment into Basin 5; and
- Outlet and overland flow from Basin 5 drains to east into Ropes Creek to the east, via Discharge Point E.

Catchment 6

- Total Area = 7.24Ha;
    - Includes: Lot 5A and Road No 8
- Over flow path to east of catchment into Basin 6; and
- Outlet and overland flow from Basin 6 drains to east into Ropes Creek to the east, via Discharge Point F.

6.3.5 On-Site Detention (OSD)

As discussed in Section 6.1, OSD is required within the development to mitigate post developed.

As discussed in Section 6.1, OSD is required within the development to mitigate post developed flows to pre-developed flow rates for peak Average Recurrence Intervals (ARIs).

Catchments Discharge Points

As discussed within Section 6.2 of this report, the main objective of the stormwater management of the proposed development is to ensure post-developed catchment flows do not exceed pre-developed catchment flows for all storms from the 1 to 100 year ARI event for all existing catchments.

In order to ensure these post-developed flows do not exceed the pre-developed flows it is important to look at the existing catchments and compare the outflows.

Comparing Drawings C1068 and C1069 and reviewing Table 5 below, indicates the pre and post-developed catchment areas do not match. This is due to creation of flat pads, retaining walls and associated roads and having to create formal drainage system to suit the proposed layout.

Whilst these areas do not match, it is important to ensure post developed flows, at the existing stormwater outlets indicated in drawing C0168, do not exceed the pre-developed flows. For simplicity the outlet points for the pre-developed flows are indicated as outlets from A to H within Drawing C1069.

Table 8 indicates the pre-development catchment areas flowing to these outlet points with a post developed catchment area draining to these same points in comparison.

Outlet Flow Point	Pre-Developed Catchment Area to Outlet Point (ha)	Associated Basins	Post-Developed Catchment Area to Outlet Point (ha)
A	11.90	1	27.77
B	26.77	3a	9.15
C	24.52	3b	33.78
E	7.60	5	26.96
F	28.97	6	7.24

Table 8 – Outlet Flow Points

To reduce the post-developed flow rates at each of these discharge points to pre-developed flow rates bio-retention/OSD basins with controlled outlet structures within are proposed.

A summary of the OSD requirements for each discharge point and associated pre-develop catchment area are as below:

Discharge Point A

All stormwater runoff into Discharge Point A will comprise outflows from Basin 1 in the post developed case. Refer to Drawing C1069. Refer Table 9 for flow rates for pre and post developed rates to Discharge Point A.

The OSD within Basin 1 has been designed to achieve the following outcomes:

- OSD volume of 14,265m^3 (capacity of the basin from extended detention RL 57.8 to weir of basin RL 60.4)

Duration	Pre-Developed Flows (m^3/s)	Post Developed Flows (m^3/s)
1-Year ARI	0.305	0.265
2-Year ARI	0.944	0.29
5-Year ARI	1.86	0.774
10-Year ARI	2.19	1.21
20-Year ARI	2.62	2.06
100-Year ARI	3.41	3.33

Table 9 – Pre-Post Development Flows to Discharge Point A

Discharge Point B

All stormwater runoff into Discharge Point B will comprise outflows from Basin No 3a in the post developed case, refer to Drawing C1069. These are compared to pre-developed rates for all storm events up to the 100-year ARI event. Refer Table 10 for flow rates.

The OSD within the basin has been designed to achieve the following outcomes:

- OSD Basin no 3a volume of 2,622m^3 (capacity of the basin from extended detention RL 58.00 to Top Water Level of basin RL 59.65)

Duration	Pre-Developed Flows (m^3/s)	Post Developed Flows (m^3/s)
1-Year ARI	0.756	0.75
2-Year ARI	2.34	0.799
5-Year ARI	4.60	1.18
10-Year ARI	5.42	1.56
20-Year ARI	6.49	1.99
100-Year ARI	8.45	2.74

Table 10 – Pre-Post Developed Flows to Discharge Point B

Discharge Point C

All stormwater runoff into Discharge Point C will comprise outflows from Basin No 3b in the post developed case. Refer to Drawing C1069. Refer Table 11 for flow rates for pre and post developed rates to Discharge Point C.

The OSD within the basin has been designed to achieve the following outcomes:

- OSD volume of 11,503m^3 (capacity of the basin from extended detention RL 58.00 to weir of basin RL 59.60)

Duration	Pre-Developed Flows (m^3/s)	Post Developed Flows (m^3/s)
1-Year ARI	0.653	0.653
2-Year ARI	2.02	0.697
5-Year ARI	3.97	1.94
10-Year ARI	4.68	2.75
20-Year ARI	5.61	3.87
100-Year ARI	7.30	6.87

Table 11 – Pre-Post Developed Flows to Discharge Point C

Discharge Point E

All stormwater runoff into Discharge Point E will comprise outflows from Basin No 5 in the post developed case. Refer to Drawing C1069 for details. Refer to Table 13 for flow rates for pre and post developed rates to Discharge Point E.

The OSD within the basin has been designed to achieve the following outcomes:

- OSD volume of 14,428m^3 (capacity of the basin from extended detention RL 60.3 to weir of basin RL 62.70.)

Duration	Pre-Developed Flows (m^3/s)	Post Developed Flows (m^3/s)
1-Year ARI	0.203	0.199
2-Year ARI	0.626	0.613
5-Year ARI	1.23	1.19
10-Year ARI	1.45	1.43
20-Year ARI	1.74	1.74
100-Year ARI	2.26	2.23

Table 12 – Pre-Post Developed Flows to Discharge Point E

Discharge Point F

All stormwater runoff into Discharge Point F will comprise outflows from Basin No 6 in the post developed case. Refer to Drawing C1069 for details. Refer to Table 14 for flow rates for pre and post developed rates to Discharge Point F.

The OSD within the basin has been designed to achieve the following outcomes:

- OSD volume of 2,746m^3 (capacity of the basin from extended detention RL 56.30 to weir of basin RL 57.50)

Duration	Pre-Developed Flows (m^3/s)	Post Developed Flows (m^3/s)
1-Year ARI	0.773	0.134
2-Year ARI	2.39	0.225
5-Year ARI	4.70	0.441
10-Year ARI	2.26	0.629
20-Year ARI	6.63	0.880
100-Year ARI	8.63	0.931

Table 13 – Pre-Post Developed Flows to Discharge Point F

Discharge Point H

Due to site regrading and the construction of flat pads and stormwater infrastructure, no stormwater from the post developed site will discharge via Discharge Point H. The post developed catchment which previously discharged into Discharge Point H will be diverted to drain via Basins 3a and 3b and out of the site at respective Discharge Points, B and C.

6.3.6 Overland Flows

Overland flows within the access roads, carparks and hardstanding areas have been designed to be safely conveyed within the road carriageway to comply with flow widths and velocities within the Penrith City Council Design Guidelines for Engineering Works.

The 100-year ARI flood level determined by Cardno within Ropes Creek adjacent to the proposed basins have been adopted as the tailwater levels for the hydraulic modelling of the basin and stormwater network for all catchments.

6.3.7 Water Sensitive Urban Design (WSUD)

Water Sensitive Urban Design (WSUD) 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.

The WSUD strategy, MUSIC Model and subsequent WSUD designs prepared by AT & L are based upon requirements within the Penrith City Council C3 Water Management DCP.

All stormwater runoff from catchments 1, 3, 4, 5 and 6 as mentioned in Section 6.3.4 is proposed to drain into Bio-Retention basins for the water to be treated and discharged at rates acceptable to Penrith City Council. A summary of the Basin parameters is provided within Table 13 and details and cross sections are included on the 1000 series Civil drawings.

Discharge from the basins will be controlled via a rock lined swale that will intersect with the existing stormwater and creek systems surrounding the site. These discharge swales will be design and documented to meet the OoW Guidelines for outlet structures on waterfront land.

Refer to attached Civil Drawings list in Appendix B.

6.3.7.1 WSUD Modelling – MUSIC Model

The MUSIC Model for Urban Stormwater Improvement Conceptualisation (MUSIC, Version 6.3.0) was used to evaluate pollutant loads from each of the proposed lots for Post-development (treated) conditions based on the proposed site development.

A conceptual view of the MUSIC model used in this report can be found in Appendix D.

Pluviograph data (6 minute rainfall intensity and evapotranspiration) for Penrith Lakes AWS (Station 67113) was used in the MUSIC model.

6.3.7.2 Catchment Areas and MUSIC Parameters

All building lot catchment areas were assumed to 65% roofed. Of the non-roofed areas, 80% of this area was assumed to be impervious. To provide a more accurate model, separate catchment nodes were created to simulate the roofed area and non-roofed areas for each lot.

MUSIC model input parameters for these catchments including rainfall-runoff, base flow concentration and stormflow concentration parameters were selected as per the Penrith City Council Water Sensitive Urban Technical Guidelines June 2015 document. The parameters used for the various catchment areas can be seen in tables 15, 16, 17, 18 and 19.

Parameter	Unit	Figure
Rainfall Threshold	mm/day	1.40
Soil Storage Capacity	Mm	105.00
Initial Storage	% of Capacity	30.00
Field Capacity	Mm	70.00
Infiltration Capacity Coefficient	a	150.00
Infiltration Capacity Coefficient	b	3.50
Initial Depth (Ground Water)	mm	10.00
Daily Recharge Rate	%	25.00
Daily Baseflow Rate	%	10.00
Daily Seepage Rate	%	0.00

Table 14 – Rainfall-Runoff Parameters – All Catchment Areas

Pollutant	Baseflow Concentration Parameter – Mean (log mg/L)	Baseflow Concentration Parameter – Std Dev (log mg/L)	Stormflow Concentration Parameters – Mean (log mg/L)	Stormflow Concentration Parameters – Std Dev (log mg/L)
TSS	0.000	0.000	1.300	0.320
Phosphorus	0.000	0.000	-0.890	0.250
Nitrogen	0.000	0.000	0.300	0.190

Table 15 – Base Flow/Stormwater Concentration Parameters – Impervious (Roofed) Areas

Pollutant	Baseflow Concentration Parameter – Mean (log mg/L)	Baseflow Concentration Parameter – Std Dev (log mg/L)	Stormflow Concentration Parameters – Mean (log mg/L)	Stormflow Concentration Parameters – Std Dev (log mg/L)
TSS	1.200	0.170	2.150	0.320
Phosphorus	-0.850	0.190	-0.600	0.250
Nitrogen	0.110	0.120	0.300	0.190

Table 16 – Base Flow/Stormwater Concentration Parameters – Pervious Areas

Pollutant	Baseflow Concentration Parameter – Mean (log mg/L)	Baseflow Concentration Parameter – Std Dev (log mg/L)	Stormflow Concentration Parameters – Mean (log mg/L)	Stormflow Concentration Parameters – Std Dev (log mg/L)
TSS	0.000	0.00	2.430	0.320

Phosphorus	0.000	0.000	-0.300	0.250
Nitrogen	0.000	0.000	0.340	0.190

Table 17 - Base Flow/ Stormwater Concentration Parameters - Road

MUSIC model parameters used for the Bio-retention basin were based off guidelines provided by FAWB – Stormwater Biofiltration Systems – Version 1, 2009, and were modified accordingly. Parameters used to model the bio-retention basin are shown in the Table 19 below.

Parameter	Unit	Figure
Extended Detention Depth	m	0.30
Surface Area	m2	Varies
Filter Area	m2	Varies
Unlined Filter Media Perimeter	M	0.01
Saturated Hydraulic Conductivity	mm/hour	125
Filter Depth	m	0.50
TN Content of Filter Media	mg/kg	800
Orthophosphate Content of Filter Media	mg/kg	40.0
Exfiltration Rate	mm/hour	0.00
Base Lined	-	No
Vegetation Properties	-	Vegetated with Effective Nutrient Removal Plants
Overflow Weir Width	m	10.00
Underdrain Present	-	Yes
Submerged Zone	-	No

Table 18 - Bio-Retention Basin Parameters

6.3.7.3 Results

MUSIC modelling results presented as mean annual loads at the receiving node indicate that adopted target reductions are achieved, as shown in Tables 20, 21, 22, 23, 24 and 25.

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	20,600	3,050	85.2	85
Total Phosphorus	42.7	14.6	65.7	60
Total Nitrogen	334	161	51.6	45
Gross Pollutants	4,330	59.7	98.6	90

Table 19 - Pollutant Loads - Bioretention Basin 1

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	4,440	586	86.8	85
Total Phosphorus	10.8	4.22	61	60
Total Nitrogen	112	52.8	52.6	45
Gross Pollutants	1,460	8.92	99.4	90

Table 20 - Pollutant Loads - Bioretention Basin 3a

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	21,400	3,220	85	85
Total Phosphorus	47.6	18.2	61.8	60
Total Nitrogen	422	220	47.9	45
Gross Pollutants	5,460	57.6	98.9	90

Table 21 - Pollutant Loads - Bioretention Basin 3b

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	13,700	1,990	85.5	85
Total Phosphorus	32.2	12.3	62	60
Total Nitrogen	313	150	52	45
Gross Pollutants	4,060	34	99.2	90

Table 223 - Pollutant Loads - Bioretention Basin 5

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	3,630	484	86.7	85
Total Phosphorus	8.55	3.15	63.1	60
Total Nitrogen	80.1	38	52.6	45
Gross Pollutants	1,050	9.24	99.1	90

Table 234 - Pollutant Loads - Bioretention Basin 6

Pollutant	Sources (Kg/yr)	Residual Load (Kg/yr)	Reduction (%)	Target Reduction (%)
Total Suspended Solids	63,800	9,330	85.4	85
Total Phosphorus	142	52.5	63	60
Total Nitrogen	1,260	622	50.6	45
Gross Pollutants	16,400	170	99	90

Table 245 - Pollutant Loads – Overall Development

6.4 Conclusion

As highlighted in the above section all stormwater drainage within the Oakdale West development has been designed in accordance with the Penrith City Council Engineering Guidelines. This includes design of the stormwater network (pits and pipes) , On-Site Detention basins and WSUD infrastructure. To summarise:

- OSD has been to be sized to ensure that for all rainwater events up to and including the 1:100 ARI event, does not increase stormwater peak flows in any downstream areas;
- OSD to mitigate post development flows to pre-developed flows for peak Average Reoccurrence Interval (ARI) events;
- 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; and
- The implementation of OSD to mitigate flows and WSUD systems to treat the water runoff prior to discharging into Ropes Creek and the existing unnamed creeks to the west demonstrates a commitment to adhere to the Sydney Regional Environmental Plan (SREP) No 20 – Hawkesbury-Nepean River guidelines.

7 Water Balance

7.1 General

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

Penrith City Council WSUD policy (July 2015) stipulates the rainwater tanks to meet 80% of non-potable demand including outdoor use, toilets and laundry.

7.2 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 reduced 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.

7.3 Water Balance End Uses

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

- Toilet and urinal flushing; and
- Landscape watering (outdoor garden use).

The proportion of total water demands for irrigation and toilet flushing within the development as shown in section 7.4 could be met with the use of recycled roof water drained directly into a rainwater tank. The tank should be sized to ensure the site meets the requirement to meet the 80% non-potable reuse requirement. This is in accordance with Penrith City Council's WSUD policy.

7.4 Total Site Demands and Non-Potable Re-use Rates

The following rates were adopted from the Penrith City Council WSUD technical Guidelines for Industrial and Commercial developments (Section 4.5):

- 0.1 kL/day per toilet or urinal; and
- 0.4 kL/year/m2 as PET-Rain for Sprinklers.

7.5 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).

7.6 Rainwater Tank Model Assumptions

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

7.6.1 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.

7.6.2 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; and
- Any roof runoff that exceeds the rainwater tank capacity is 'overflow' and is directed to the stormwater drainage system.

7.7 Conclusion

The use of rainwater harvest tanks and the design basis to size the tanks to ensure as a minimum, 80% of all non-potable water on each lot 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.

8 Flood Modelling

A Flood Impact Assessment of the Proposed Oakdale West Estate was undertaken by Cardno in March 2016.

8.1 Purpose of Flood Report

The purpose of this report is to determine the flood impact assessment to the surrounding areas and proposed building pads and roads within the Oakdale West site due to the proposed development. For the basis of the proposed development conditions Cardno used the latest Architectural masterplan and AT&L design siteworks plan. Both the 100-year ARI and PMF (Probable Maximum Flood) levels have been identified within this report.

8.2 Flood Modelling Results

Based on the Cardno flood report the following impacts were discovered when comparing the proposed development flood conditions against the existing flood conditions:

- There will be minor impacts on the 100-year ARI flooding on the Ropes Creek floodplain which will not adversely impact on any adjoining property subject to the peak target outflows not exceed the designated 2-year ARI and 100-year ARI peak flows; and
- Any impacts on the 100-year ARI and PMF flood levels and velocities are primarily associated with the Oakdale South development and the local impacts of Oakdale West development is primarily created by Lot % impervious and the incremental impacts are confined within the overall Oakdale precinct.

8.3 Conclusion

The Cardno report concludes that the proposed development will have minor impacts on the 100-year ARI flooding on the Ropes Creek floodplain however this will not adversely impact on any adjoining property. This is subject to the post-developed peak flows being limited to pre-developed flows which has been discussed in Section 6.3.5 of this report.

9 Services

9.1 Sydney Water

AT&L has undertaken extensive consultation with Sydney Water during the development of OWE. As a result of the ongoing development within the Western Sydney Employment Area (WSEA) Precinct No.8 – Area South of Pipeline, Sydney Water requested that a Local Area Servicing Plan (LASP) for both sewer and potable water infrastructure was prepared. This was to ensure that future Sydney Water infrastructure could ultimately service future developments within the WSEA Precinct No.8 – Area South of Pipeline.

The LASP for sewer and potable water (GHD 2016) identifies the servicing strategy for the WSEA Precinct No.8 – Area South of Pipeline as shown below within Figure 6.

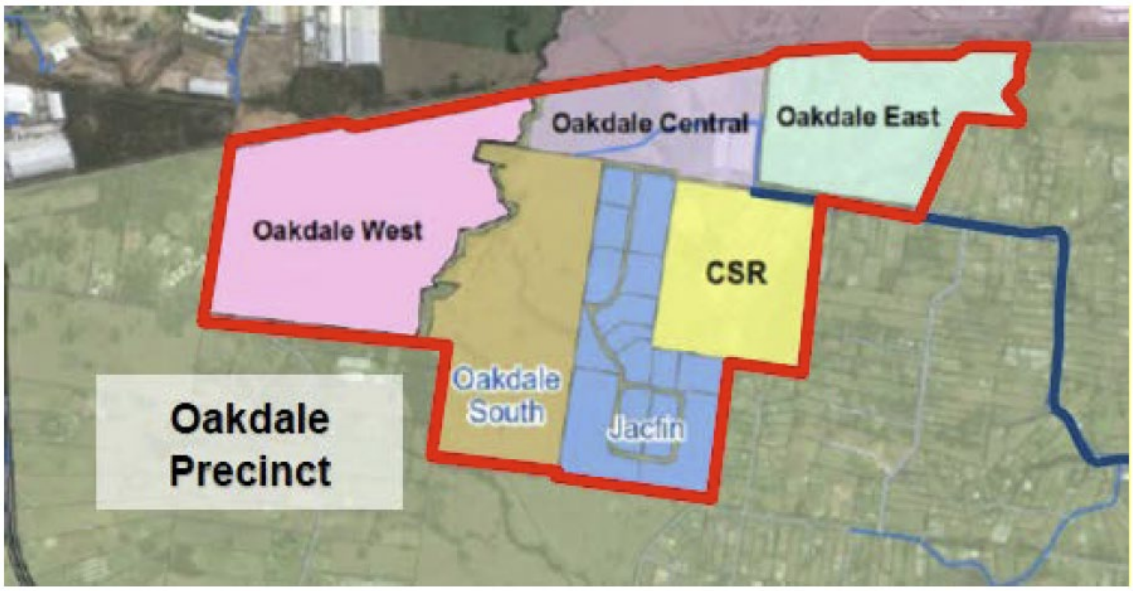


Figure 6 – WSEA Precinct No.8 – Area South of Pipeline.

At the request of Sydney Water, GHD were engaged to prepare the LASP for both sewer and potable water. During preparation of these documents, extensive consultation was undertaken with Sydney Water, Jacfin and CSR to ensure compliance with Sydney Water's performance requirements for both sewer and potable water.

An overview of the sewer and potable water servicing strategy for the WSEA Precinct No.8 – Area South of Pipeline with specific reference to Oakdale South is provided below.

9.1.1 Water Supply

Oakdale West is zoned as IN1 'General Industrial' under the State Environmental Planning Policy (Western Sydney Employment Area) 2009. Water demands were assessed for Oakdale West on this basis within the LASP for potable water (GHD 2016).

Within the LASP for potable water (GHD 2016), an evidence based approach to forecasting future demands in the WSEA Precinct No.8 – Area South of Pipeline, based on observed demands in an adjacent water supply system, was adopted as per the 'Water System Planning Guidelines 2014".

The LASP for potable water (GHD 2016) calculated the potable water daily demands for Oakdale West as follows:

- Average Day Demand (ML/d): 0.83ML/d; and
- Max Day Demand (ML/d): 1.3ML/d.

The LASP for potable water (GHD 2016) states that Oakdale West will be supplied via the proposed DN300 potable water main (Refer Section 7-8 within Figure 2 in Appendix F) which is supplied from the Minchinbury Elevated System.

To improve system reliability, the LASP also requires a proposed DN300 connection (refer section 4-7 within Figure 2 in Appendix F) between the existing DN250 within Millner Avenue (refer section 3-4 within Figure 2 in Appendix E) to the proposed DN300 within Oakdale West (refer section 7-8 within Figure 2 in Appendix F) which ultimately connects to the existing DN300 within Erskine Park Link Road (EPLR). The proposed DN300 connection (refer section 4-7 within Figure 2 in Appendix E) between Millner Avenue and Oakdale West is included within this proposal and will be provided as part of the OSE development.

A DN300 connection between the existing DN450 within Burley Road and the Millner Avenue Roundabout (refer section 2-4 within Figure 2 in Appendix E) is also required as part of the LASP. This proposed DN300 connection will be provided as part of the OWE development subject to Sydney Water Notice of Requirements.

The provision of OSE potable water reticulation (internal and external works) will be undertaken in accordance with the Sydney Water endorsed LASP for potable water (GHD 2016), Sydney Water requirements and procurement process.

9.1.2 Sewerage

Oakdale West is zoned as IN1 'General Industrial' under the State Environmental Planning Policy (Western Sydney Employment Area) 2009. Sewer loads were assessed for Oakdale West on the basis within the LASP for sewer (GHD 2016)

The St Clair Trunk sewer system has recently been completed which connects the wider Oakdale Precinct to the existing St Clair Sewer Carrier approximately 1.6km to the north west of the site. As part of the works, a connection point was provisioned for OWE in the north east corner.

The LASP for sewer (GHD 2016) calculated the sewer loads for Oakdale West as follows:

- Average Dry Weather Flow (ML/d): 1.34ML/d

The LASP for sewer (GHD 2016) identified the sizing of sewer infrastructure required to service Oakdale West as between DN375 to DN225. For further details on proposed sewer alignments for Oakdale West, refer to Appendix E.

The provision of OWE sewer infrastructure (internal and external works) will be undertaken in accordance with the Sydney Water endorsed LASP for sewer (GHD 2016), Sydney Water requirements and procurement process.

In the event of delays of delivery of sewer infrastructure to service OWE, temporary interim measures may need to be adopted such as provision of sewer rising main systems between OWE and the East St Clair Carrier, located at Millner Avenue roundabout, subject to PCC and/or Sydney Water approvals.

An overview of the preliminary alignments and sizing of sewer infrastructure within the Sydney Water endorsed LASP for sewer (GHD 2016) is shown within Figure 6 in Appendix E.

The existing school and retirement village may be able to connect to the proposed sewer service in the North West corner of the OWE. When designing the sewer, consideration will be made and provisioned to service the adjacent site. Connection to adjoining properties will be subject to level constraints and Sydney Water approvals.

The school and retirement village currently have no trunk sewer system and utilise a low-pressure pump system.

9.2 Communications

Communication conduits will be extended along the proposed WNSLR to service Oakdale West, the pit and pipe network will be extended and reticulated through the roadways to service the proposed lots.

Staging of the pit and pipe network will coincide with the civil stages.

9.3 Gas

To service Oakdale West, conduits will be extended and reticulated through the roadways to service the proposed lots.

Staging of the reticulation will coincide with the civil stages.

It is not proposed to reticulate gas although provision for it.

9.4 Electrical

Over the past 18 months' numerous meetings have been held with Endeavour Energy (EE) in relation to servicing the proposed development site. Currently EE have indicated that a new Zone Substation (ZS) will ultimately be required to service the greater development area. The new ZS will potentially have capacity to also service adjacent developments. This is subject to detailed design, investigation and a separate application by EE.

The Services Lot located within Precinct 4 has been identified as the location for the Zone Substation. This has been determined in consultation with EE and they have verbally agreed to the location.

EE will ultimately construct and own and operate the zone substation and is not subject to this application.

EE has indicated that Stage 1 could be serviced in the interim by connecting to the existing 11kV reticulation within the EPLR and to the existing Erskine Park Zone Substation. Reticulation would be extended along the proposed WNSLR.

EE has indicated that in order to service further Stages of development the new Zone Substation will be required on the site subject to future design and evaluation by EE. Stage 1 and all remaining Stages of development would then be serviced by the new Zone Substation upon completion of the ZS.

Whilst Stage 1 could be serviced by the existing Erskine Park Zone Substation, depending on discussion with EE, additional feeders could be pulled to service all subsequent stages although this would not be economically viable option.

The new zone substation would be supplied via the overhead 132kV feeder 93X located approximately 400m east of Old Wallgrove Road. Additional works associated with supplying power to the new Zone Substation will need to be completed as follows:

- Possible augmentation to feeder 93X; and

9.5 Conclusion

This section demonstrates that services including sewer, water, power, telecommunications and gas can be made available to the site.

Internal reticulation will be coordinated at the Construction Certificate (CC) stage of works and applications to the relevant authorities.

10 Infrastructure Staging

10.1 Staging

Stage 1 Development Application, includes:

- Bulk earthworks across the whole site including retaining wall and noise wall construction;
- Bio-retention and detention basins across the entire site;
- Staged trunk infrastructure for the site;
- Staged subdivision;
- Landscaping and public domain works;
- Development comprising the construction and operation of three warehouse and distribution facilities in Precinct 1;
- Road and Stormwater infrastructure associated with Road No.1, Road No.2, Road No.6 and part Road No.7;
- Western North South Link Road (WNSLR) connecting the site northward to the Erskine Park Link Road. Including associated bridge works, utilities, stormwater drainage and bio-retention basins; and
- Lead in utility services as outlined above within Section 9.

For Stage 1 Development Application civil infrastructure works extent, refer to civil drawings C0004 and C0005.

Temporary access associated with the construction of the proposed Oakdale West Stage 1 works is proposed via Bakers Lane.

Temporary access associated with the construction of the proposed WNSLR north of the pipeline is proposed via the Erskine Park Link Road or Lockwood Road. Temporary access associated with the construction of the proposed WNSLR south of the pipeline is proposed via Bakers Lane.

Upon completion of the WNSLR, general access to/from the Oakdale West Estate to Bakers Lane will not be required. The development is ultimately serviceable via the proposed Western North South Link Road and the future Southern Link Road.

During construction of the Oakdale West Stage 1 works, temporary construction access via Bakers lane will be restricted to the following:

- Light vehicle construction worker access to and from site;
- Delivery of construction materials required for the Oakdale West Stage 1 infrastructure works, including, though not limited to:
    - Retaining wall products including block work and select materials;
    - Road pavement products, including sub-base, base and asphalt materials;
    - Stormwater drainage materials, including stormwater pipes and select materials;
    - Landscaping and associated irrigation materials;
    - Precinct No.1 building materials;
    - WNSLR south of pipeline construction materials;

- Floating of earthwork equipment to site. Note earthwork equipment is envisaged to remain on site until completion of the Oakdale West Stage 1 infrastructure works. At which time the proposed WNSLR is envisaged to be complete. Demobilisation of earthwork equipment from site is proposed to be completed via the proposed WNSLR

No importation of general fill will be undertaken via Bakers lane. Fill importation will be completed via the WNSLR (once completed) in accordance with a Construction Traffic Management Plan (CTMP) to be prepared and approved by the Secretary prior to commencement of construction.

Prior to the commencement of construction, a Construction Traffic Management Plan (CTMP) for the Development will be prepared to describe the management of traffic and access arrangements during construction. The CTMP shall be prepared by a suitably qualified and experienced expert in consultation with RMS and Council and approved by the Secretary prior to the commencement of construction. The CTMP will detail the number and frequency of truck movements, size of trucks, vehicle routes and hours of construction. The CTMP will be implemented for the full duration of the construction works.

The construction of on lot warehousing and distribution facilities within Precincts No.2, No.3, No.4 and No.5 will be subject to future development applications.

The below table outlines the typical construction activities and associated works to be undertaken within each stage of works. Construction methods for the project would be conventional techniques employed on Penrith City Council projects, adapted to account for project-specific environmental and site constraints.

Construction Activity	Typical Activities
Enabling works	• Pre-commencement documentation / approvals • Community notification of construction commencement • Archaeological salvage works • Relocation of flora and fauna species, if required • Dam decommissioning • Establishment of survey control • Utility relocations at selected locations • Minor clearing works • Minor topsoil stripping • Construction of minor access roads • Construction access • Investigative drilling • Dwelling demolition works
Site establishment	• Construction of temporary internal access roads • Clearing of vegetation and stockpiling of mulch materials • Progressive construction of sedimentation and erosion controls as required, including construction of diversion and catch drains along the project formation • Progressive installation of temporary fencing • Temporary traffic management arrangements • Establishment of construction on-site compounds • Installation of temporary construction signage and lighting • Fencing of construction areas and site compounds
Bulk Earthworks	• Stripping topsoil and stockpiling for reuse in batter stabilisation • Progressive construction of Sedimentation and Erosion controls as required • Excavation of cuttings and stockpiling of better quality materials to be used as select fill • Construction of fill embankments including foundation drainage • Placement and compaction of selected material

	• Excavation of unsuitable materials, including blending and/or disposal of surplus material
Drainage and Structures	• Construction of retaining walls • Construction of longitudinal and vertical drainage structures within cuttings • Construction of subsurface drainage • Construction of road longitudinal and cross drainage including outlets and scour protection work • Construction of open drains and catch drains including scour protection work
Utilities	• Sydney Water Potable Water works • Sydney Water Sewer Works • Endeavour Energy electrical works • Telstra/NBN communications works • Private gas main relocation works, if required
WNSLR Bridge construction	• Establishment of satellite work compounds • Installation of temporary access tracks and drainage to facilitate construction • Construction of bridge foundations • Construction of bridge abutments and piers • Construction of bridge deck superstructures
Pavement Works	• Construction of base and sub-base pavement layers • Construction of pavement drainage including kerb and gutters as required • Construction of medians and barriers • Construction of pavement wearing course
Finishing work	• Final pavement line marking • Signposting • Street lighting • Landscaping and tree planting • Demobilisation • Restoration of on-site compounds

11 Construction

11.1 Clearing and Grubbing

The site is predominantly grassed paddocks with minor pockets of trees. Clearing and Grubbing would generally consist of slashing, tree removal and removal of grass and roots within the top layer of the topsoil where required.

Where trees are to be removed these will be mulched and then reused on site as part of the landscape treatment.

Clearing and grubbing would take place in a staged manner in line with civil and infrastructure works. Where possible existing ground coverings will be left undisturbed until such time it is required to be removed.

All riparian and offset lands would be fenced off and trees to be retained marked to prevent clearing and protected areas.

11.2 Demolition

A number of small structures need to be removed from site including a derelict house, cattle yards and rural fencing. There are no substantial improvements on the site that require demolition. Demolition of existing dwelling to be conducted in accordance with the provisions of *AS2601-2001 – Demolition of Structures* by contractors experienced in this class of work and holding required current permits and licenses as required.

Existing internal fencing, cattle yards, utilities and other redundant structures to be demolished and removed from site to an approved waste management and /or recycling facility.

11.3 Road Works and Services

The roads and services to be constructed will be undertaken once the earthworks for the road corridor and adjacent lots are completed.

The performance of the imported sub grade may ultimately determine whether any modifications are required to the pavement design although at the time of tender, the contractors will be required to determine their source of material and the applicable CBR.

If the cut material from the site is better suited for sub grade, it will be separated and utilised for the final layers.

The general sequence of the road and services is as follows;

- Boxing and construction of base pavement layers;
- Excavation for stormwater and laying of pipes and construction of pits;
- Excavation for combined services trenches;
- Where deep sewer is required to cross roads, this will be finalized;
- Services road crossings including water;
- Kerb and gutter;
- Watermain installation;
- Final pavement base layer;
- First layer of asphalt
- Light poles stood

- Foot paths constructed
- Topsoil and landscaping completed; and
- Signage and linemarking.

Stormwater basin will be established as a matter of priority to control sediment runoff and once the roads are completed these will be finalised in their final configuration.

11.4 Program

The Stage 1 Development Application includes:

- Staged bulk earthworks across the whole site including retaining wall construction;
- Staged trunk infrastructure for the site;
- Staged subdivision;
- Landscaping and public domain works;
- Development comprising the construction and operation of three warehouse and distribution facilities in Precinct 1. Refer to Architectural Drawing OAK MP 02 (by SBA Architects) and AT&L Drawing C1003 indicating Precinct 1 extents;
- Road and Stormwater infrastructure associated with Road No.1, Road No.2, Road No.6 and part Road No.7;
- Western North South Link Road (WNSLR); and
- Lead in services.

These works are forecast to commence end of 2018 and be completed over a duration of 18-24 months subject to authority approvals and inclement weather delays.

The importation of fill for Precinct 5 is expected to occur once the proposed WNSLR is complete so as to limit heavy vehicle usage of Bakers Lane.

11.5 Construction Plant and Equipment

Throughout the various stages of the project, it is expected that the following construction plant and equipment will be required. This list is including but is not limited to:

- Construction compound
    - Site offices and facilities for staff
    - Car parking
    - Meeting rooms
    - Lay down area for delivery of materials
    - Mechanical bay for plant
- Construction plant
    - Skidsteer loader (Bobcat) 5 of
    - Backhoe (dig depth up to 5 m) 5 of
    - Backhoe + hammer 2 of
    - Dozer 98 to 145 kW (equivalent to Caterpillar D6) 1 of
    - Dozer 145 to 175 kW (equivalent to Caterpillar D7) 1 of
    - Dozer 220 to 305 kW (equivalent to Caterpillar D8) 1 of
    - Dozer 305 to 400 kW (equivalent to Caterpillar D9) 1 of
    - Grader 3 of
    - Loader (up to 90 kW) 5 of
    - Roller, multi-tyred 1 of
    - Roller, padfoot (various sizes) 3 of
    - Roller, smooth drum 1 of

- Scraper, open bowl, 17 to 28 m3 5 of
- Excavator < 10 t + hammer 1 of
- Excavator 12 t + hammer 1 of
- Excavator 20 t + hammer 1 of
- Excavator 30 t + hammer 1 of
- Watercart 15,000 L 3 of
- Truck 13 t payload 1 of
- Truck and dog 30 t payload 5 of
- Road profiler
- Air compressor (without operator) 41 L/s
- Generator 6.8 kVA (without operator)

Type and quantity of plant and equipment may vary largely depending on the construction staging and construction methods adopted by the construction Contractor.

Appendix A

Proposed Site Plans, Staging and Catchment Plans

CONTINUED ON SHEET C005

FITZPATRICK LAND

DP1168407

PROPOSED ACCESS TRACK AMENDMENTS TO FACILITATE WNSLR BRIDGE WORKS IN CONSULTATION WITH WATERNSW

EXTENSION OF WATERNSW ACCESS TRACK

WESTERN NORTH - SOUTH LINK ROAD

TRANSGRID EASEMENT

WATER NSW PIPELINE

PROPOSED DRAINAGE UPGRADE WORKS WITHIN WATERNSW LAND.

ROAD No.1

AMENITIES LOT

PROPOSED SIGNAGE.

LOT 1A

LOT 1B

LOT 1C

ROAD No.2

BIO-RETENTION BASIN No.1

LOT 2B

LOT 2A

FUTURE ROAD No.4

FUTURE ROAD No.3

EXISTING AGED CARE FACILITY

BIO-RETENTION BASIN No.3a & 3b

LOT 2 DP556036

ROPES CREEK

LOT 3B

LOT 3A

ROAD No.1

LOT 4D

FUTURE SOUTH-ERN LINK ROAD

FUTURE ROAD No.8

BIO-RETENTION BASIN No.6

LOT 5A

LOT 2E

FUTURE ROAD No.5

LOT 4C

EXISTING DRAINAGE SYSTEM TO BE CLEANED AND FORMED WITH CONTINUATION OF SCOUR PROTECTION SUBJECT TO OWNER'S CONSENT

EXISTING COLLEGE

LOT 2F & 2G

FUTURE ROAD No.3

LOT 3C

SERVICES LOT

LOT 3D

ROAD No.6

ROAD No.7

LOT 2H & 2J

LOT 4B

LOT 4F & 4G

BAKERS LANE

FUTURE ROAD No.7

LOT 4A

TEMPORARY CONSTRUCTION ACCESS

LOT 4E

TRANSGRID EASEMENT

ROPES CREEK

BIO-RETENTION BASIN No.5

LOT 12 DP1173181

LOT 44 DP708347

OAKDALE SOUTH ESTATE (SSD6917)

LEGEND

- EXISTING BOUNDARY
- EXISTING EASEMENT
- PROPOSED BOUNDARY
- STAGE 1 RETAINING WALLS
- STAGE 1 NOISE WALLS
- STAGE 1 STORMWATER PIPE
- PRECINCT NO.1 ON LOT WORKS
- BULK EARTHWORKS /BIO-RETENTION / OSD / BASINS* / LANSCAPING / BATTER STABILISATION
- STAGE 1 INFRASTRUCTURE WORKS
- FUTURE ZONE SUBSTATION, PAD & ASSOCIATED INFRASTRUCTURE WITHIN STAGE 1
- TEMPORARY HAUL ROAD

* WHERE FEASIBLE, BASINS TO BE UTILISED AS TEMPORARY SEDIMENT CONTROL BASINS UNTIL 90 PER CENT COMPLETE AND THE AREA WITHIN THE RELEVANT STAGE IS STABILISED

NOTES

1. ALL SITE WIDE BATTER SLOPE LANDSCAPING/STABILISATION INCLUDED IN THIS APPROVAL.
2. REFER SITE IMAGE DRAWINGS FOR EXTENT OF LANDSCAPING.
3. LOT 2A AND 2B STORMWATER TRUNK DRAINAGE IS INCLUDED IN THIS APPROVAL.

Bar Scales

0 50 100 150 200 250

1 : 3000 @ A1

Issue	Description	Date
A6	ISSUED FOR SSD APPROVAL	05-10-18
A5	ISSUED FOR SSD APPROVAL	28-09-18
A4	ISSUED FOR SSD APPROVAL	21-09-18
A3	ISSUED FOR SSD APPROVAL	11-05-18
A2	ISSUED FOR SSD APPROVAL	04-05-18
A1	ISSUED FOR SSD APPROVAL	14-03-17

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Scales	1 : 3000	15-272-C0004.dwg	
		Drawn	GB
		Designed	GB
Height Datum	AHD	Checked	AM
Grid	MGA	Approved	AM

Client: Goodman

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Project

PROPOSED INDUSTRIAL DEVELOPMENT
OAKDALE WEST

Title

STAGE 1 SSD APPROVAL EXTENTS
SHEET 1 OF 2

Drawing No.	Project No.	Issue
15-272-C0004	15-272	A6

100mm on Original

LENORE DRIVE

LOCKWOOD ROAD

DP1168407

DP1168407

DP1168407

FITZPATRICK LAND

WESTERN NORTH - SOUTH LINK ROAD

TRANSGRID EASEMENT

TRANSGRID EASEMENT

WATER NSW PIPELINE

ROAD No.1

ROAD No.2

LOT 1A

LOT 1B

LOT 1C

AMENITIES LOT

PROPOSED SIGNAGE.

BIO-RETENTION BASIN No.1

BIO-RETENTION BASIN No.6

ROPES CREEK

LOT 4C

LOT 4D

LOT 5A

FUTURE SOUTHERN LINK ROAD

FUTURE ROAD No.8

CONTINUED ON SHEET C0004

100mm on Original

LEGEND

- EXISTING BOUNDARY
- EXISTING EASEMENT
- PROPOSED BOUNDARY
- STAGE 1 RETAINING WALLS
- STAGE 1 NOISE WALLS
- PRECINCT NO.1 ON LOT WORKS
- BULK EARTHWORKS /BIO-RETENTION / OSD / BASINS* / LANSCAPING / BATTER STABILISATION
- STAGE 1 INFRASTRUCTURE WORKS

* WHERE FEASIBLE, BASINS TO BE UTILISED AS TEMPORARY SEDIMENT CONTROL BASINS UNTIL 90 PER CENT COMPLETE AND THE AREA WITHIN THE RELEVANT STAGE IS STABILISED

NOTES

1. ALL SITE WIDE BATTER SLOPE LANDSCAPING/STABILISATION INCLUDED IN THIS APPROVAL.
2. REFER SITE IMAGE DRAWINGS FOR EXTENT OF LANDSCAPING.
3. LOT 2A AND 2B STORMWATER TRUNK DRAINAGE IS INCLUDED IN THIS APPROVAL.

Bar Scales

0 50 100 150 200 250

1 : 3000 @ A1

Issue	Description	Date
A4	ISSUED FOR SSD APPROVAL	21-09-18
A3	ISSUED FOR SSD APPROVAL	11-05-18
A2	ISSUED FOR SSD APPROVAL	04-05-18
A1	ISSUED FOR SSD APPROVAL	14-03-17

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Scales	1 : 3000	15-272-C0005.dwg	
		Drawn	GB
		Designed	GB
Height Datum	AHD	Checked	AM
Grid	MGA	Approved	AM

Client: Goodman

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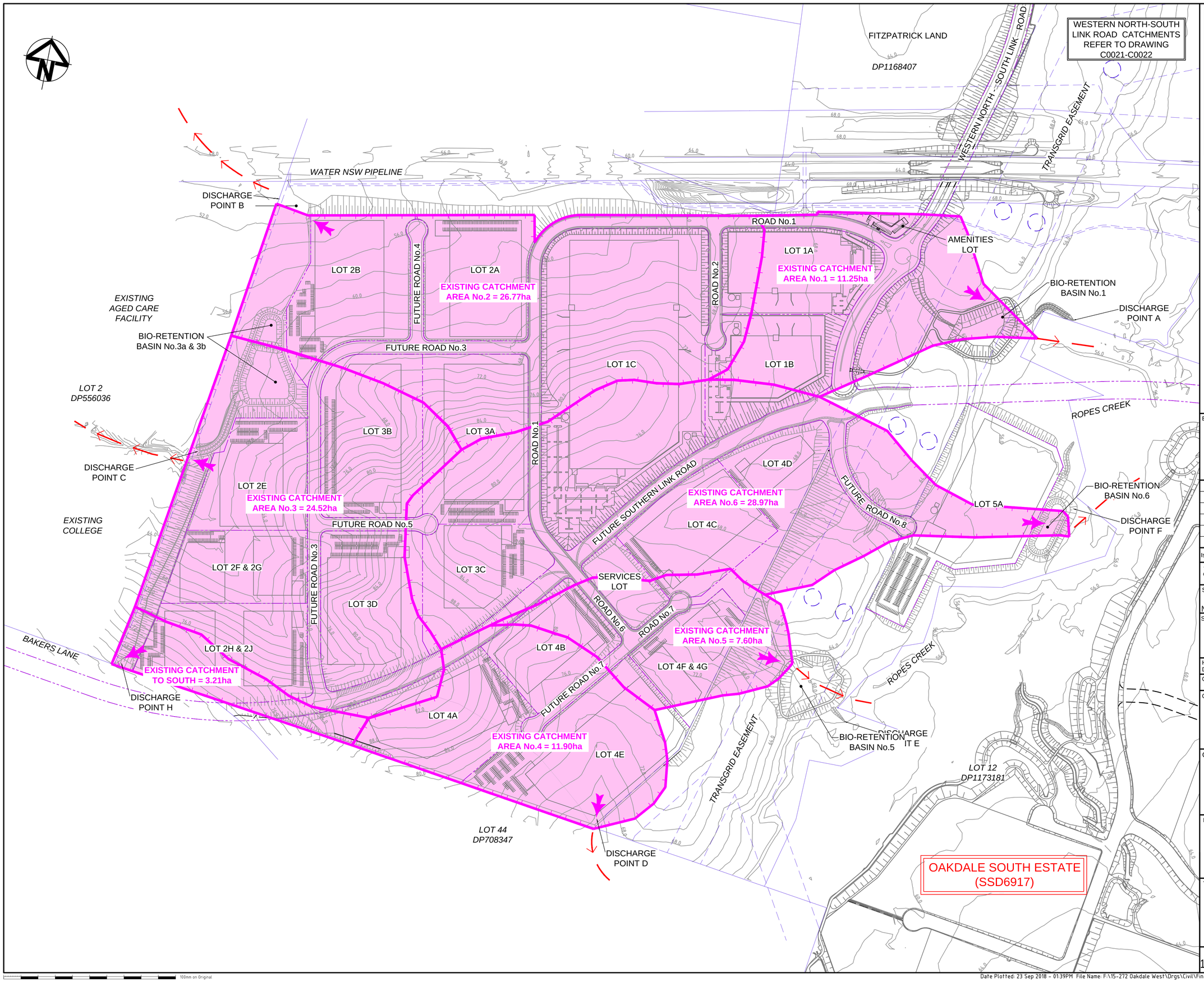
Project
PROPOSED INDUSTRIAL DEVELOPMENT
OAKDALE WEST

Title
STAGE 1 SSD APPROVAL EXTENTS
SHEET 2 OF 2

Drawing No.	Project No.	Issue
15-272-C0005	15-272	A4



Issue	Description	Date
A3	ISSUED FOR SSD APPROVAL	21-09-18
A2	ISSUED FOR SSD APPROVAL	04-05-18
A1	ISSUED FOR SSD APPROVAL	14-03-17

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Scales	1 : 3000	15-272-C0007.dwg	
		Drawn	GB
		Designed	GB
Height Datum	AHD	Checked	AM
Grid	MGA	Approved	AM

Client: Goodman

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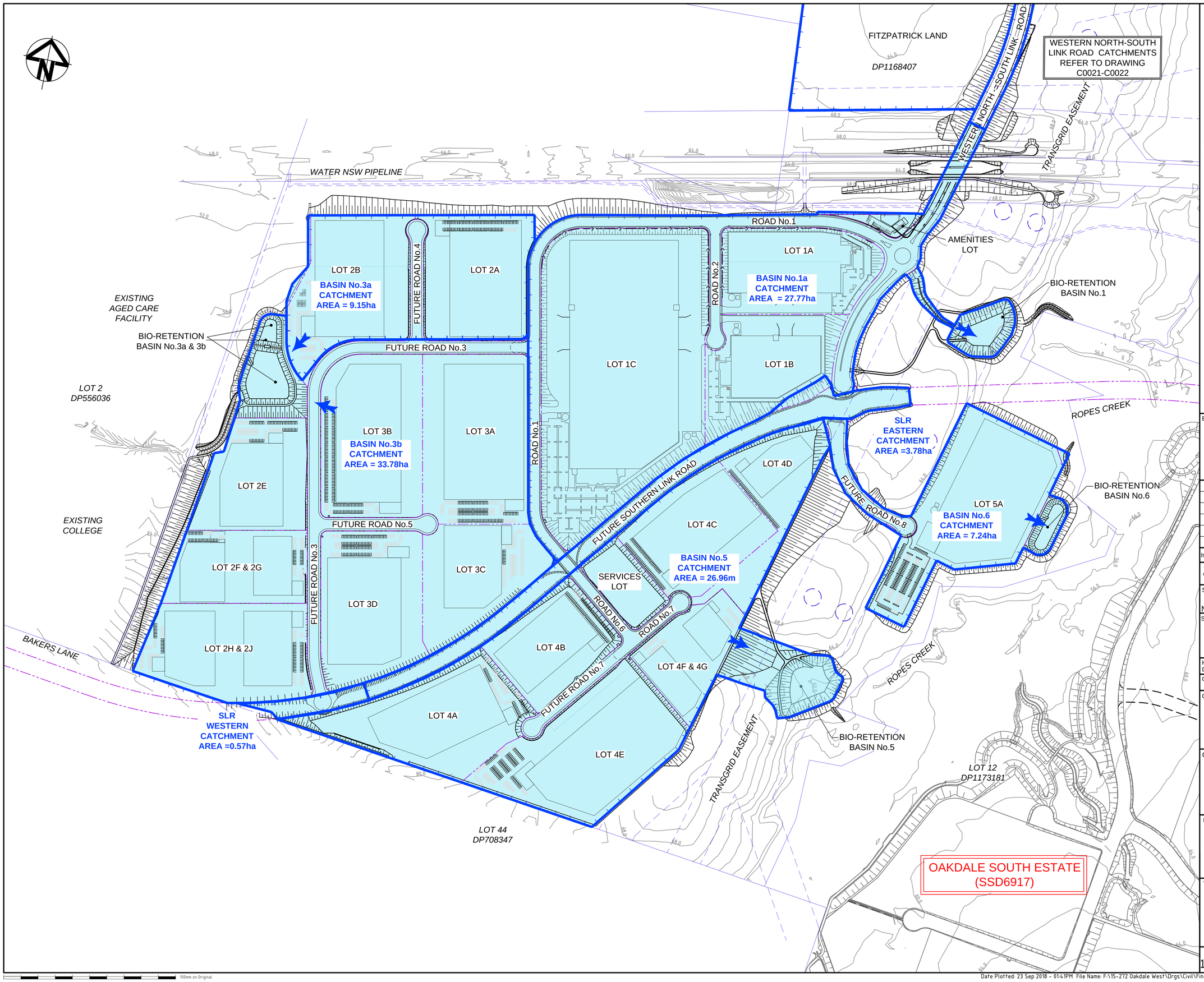
Project: PROPOSED INDUSTRIAL DEVELOPMENT OAKDALE WEST

Title: STORMWATER DRAINAGE CATCHMENT PLAN (PRE-DEVELOPED)

Drawing No.	Project No.	Issue
15-272-C0007	15-272	A3

100mm on Original

Date Plotted: 23 Sep 2018 - 01:39PM File Name: F:\15-272 Oakdale West\Drgs\Civil\Final\SSDA\0000_Masterplan Package\15-272-C0007.dwg V1



LEGEND

- EXISTING BOUNDARY
- EXISTING EASEMENT
- PROPOSED BOUNDARY
- STORMWATER CATCHMENT BOUNDARY
- FLOW DIRECTION

Bar Scales

0 50 100 150 200 250

1 : 3000 @ A1

A3	ISSUED FOR SSD APPROVAL	21-09-18
A2	ISSUED FOR SSD APPROVAL	04-05-18
A1	ISSUED FOR SSD APPROVAL	14-03-17
Issue	Description	Date

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Scales	1 : 3000	15-272-C0008.dwg	
		Drawn	GB
		Designed	GB
Height Datum	AHD	Checked	AM
Grid	MGA	Approved	AM

Client: Goodman

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Project: PROPOSED INDUSTRIAL DEVELOPMENT OAKDALE WEST

Title: STORMWATER DRAINAGE CATCHMENT PLAN (DEVELOPED)

Drawing No.	Project No.	Issue
15-272-C0008	15-272	A3

100mm on Original

LEGEND

- EXISTING BOUNDARY
- EXISTING EASEMENT
- PROPOSED BOUNDARY
- EXISTING STORMWATER FLOW PATH
- EXISTING STORMWATER CATCHMENT BOUNDARY
- FLOW DIRECTION

Bar Scales

0 50 100 150 200 250

1 : 3000 @ A1

Issue	Description	Date
A3	ISSUED FOR SSD APPROVAL	21-09-18
A2	ISSUED FOR SSD APPROVAL	04-05-18
A1	ISSUED FOR SSD APPROVAL	14-03-17

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Scales	1 : 3000	15-272-C0021.dwg	
		Drawn	GB
		Designed	GB
Height Datum	AHD	Checked	AM
Grid	MGA	Approved	AM

Client: Goodman

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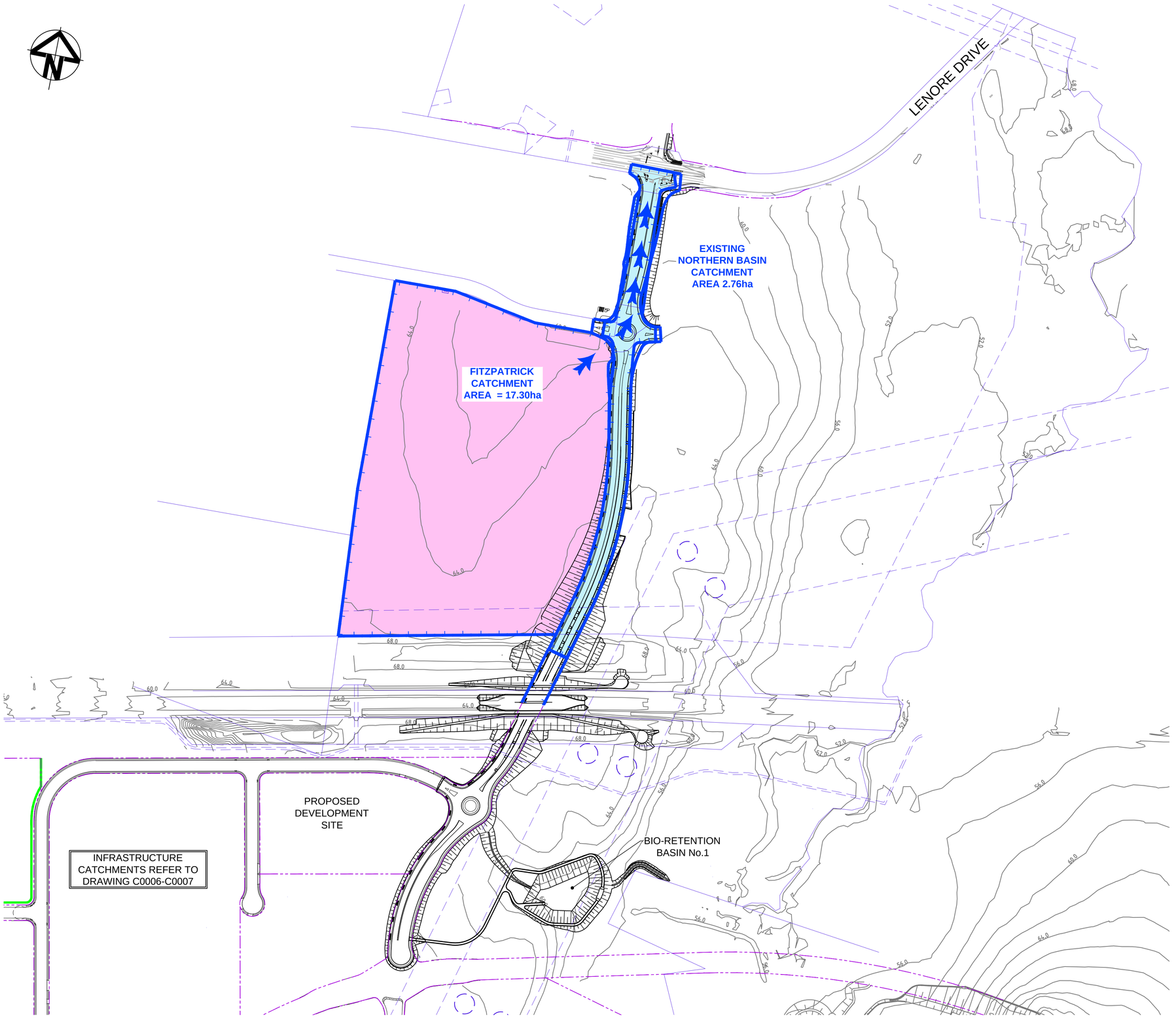
Project
PROPOSED INDUSTRIAL DEVELOPMENT
OAKDALE WEST

Title
WESTERN NORTH-SOUTH LINK ROAD STORMWATER DRAINAGE CATCHMENT PLAN (PRE-DEVELOPED)

Drawing No.	Project No.	Issue
15-272-C0021	15-272	A3

100mm on Original



LEGEND

- EXISTING BOUNDARY
- EXISTING EASEMENT
- PROPOSED BOUNDARY
- EXISTING STORMWATER CATCHMENT BOUNDARY
- WNSLR STORMWATER CATCHMENT BOUNDARY
- FLOW DIRECTION

Bar Scales

0 50 100 150 200 250

1 : 3000 @ A1

Issue	Description	Date
A3	ISSUED FOR SSD APPROVAL	21-09-18
A2	ISSUED FOR SSD APPROVAL	04-05-18
A1	ISSUED FOR SSD APPROVAL	14-03-17

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION

A1

Scales	1 : 3000	15-272-C0022.dwg	
		Drawn	GB
		Designed	GB
Height Datum	AHD	Checked	AM
Grid	MGA	Approved	AM

Client: Goodman

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Project
PROPOSED INDUSTRIAL DEVELOPMENT
OAKDALE WEST

Title
WESTERN NORTH-SOUTH LINK ROAD STORMWATER DRAINAGE CATCHMENT PLAN (DEVELOPED)

Drawing No.	Project No.	Issue
15-272-C0022	15-272	A3

100mm on Original

Appendix B

AT&L – Drawing List of Civil Works

0000 SERIES - MASTER PLAN PACKAGE	
DRAWING No.	DRAWING TITLE
15-272-C0000	COVER SHEET
15-272-C0001	GENERAL ARRANGEMENT MASTER PLAN
15-272-C0002	EXISTING SITE PLAN
15-272-C0003	PRECINCT PLAN
15-272-C0004	STAGE 1 SSD APPROVAL EXTENTS SHEET 1 OF 2
15-272-C0005	STAGE 1 SSD APPROVAL EXTENTS SHEET 2 OF 2
15-272-C0006	CUT\FILL PLAN
15-272-C0007	STORMWATER DRAINAGE CATCHMENT PLAN (PRE-DEVELOPED)
15-272-C0008	STORMWATER DRAINAGE CATCHMENT PLAN (DEVELOPED)
15-272-C0009	EROSION AND SEDIMENT CONTROL MASTER PLAN
15-272-C0010	TYPICAL SECTIONS SHEET 1
15-272-C0011	TYPICAL SECTIONS SHEET 2
15-272-C0012	TYPICAL SECTIONS SHEET 3
15-272-C0013	TYPICAL SECTIONS SHEET 4
15-272-C0020	WESTERN NORTH-SOUTH LINK ROAD GENERAL ARRANGEMENT PLAN
15-272-C0021	WESTERN NORTH-SOUTH LINK ROAD STORMWATER DRAINAGE CATCHMENT PLAN (PRE-DEVELOPED)
15-272-C0022	WESTERN NORTH-SOUTH LINK ROAD STORMWATER DRAINAGE CATCHMENT PLAN (DEVELOPED)
15-272-C0023	WESTERN NORTH-SOUTH LINK ROAD PROPOSED LAND ACQUISITION PLAN

1000 SERIES - INFRASTRUCTURE PACKAGE	
DRAWING No.	DRAWING TITLE
15-272-C1000	COVER SHEET
15-272-C1001	DRAWING LIST
15-272-C1002	GENERAL NOTES
15-272-C1003	PRECINCT GENERAL ARRANGEMENT PLAN
15-272-C1004	TYPICAL SITE SECTIONS SHEET 1 OF 6
15-272-C1005	TYPICAL SITE SECTIONS SHEET 2 OF 6
15-272-C1006	TYPICAL SITE SECTIONS SHEET 3 OF 6
15-272-C1007	TYPICAL SITE SECTIONS SHEET 4 OF 6
15-272-C1008	TYPICAL SITE SECTIONS SHEET 5 OF 6
15-272-C1009	TYPICAL SITE SECTIONS SHEET 6 OF 6
15-272-C1010	TYPICAL ROAD SECTIONS
15-272-C1011	CONTOUR PLAN
15-272-C1014	BULK EARTHWORKS CUT\FILL PLAN
15-272-C1015	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 1 OF 20
15-272-C1016	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 2 OF 20
15-272-C1017	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 3 OF 20
15-272-C1018	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 4 OF 20
15-272-C1019	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 5 OF 20
15-272-C1020	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 6 OF 20
15-272-C1021	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 7 OF 20
15-272-C1022	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 8 OF 20

15-272-C1023	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 9 OF 20
15-272-C1024	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 10 OF 20
15-272-C1025	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 11 OF 20
15-272-C1026	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 12 OF 20
15-272-C1027	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 13 OF 20
15-272-C1028	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 14 OF 20
15-272-C1029	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 15 OF 20
15-272-C1030	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 16 OF 20
15-272-C1031	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 17 OF 20
15-272-C1032	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 18 OF 20
15-272-C1033	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 19 OF 20
15-272-C1034	EARTHWORKS AND STORMWATER DRAINAGE PLAN SHEET 20 OF 20
15-272-C1040	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 1 OF 10
15-272-C1041	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 2 OF 10
15-272-C1042	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 3 OF 10
15-272-C1043	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 4 OF 10
15-272-C1044	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 5 OF 10
15-272-C1045	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 6 OF 10
15-272-C1046	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 7 OF 10
15-272-C1047	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 8 OF 10
15-272-C1048	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 9 OF 10
15-272-C1049	ROADWORKS AND STORMWATER DRAINAGE PLAN SHEET 10 OF 10
15-272-C1050	ROAD LONGITUDINAL SECTIONS SHEET 1 OF 5
15-272-C1051	ROAD LONGITUDINAL SECTIONS SHEET 2 OF 5
15-272-C1052	ROAD LONGITUDINAL SECTIONS SHEET 3 OF 5
15-272-C1053	ROAD LONGITUDINAL SECTIONS SHEET 4 OF 5
15-272-C1054	ROAD LONGITUDINAL SECTIONS SHEET 5 OF 5
15-272-C1058	WESTERN BOUNDARY LAYOUT AND SECTIONS
15-272-C1059	SOUTHERN BOUNDARY LAYOUT AND SECTIONS
15-272-C1062	BIO-RETENTION BASIN No.3 DETAIL PLAN SHEET 1 OF 2
15-272-C1063	BIO-RETENTION BASIN No.3 DETAIL PLAN SHEET 2 OF 2
15-272-C1065	BIO-RETENTION BASIN No.5 DETAIL PLAN
15-272-C1066	BIO-RETENTION BASIN No.6 DETAIL PLAN
15-272-C1068	STORMWATER DRAINAGE CATCHMENT PLAN (PRE-DEVELOPED)
15-272-C1069	STORMWATER DRAINAGE CATCHMENT PLAN (POST-DEVELOPED)
15-272-C1070	RETAINING WALL GENERAL ARRANGEMENT PLAN
15-272-C1071	RETAINING WALL PROFILES SHEET 1 OF 7
15-272-C1072	RETAINING WALL PROFILES SHEET 2 OF 7
15-272-C1073	RETAINING WALL PROFILES SHEET 3 OF 7
15-272-C1074	RETAINING WALL PROFILES SHEET 4 OF 7
15-272-C1075	RETAINING WALL PROFILES SHEET 5 OF 7
15-272-C1076	RETAINING WALL PROFILES SHEET 6 OF 7
15-272-C1077	RETAINING WALL PROFILES SHEET 7 OF 7
15-272-C1080	STAGE 1 SERVICES AND UTILITIES COORDINATION PLAN SHEET 1 OF 6
15-272-C1081	STAGE 1 SERVICES AND UTILITIES COORDINATION PLAN SHEET 2 OF 6
15-272-C1082	STAGE 1 SERVICES AND UTILITIES COORDINATION PLAN SHEET 3 OF 6
15-272-C1083	STAGE 1 SERVICES AND UTILITIES COORDINATION PLAN SHEET 4 OF 6
15-272-C1084	STAGE 1 SERVICES AND UTILITIES COORDINATION PLAN SHEET 5 OF 6

15-272-C1085	STAGE 1 SERVICES AND UTILITIES COORDINATION PLAN SHEET 6 OF 6
15-272-C1086	EXISTING TRANSGRID OVERHEAD ELECTRICAL CABLES PLAN
15-272-C1087	EXISTING TRANSGRID OVERHEAD ELECTRICAL CABLES LONGITUDINAL SECTIONS
15-272-C1088	EXISTING TRANSGRID OVERHEAD ELECTRICAL CABLES TYPICAL SECTIONS SHEET 1 OF 2
15-272-C1089	EXISTING TRANSGRID OVERHEAD ELECTRICAL CABLES TYPICAL SECTIONS SHEET 2 OF 2
15-272-C1090	EROSION AND SEDIMENT CONTROL PLAN SHEET 1 OF 7
15-272-C1091	EROSION AND SEDIMENT CONTROL PLAN SHEET 2 OF 7
15-272-C1092	EROSION AND SEDIMENT CONTROL PLAN SHEET 3 OF 7
15-272-C1093	EROSION AND SEDIMENT CONTROL PLAN SHEET 4 OF 7
15-272-C1094	EROSION AND SEDIMENT CONTROL PLAN SHEET 5 OF 7
15-272-C1095	EROSION AND SEDIMENT CONTROL PLAN SHEET 6 OF 7
15-272-C1096	EROSION AND SEDIMENT CONTROL PLAN SHEET 7 of 7
15-272-C1097	EROSION AND SEDIMENT CONTROL DETAILS

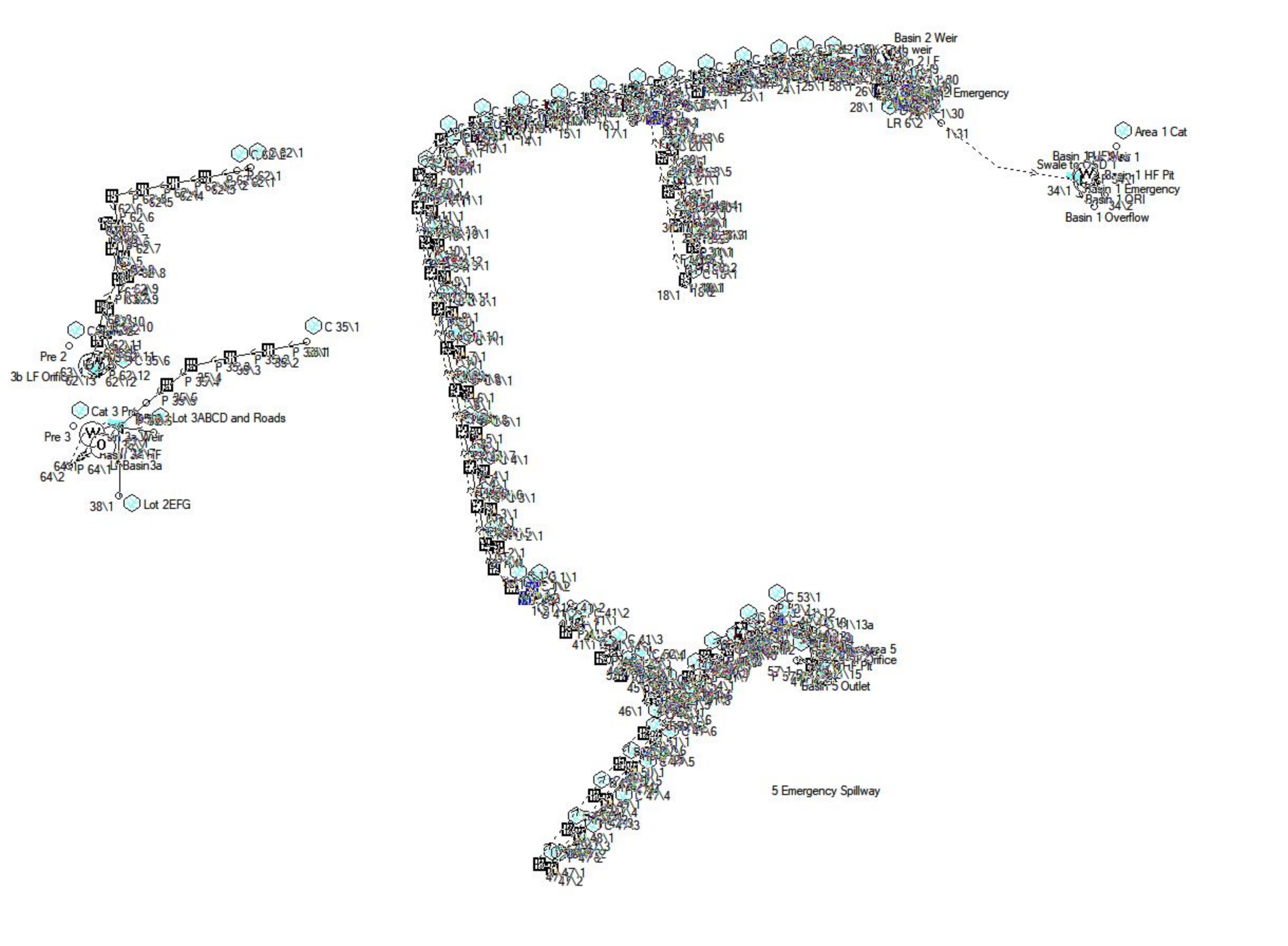
2000 SERIES - STAGE 1 ON-LOT PACKAGE	
DRAWING No.	DRAWING TITLE
15-272-C2000	COVER SHEET
15-272-C2001	DRAWING LIST
15-272-C2002	GENERAL NOTES
15-272-C2003	GENERAL ARRANGEMENT PLAN
15-272-C2010	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 1 OF 15
15-272-C2011	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 2 OF 15
15-272-C2012	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 3 OF 15
15-272-C2013	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 4 OF 15
15-272-C2014	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 5 OF 15
15-272-C2015	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 6 OF 15
15-272-C2016	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 7 OF 15
15-272-C2017	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 8 OF 15
15-272-C2018	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 9 OF 15
15-272-C2019	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 10 OF 15
15-272-C2020	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 11 OF 15
15-272-C2021	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 12 OF 15
15-272-C2022	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 13 OF 15
15-272-C2023	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 14 OF 15
15-272-C2024	SITEWORKS AND STORMWATER DRAINAGE PLAN SHEET 15 OF 15
15-272-C2030	PAVEMENT PLAN

3000 SERIES - WNSLR PACKAGE	
DRAWING No.	DRAWING TITLE
15-272-C3000	COVER SHEET
15-272-C3001	DRAWING LIST
15-272-C3002	GENERAL NOTES
15-272-C3003	GENERAL ARRANGEMENT PLAN
15-272-C3010	TYPICAL ROAD SECTIONS
15-272-C3020	ROADWORKS PLAN AND LONGITUDINAL SECTION SHEET 1 OF 5
15-272-C3021	ROADWORKS PLAN AND LONGITUDINAL SECTION SHEET 2 OF 5
15-272-C3022	ROADWORKS PLAN AND LONGITUDINAL SECTION SHEET 3 OF 5

15-272-C3023	ROADWORKS PLAN AND LONGITUDINAL SECTION SHEET 4 OF 5
15-272-C3024	ROADWORKS PLAN AND LONGITUDINAL SECTION SHEET 5 OF 5
15-272-C3030	ROAD LONGITUDINAL SECTIONS
15-272-C3040	BRIDGE ELEVATION AND TYPICAL SECTION
15-272-C3050	STORMWATER DRAINAGE PLAN SHEET 1 OF 5
15-272-C3051	STORMWATER DRAINAGE PLAN SHEET 2 OF 5
15-272-C3052	STORMWATER DRAINAGE PLAN SHEET 3 OF 5
15-272-C3053	STORMWATER DRAINAGE PLAN SHEET 4 OF 5
15-272-C3054	STORMWATER DRAINAGE PLAN SHEET 5 OF 5
15-272-C3057	STORMWATER DRAINAGE CATCHMENT PLAN (PRE-DEVELOPED)
15-272-C3058	STORMWATER DRAINAGE CATCHMENT PLAN (POST-DEVELOPED)
15-272-C3060	BIO-RETENTION BASIN No.1 DETAIL PLAN
15-272-C3070	PAVEMENT PLAN SHEET 1 OF 5
15-272-C3071	PAVEMENT PLAN SHEET 2 OF 5
15-272-C3072	PAVEMENT PLAN SHEET 3 OF 5
15-272-C3073	PAVEMENT PLAN SHEET 4 OF 5
15-272-C3074	PAVEMENT PLAN SHEET 5 OF 5
15-272-C3075	LEAD IN POTABLE WATERMAIN PLAN
15-272-C3080	RETAINING WALL PLAN AND ELEVATION
15-272-C3081	RETAINING WALL SECTIONS SHEET 1 OF 4
15-272-C3082	RETAINING WALL SECTIONS SHEET 2 OF 4
15-272-C3083	RETAINING WALL SECTIONS SHEET 3 OF 4
15-272-C3084	RETAINING WALL SECTIONS SHEET 4 OF 4
15-272-C3090	WNSLR AND LOCKWOOD RD INTERSECTION VEHICLE TURNING PATH PLAN SHEET 1
15-272-C3091	WNSLR AND LOCKWOOD RD INTERSECTION VEHICLE TURNING PATH PLAN SHEET 2
15-272-C3092	WNSLR AND LOCKWOOD RD INTERSECTION VEHICLE TURNING PATH PLAN SHEET 3
15-272-C3093	WNSLR AND ROAD No.1 INTERSECTION VEHICLE TURNING PATH PLAN SHEET 1
15-272-C3094	WNSLR AND ROAD No.1 INTERSECTION VEHICLE TURNING PATH PLAN SHEET 2

Appendix C

DRAINs Model

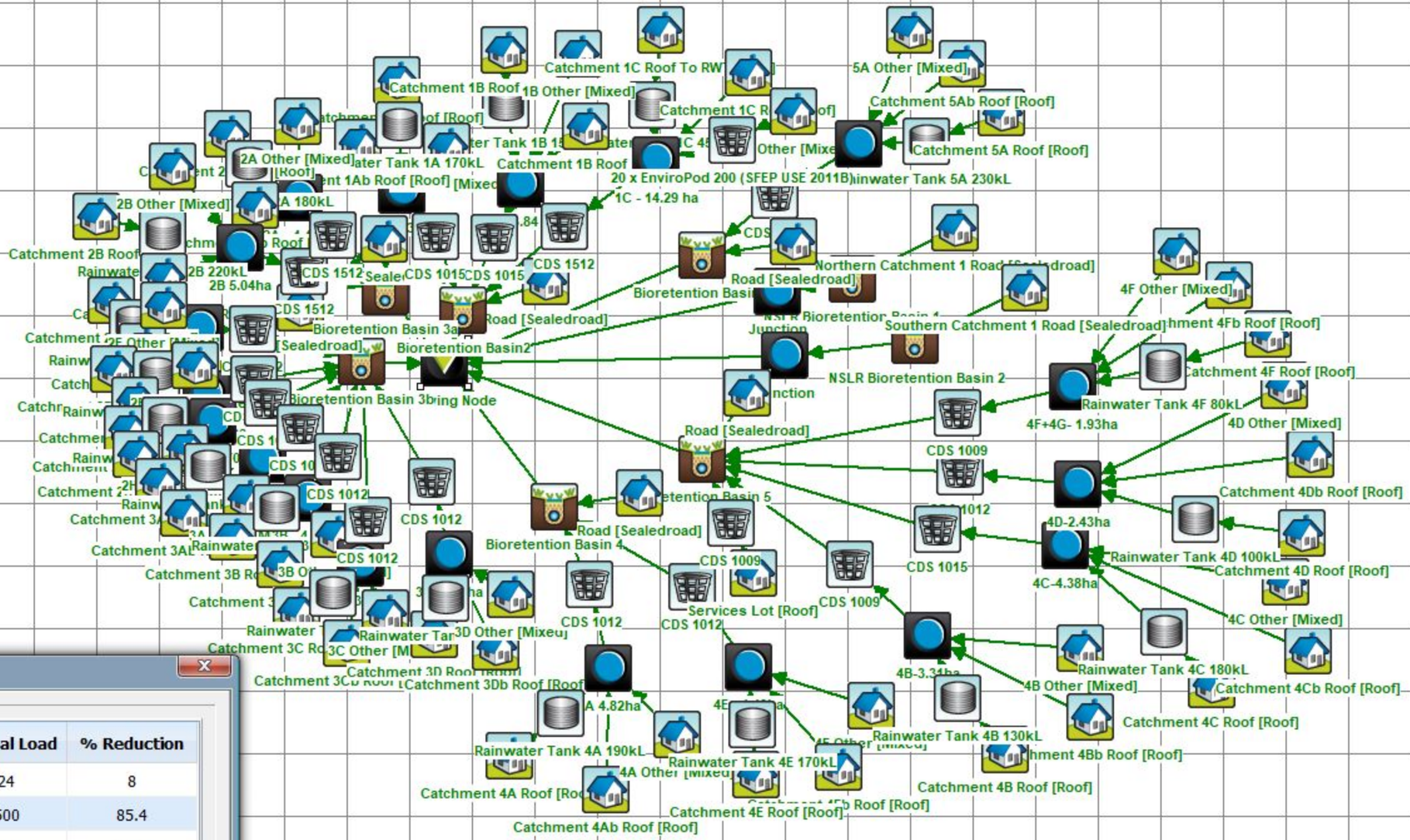

Basin 2 Weir
Emergency
Area 1 Cat
Basin 1 HF Pit
Basin 1 Emergency
Basin 1 ORI
Basin 1 Overflow
C 35\1
Pre 2
3b LF Orifice
Cat 3 Pre
Lot 3ABCD and Roads
Pre 3
Basin3a
Lot 2EFG
C 53\1
Basin 5 Outlet
5 Emergency Spillway

Worst case major storm

Worst case minor storm

Appendix D

MUSIC Model & Results



Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	570	524	8
Total Suspended Solids (kg/yr)	65000	9500	85.4
Total Phosphorus (kg/yr)	144	53.7	62.7
Total Nitrogen (kg/yr)	1270	635	49.8
Gross Pollutants (kg/yr)	16400	154	99.1

Appendix E

Proposed Service Strategy Drawings

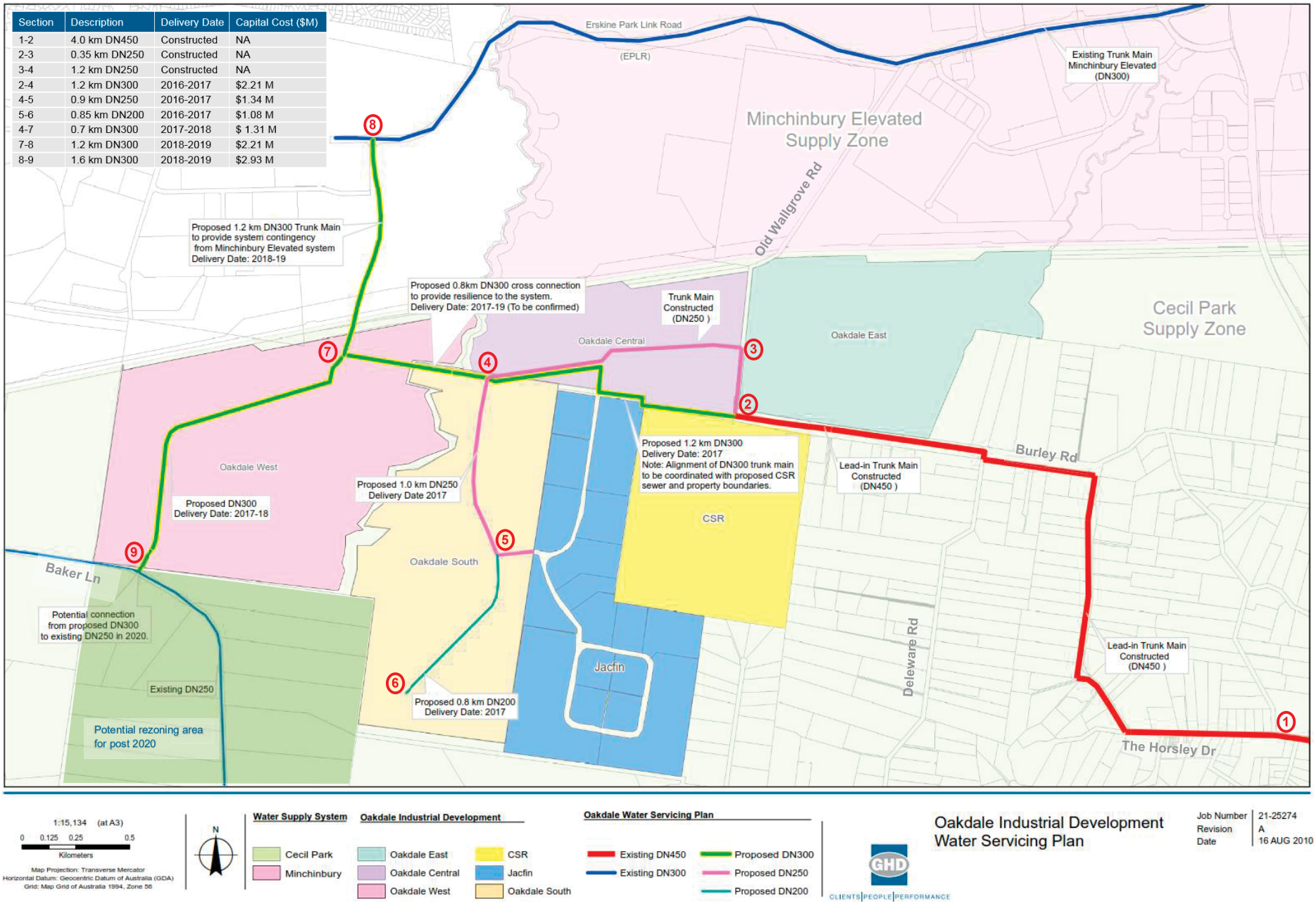


Figure 2- Oakdale Industrial Water Servicing Plan

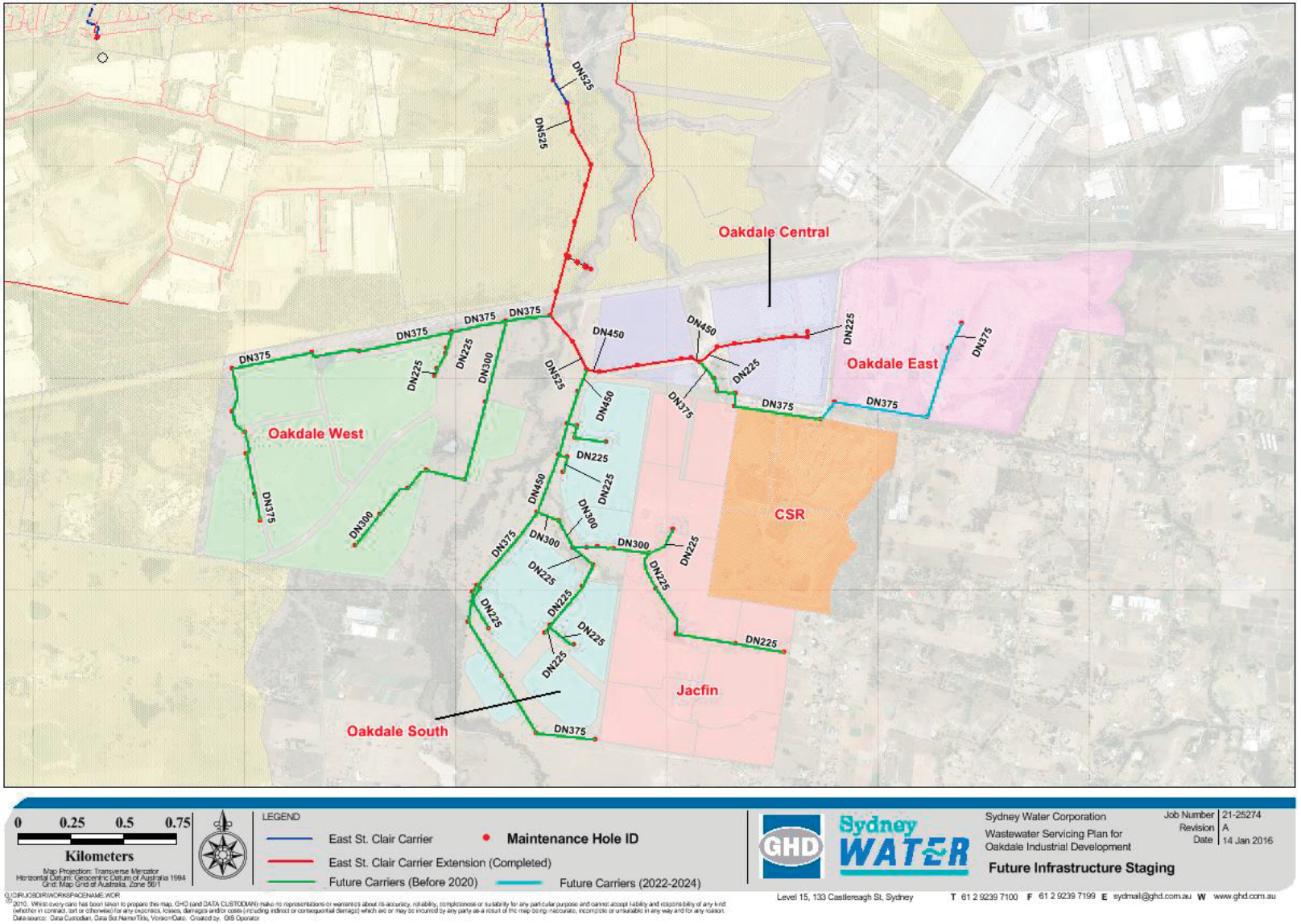


Figure 6 Future Infrastructure Staging

Appendix F

Extract from Sydney Water LASP

Oakdale Industrial Development - Planning of Water Related Services

Final Report - Wastewater

July 2016

GHD Disclaimer

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The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

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Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Rev. 01	M Hossain	M Healey		M Healey		5/05/16
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Rev 03	M Hossain	M Hossain		M Healey		30/06/16

Document Status

Oakdale Industrial Development June 2016

This report has been prepared by GHD

Approved for Issue

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Kym Dracopoulos		Russell Hogan		Amir Rashidi	
Manager, Technical		Project Manager		Project Manager	
Goodman Property Services (AUST) Pty Ltd		AT&L Associates		GHD	

Endorsed

I confirm that impacted parties within my business have been consulted, their inputs have been considered and the decisions have been communicated to relevant parties.

Signature	Date	Signature	Date
VSamarasinghe	20/07/16	R Schuil	20/7/16
Vajira Samarasinghe		Richard Schuil	
Principal Planner		Engineering & Planning Manager	
Engineering & Environmental Services		Growth Centres	
Sydney Water		Sydney Water	

Approved

Signature	Date
	27/7/16
Jim Price	
Development Services Officer	
Liveable City Solutions	
Sydney Water	

Executive Summary

The Oakdale industrial site is part of the existing Western Sydney Employment Area (WSEA 8 – Area South of Pipeline Precinct), located approximately 40 kms west of the Sydney CBD, adjacent to the M7 and M4 intersection. The site was rezoned in September 2009 through the WSEA SEPP 2009, and Goodman is the lead developer of the precinct. An overview of study area is presented in Figure 1

The Oakdale industrial site wastewater system can be served through extensions connecting into the St Marys Sewerage Network via the East St Clair carrier. The extension of East St Clair Carrier is complete. Following completion of the last section of the East St Clair carrier extension the remainder of wastewater servicing work will be within the Oakdale site itself and will comprise extension of site sewer reticulation works. An overview of East St Clair carrier is presented in Figure 2.

This Local Area Servicing Plan (LASP) for wastewater has been prepared at the request of Sydney Water to provide a servicing strategy for the existing WSEA Precinct No.8 – Area South of Pipeline, including Goodman's Oakdale Development. This servicing strategy identifies the Sydney Water infrastructure required to service the Oakdale Precinct, anticipated costs, sizing, preliminary alignment and trigger points (i.e. development timing and staging) for delivery of wastewater infrastructure to service the Oakdale Precinct.

GHD have also undertaken wastewater modelling of the East St. Clair Carrier Extension and wastewater system within the Oakdale industrial development to ensure compliance with Sydney Water's performance requirements.

The hydraulic assessment determined that there were no fundamental issues with the design of the East St. Clair Carrier Extension.

System Performance Assessment

Almost all the carriers servicing Oakdale industrial development and the downstream trunk sewers meet dry weather performance criteria under both 2020 and 2036 flow condition with exception of a small number of sewers which marginally fail to meet the criteria. However, these are not considered severe enough to warrant augmentation.

The system within the Oakdale industrial development and the downstream trunk system will comply with the wet weather overflow frequency limit of 35 overflows in 10 years for the 2036 planning horizon.

However, the overall wet weather performance of St Marys system for existing and all future milestones exceeds the system licence limit of 35 overflows in 10 years (40 events in existing and 50 events in 2036 scenario). Although there is no direct impact to the branch which receives flow from Oakdale developments, as a system there is an issue.

The number of bypass events at the St Marys WWTP remains within the licence limit of 153 events in 10 years for the 2036 planning horizon. The existing system performance is 100 bypass events in 10 years and in 2036 will increase to 142 bypass events in 10 years.

The 2014 GSS recommended the upgrade of downstream pumping station SP0204 meets the minimum detention time of 4 hours for 2036 flow condition.

Growth forecast

Oakdale Estate is an ongoing industrial development with approximately 452 nett hectares of developable area. This includes Goodman, CSR and Jacfin lands. These lands are predominately zoned IN1 'General Industrial' under the State Environmental Planning Policy (Western Sydney Employment Area) 2009. The site spans two local government areas of Penrith and Fairfield.

The growth projections listed for this study are supplied by AT&L in conjunction with Jacfin, CSR and Goodman. Growth projections within the Oakdale Industrial Development are summarised in Table 1.

Table 1 Growth Projections

Development site	Nett Development (ha)	Development type	Connection [1]
Oakdale Central	45.2	IN1 – General Industrial	2016-2017
Jacfin	87.8	IN1 – General Industrial/ Residential	2016-2017
Oakdale South	70.2	IN1 – General Industrial	2017-2019
CSR	63.4	IN1 – General Industrial	2017-2020
Oakdale West	90.5	IN1 – General Industrial	2019-2021
Oakdale East	95.0	IN1 – General Industrial	2022-2024
Grand Total	**452**		

The calculated wastewater loads for the Oakdale Industrial Development are presented below within Table 2.

Table 2 Summary of Wastewater Loads - Oakdale Industrial Development

Development site	EP	Average Dry Weather Flow (ML/d)
Oakdale South	6,581	0.99
Oakdale West	8,906	1.34
Oakdale East	8,480	1.27
Oakdale Central	4,236	0.64
Jacfin	6,960	1.04
CSR	4,866	0.73
Total	40,028	6.00

The preliminary capital cost estimates associated with Oakdale Industrial wastewater servicing is presented below in Table 3.

Table 3 Required Infrastructure to Service the Development Areas

Development Site	Timing	Capital Cost ($M)	Gravity Sewer Length (m)			
			DN225	DN300	DN375	DN450
Oakdale Central	2016-2017	1.6	-	-	728	-
Oakdale East	2022-2024	2.2	-	-	1,018	-
Oakdale West	2019-2020	7.8	227	1,472	2,317	-
Oakdale South	2017-2019	7.4	1,271	453	1,246	715
Jacfin	2016-2017	2.0	1,124	168		
CSR	2017-2020	0.9			415	
Total	**2016-2024**	**21.9**	**2,622**	**2,093**	**5,724**	**715**

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Appendices

1. Introduction

1.1 Background

The Oakdale industrial site is part of the existing Western Sydney Employment Area (WSEA 8 – Area South of Pipeline Precinct), located approximately 40 kms west of the Sydney CBD, adjacent to the M7 and M4 intersection, adjacent south to the Eastern Creek Precinct and Warragamba Water Pipeline at Horsley Park. The site was rezoned in September 2009 through the WSEA SEPP 2009, and Goodman is the lead developer of the precinct. An overview of study area is presented in Figure 1.

The Oakdale industrial site wastewater system can be served through extensions connecting into the St Marys Sewerage Network via East St Clair carrier. The extension of East St Clair Carrier is in progress. Following completion of the last section of the East St Clair carrier extension the remainder of wastewater servicing work will be within the Oakdale site itself and will comprise extension of site sewer reticulation works. An overview of East St Clair carrier is presented in Figure 2.

Assets required to service proposed Goodman, Jacfin and CSR developments at Oakdale are to be staged to meet development timeframes, with lead-in infrastructure funded up front and delivered by the lead developer and to be reimbursed by Sydney Water in accordance with its policy on Funding Infrastructure to Service Growth.

1.2 Purpose of this report

The purpose of this report is to demonstrate that the proposed development can be serviced by the East Clair carrier with the wastewater infrastructure detailed and document the expected performance of the wastewater system.

This Local Area Servicing Plan (LASP) for wastewater has been prepared at the request of Sydney Water to provide a servicing strategy for the existing WSEA Precinct No. 8 – Area South of Pipeline, including Goodman's Oakdale Development. This servicing strategy identifies the Sydney Water infrastructure required to service the Oakdale Precinct, anticipated costs, sizing, preliminary alignments and trigger points (i.e. development timing, staging & timing of connection to SWC network) for the delivery of wastewater infrastructure required to service the Oakdale Precinct.

1.3 Scope

The scope of the wastewater modelling is to:

- Assess the current design of the East St. Clair Carrier Extension and wastewater system within the Oakdale industrial development and the downstream trunk sewers for 2020 and 2036 growth scenarios.

The assessment examined a range of performance requirements including:

- Dry weather performance (Hmax/d)
- Carrier performance in wet weather design storm (35th largest rainfall event within the 10 year rainfall series)
- Constructed overflow and maintenance hole spilling performance based on a 10 year long term model simulation.
- Dry weather contingency storage of downstream pumping station SP0204.

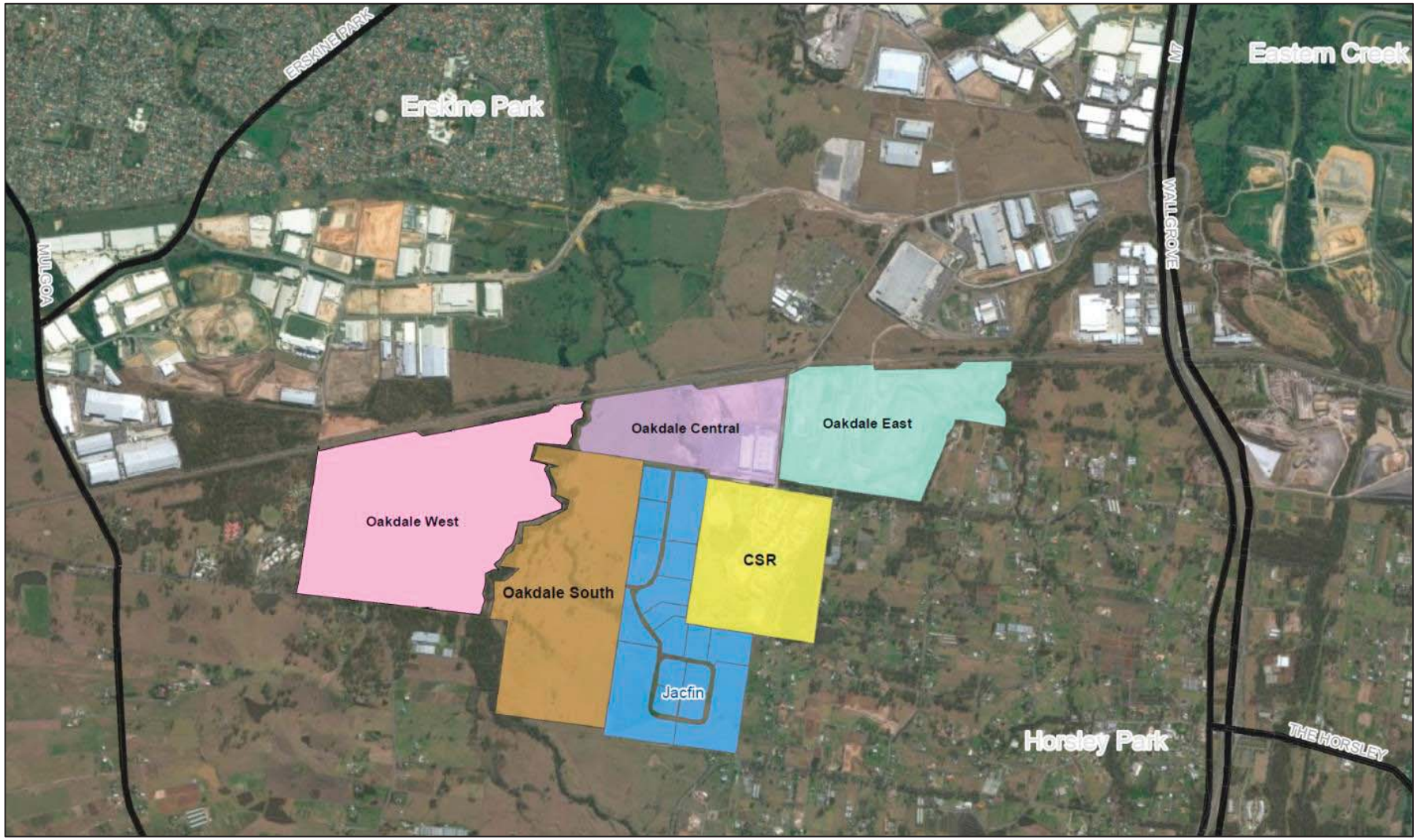


Figure 1 Oakdale Industrial Development Overview

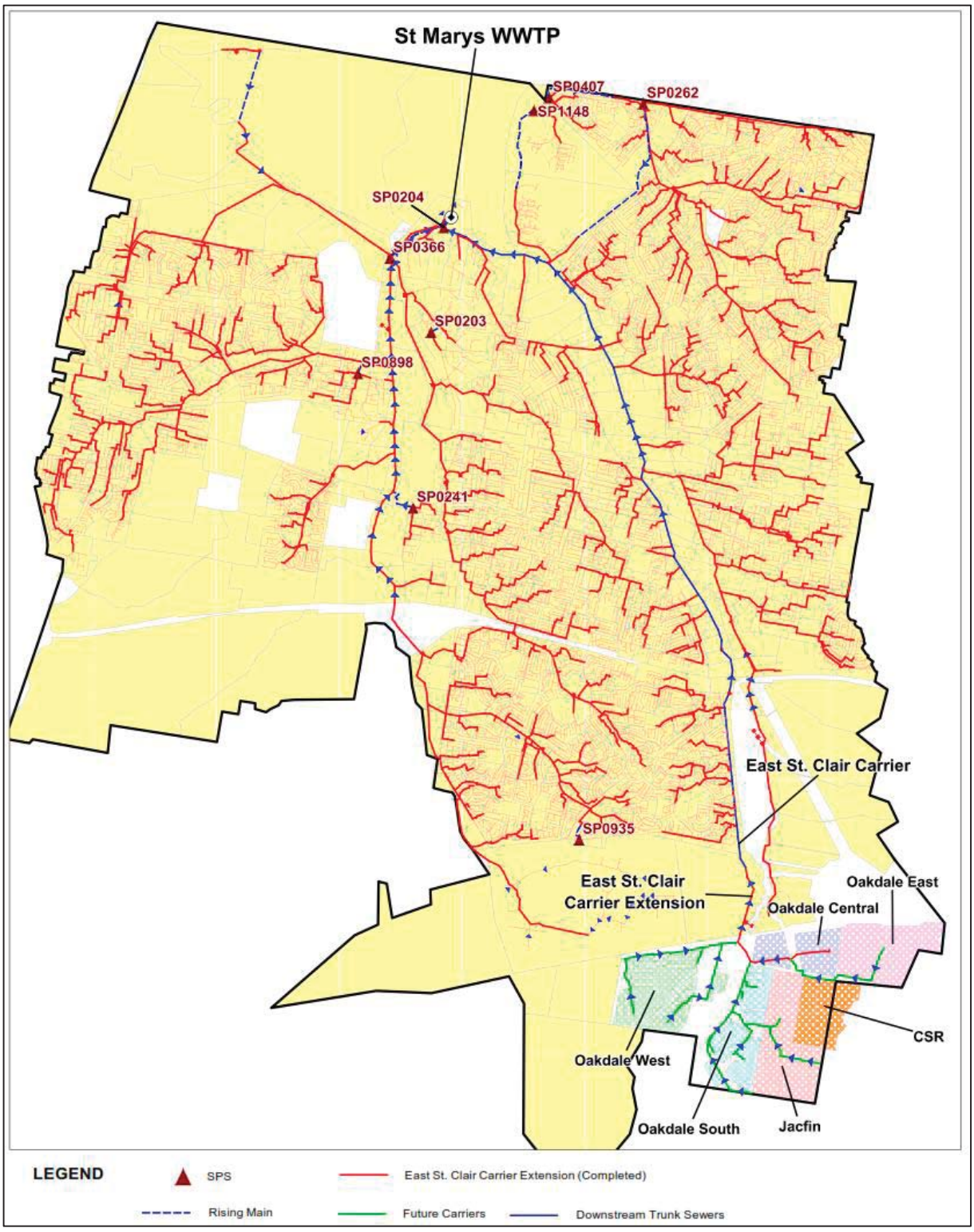


Figure 2 Overview of East St Clair carrier

2. Summary of Growth

This section provides details of growth projections within the study area including the expected timing, and scale of growth.

2.1 Growth

Growth forecasts are a key input into the planning process and provide an insight into future infrastructure needs as well as future capital investment needs.

Oakdale Estate is an ongoing industrial development with approximately 452 nett hectares of developable area. This includes Goodman, CSR and Jacfin lands. These lands are predominately zoned IN1 'General Industrial' under the State Environmental Planning Policy (Western Sydney Employment Area) 2009. The site spans two local government areas of Penrith and Fairfield.

The growth projections listed for this study are supplied by AT&L in conjunction with Jacfin, CSR and Goodman. The list of the growth projection within the Oakdale Industrial Development is summarised in Table 4.

Table 4 Growth Projections

Development site	Precinct	Nett Development (ha)	Development type	Connection
Oakdale South	1	18.8	IN1-General Industrial	2017-2018
	2	4.4		2018
	3	16.5		2017-2019
	4	9.5		2019
	5	14.0		2017
	6	7.0		2019
	Total	**70.2**		
Oakdale East	1	95.0	IN1-General Industrial	2022-2024 (1)
Oakdale West	1	21.7		2019
	2	21.6		2019-2020
	3	18.5		2020
	4	22.6		2020-2021
	5	6.1		2020
	Total	**90.5**		
Oakdale Central	1A	4.1	IN1-General Industrial	Built
	1B	5.9		Built
	1C	4.6		Q1-2016
	2A	7.5		Built

Development site	Precinct	Nett Development (ha)	Development type	Connection
	2B	6.0		Q1-2016
	3A	1.6		2017
	3B	5.8	IN1-General Industrial	Q4-2016
	3C	5.6		2017
	3D	1.9		2017
	Lot 4	2.2		2017
	Total	**45.2**		
Jacfin [2]	1	3.6	IN1-General Industrial	2016
	2	17.4		2016
	3	21.6		2017
	4	25.7	RU4-Rural Residential	2016
	5	19.5		2016
	Total	**87.8**		
CSR	1	10.1	IN1-General Industrial	2017
	2	20.8		2018
		11.5	Environmental /Open Space	
	3	21.0	IN1-General Industrial	2020 [1]
	Total	**63.4**		
Grand Total		**452**		

Note 1: The timeframes are subject to change

Note 2: Sydney Water has queried growth forecasts shown above for Jacfin lands noting that these growth forecasts appear optimistic in consideration of current market demands, comparison growth forecasts for surrounding developers, Jacfin current and required approvals and construction requirements. Jacfin however have reconfirmed these growth forecasts and hence this report and modelling has been completed on this basis,

Note 3: The above growth projections have been provided by the following:

Developer	Contact(s) - Role	Received	Date received
CSR	Wayne Pasalich – CSR Senior Development Manager	Via Email	1st March 2016
Jacfin	Emma Sunderland – Calibre Consulting on behalf of Jacfin	Via Email	29th Feb 2016
Goodman	Richard Seddon – Goodman Development Manager	Via Email	29th Feb 2016

3. Forecast Wastewater Loads

The following outline of wastewater discharge provides predicted Average Dry Weather Flow (ADWF) based on projected development loads.

The following broad assumptions were used to develop the estimate of discharge.

- 15 residential lots per gross hectare of nominated residential area within the development.
- 3.5 EP per residential lot and
- 75 EP per gross hectare of non-residential development derived from Wastewater Network Growth Servicing Strategy Criteria and Guideline 2012. (i.e. Assume Gross hectare = 1.25 × net hectares)

The Oakdale Industrial wastewater loads summarised in Table 5.

Table 5 Summary of Wastewater Loads - Oakdale Industrial Development

Development site	EP	Average Dry Weather Flow (ML/d)
Oakdale South	6,581	0.99
Oakdale West	8,906	1.34
Oakdale East	8,480	1.27
Oakdale Central	4,236	0.64
Jacfin	6,960	1.04
CSR	4,866	0.73
Total	40,028	6.00

4. Wastewater System Performance

4.1 Acceptable Dry Weather System Performance (2020 & 2036)

Wastewater system modelling indicates that there is no discharge occurrence in any part of the entire St Marys system including the new developments in Oakdale during dry weather for both 2020 and 2036 flow condition.

Modelling also shows that almost all the carriers servicing Oakdale industrial development and the downstream trunk sewers meet dry weather flow depth criteria (Hmax/d<0.6) under both 2020 and 2036 flow condition with exception of a small number of sewers where Hmax/d marginally exceed the value of 0.6. The dry weather system performance for 2020 and 2036 scenario is shown in Figure 3 and Figure 4 respectively.

In the 2020 flow condition, there are four sections of sewer on East St. Clair Carrier Extension that marginally exceeds the dry weather performance criteria as have flow depth ratio (Hmax/D) varies between 0.60 to 0.65. There is one section on the downstream East St. Clair Carrier that has a flow depth ratio (Hmax/D) of 0.65 in 2020 flow condition.

In 2036, there are five more sections on East St. Clair Carrier Extension and three more sections on the downstream East St. Clair Carrier that exceed the flow depth ratio (Hmax/D) of 0.6. Hmax/d value on East St. Clair Carrier Extension vary from 0.64 to 0.76 and on the downstream East St. Clair Carrier vary from 0.62 to 0.75. The Hmax/d values of all the sewers servicing Oakdale industrial development and the downstream trunk sewers are presented in Appendix D.

The sections on East St. Clair Carrier Extension which exceed the flow depth ratio (Hmax/D) of 0.6 are already been constructed. Also the Hmax/D values are only marginally higher than 0.6 and are not considered severe enough to warrant augmentation.

HGL along East St. Clair Carrier Extension and downstream East St. Clair Carrier in 2020 and 2036 PDWF condition is shown in Appendix E.

4.2 Dry Weather Emergency Storage (2020 & 2036)

Modelling indicates that the downstream pumping station SP0204 fails to meet the minimum detention time of 4 hours for 2020 and 2036 flow condition. This pumping station will have a detention time of only 0.9 and 0.8 hours for the year 2020 and 2036 respectively. From an earlier 2014 GSS study, this station was found to have a detention time of only 1.50 hours for the existing (2011) scenario.

SP0204 have a standby pump to manage any mechanical failure. But It does not have dual power supply although have provision for installing generator.

SP0366 dual power supply recommended in GSS report has now been installed. With the dual power feeder at SP0366, cross connection valve will open automatically should signal from SP0204 fail. This will allow storage at SP0366 to be utilised should SP0204 fail and increase detention time of SP0204 to 4 hours in 2036 flow condition.

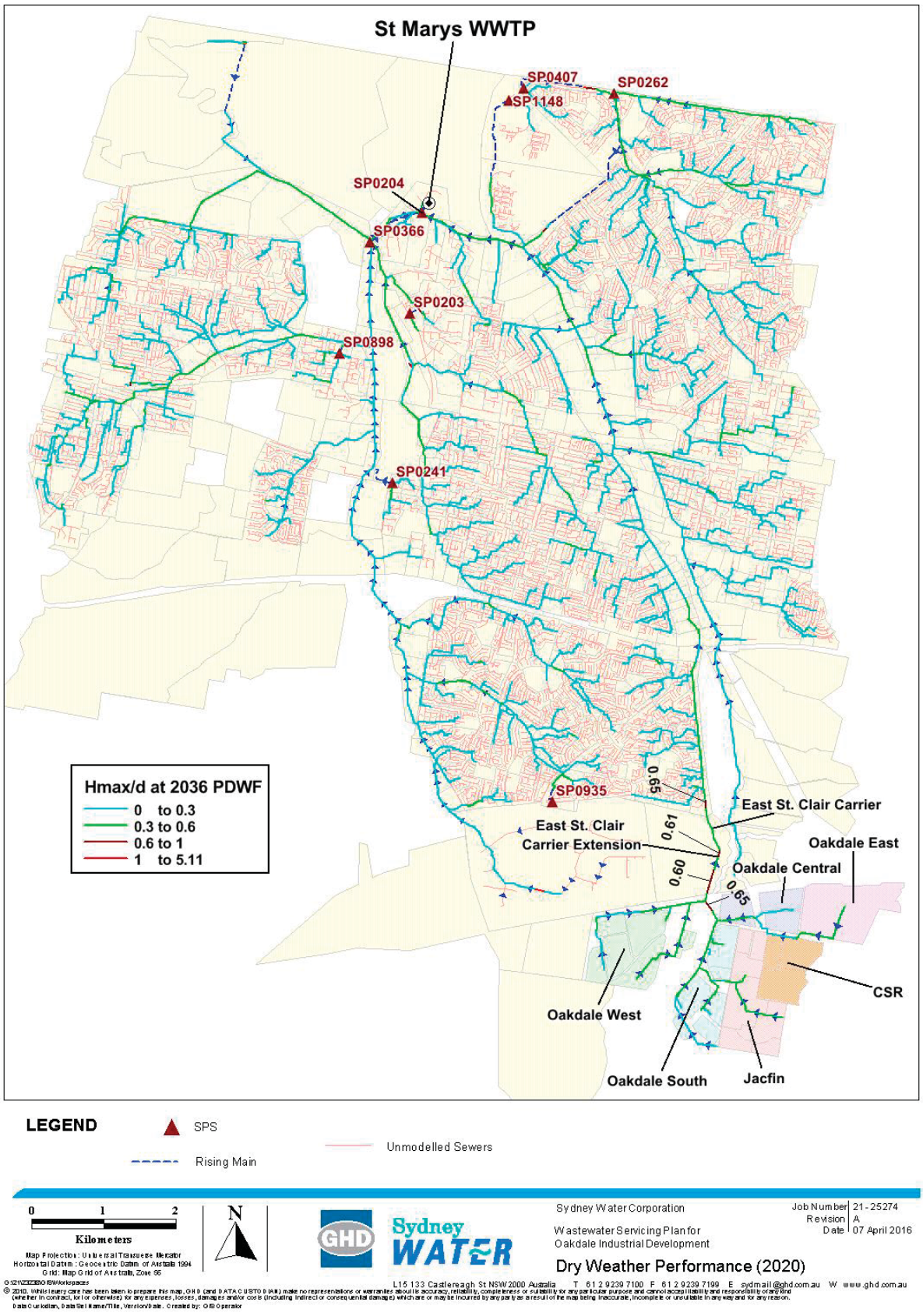


Figure 3 Dry Weather Performance (2020)

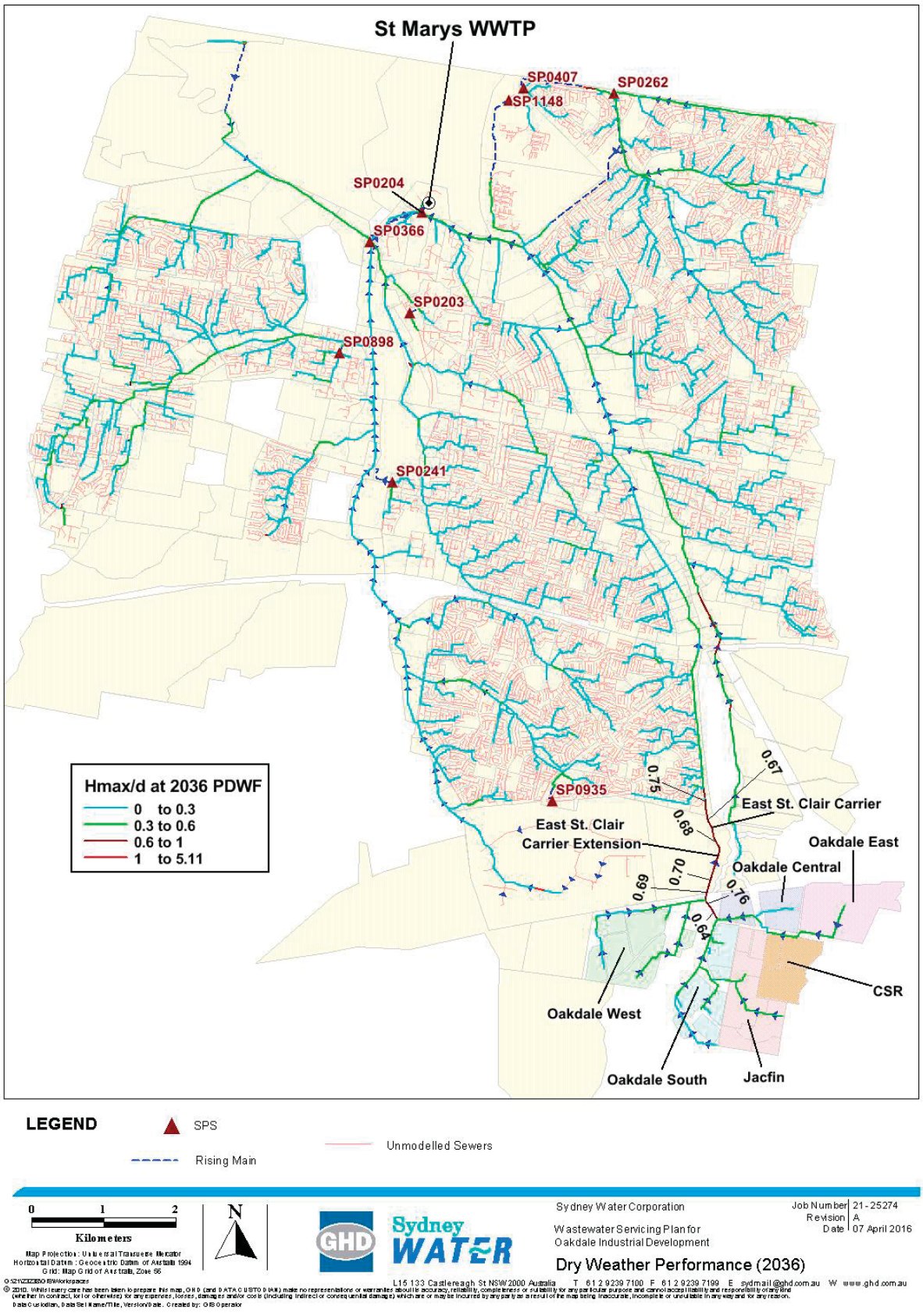


Figure 4 Dry Weather Performance (2036)

4.3 Acceptable Wet Weather System Performance (2036)

The 2010-2015 Environment Protection Licence (EPL) for the St Marys Sewerage Treatment System limits the wet weather overflow frequency to 35 overflows in 10 years. The new license for 2015-2020 is still under negotiation with the EPA. The modelling shows that the system within the Oakdale industrial development and the downstream trunk system will comply with this limit for the 2036 planning horizon. The wet weather performance of the designed overflows and the activated maintenance holes within the Oakdale industrial development and the downstream trunk system in 2036 is presented in Table 6 and Figure 5.

The design wet weather event (35th largest rainfall event within the 10 year rainfall series) corresponds to the overflow frequency limit in the EPL. The modelling shows that the system within the Oakdale industrial development and the downstream trunk system have sufficient capacity in the design wet weather event. The HGL along East St. Clair Carrier Extension and downstream East St. Clair Carrier in the design wet weather event is shown in Appendix E.

However it should be noted that the overall wet weather performance of St Marys system for existing and all future milestones exceeds the system licence limit of 35 overflows in 10 years. The existing system performance is 40 events in 10 years, and in 2036 the system performance will increase to 50 events in 10 years. Although there is no direct impact to the branch which receives flow from Oakdale developments.

The number of bypass events at the St Marys WWTP remains within the licence limit of 153 events in 10 years for the 2036 planning horizon. The existing system performance is 100 bypass events in 10 years and in 2036 will increase to 142 bypass events in 10 years.

Table 6 Wet Weather Performance (2036)

Location	Maintenance Hole ID	Overflow Events/10 Years	Volume (M3/yr)
Designed Overflows			
East St. Clair Carrier Extension	NEWMH06	7	842
East St. Clair Carrier	1394290	17	616
Ropes Creek Carrier Sec.6	1066026	11	157
Ropes Creek Carrier Sec.3	1281835	10	3,364
Ropes Creek Carrier Sec.1	1280786	14	19,017
Ropes Creek Carrier Sec.1	1282022	20	19,531
SPS204 Inlet	1404019	22	729
Maintenance Holes			
East St. Clair Carrier	NEWMH01	3	10
East St. Clair Carrier Extension	NEWMH09	2	9
East St. Clair Carrier Extension	NEWMH10	2	33
Oakdale South	NEWMH40	1	0.02
Jacfin Extension	NEWMH86	4	44

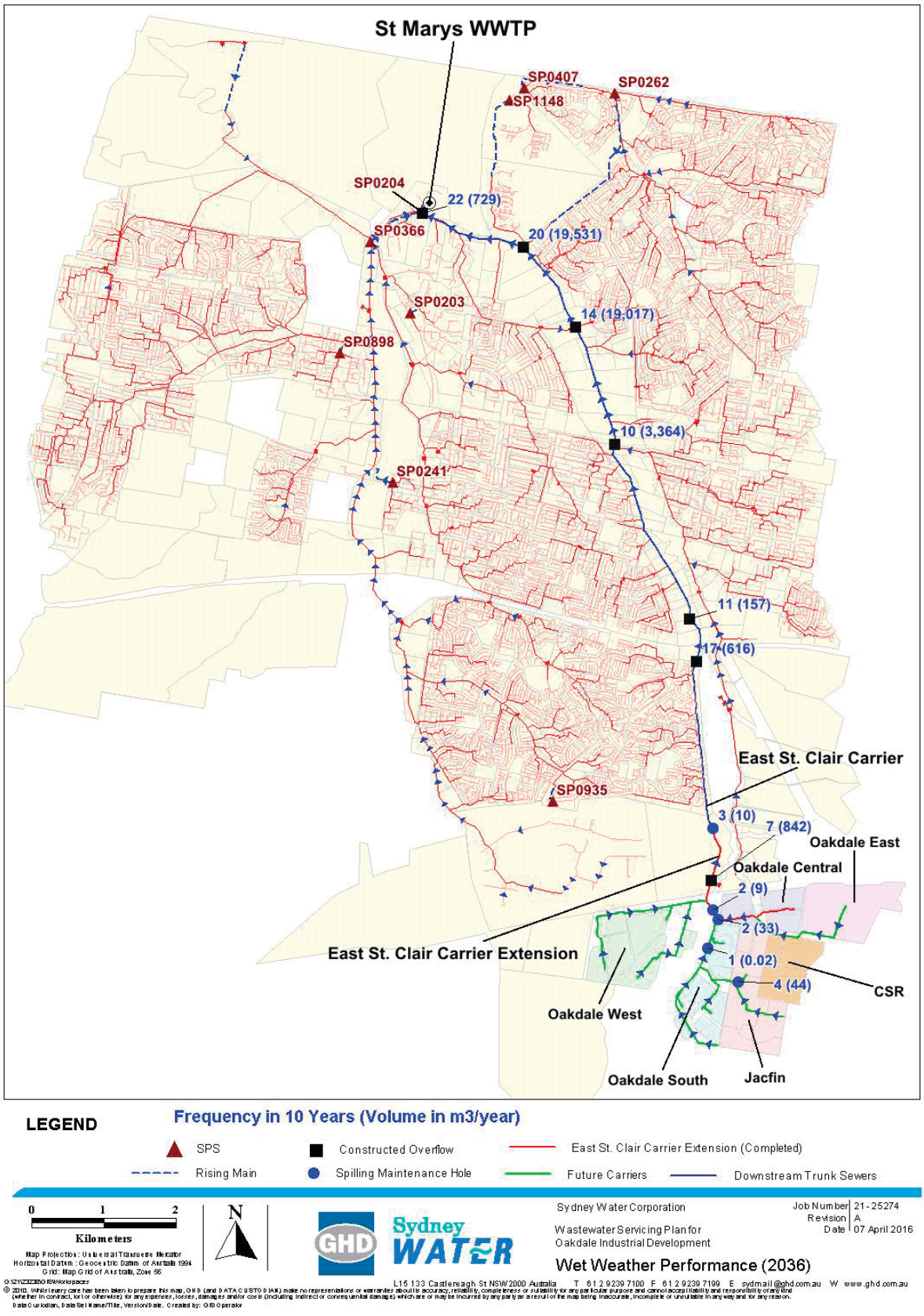


Figure 5 Wet Weather Performance (2036)

4.4 Conclusion

- Almost all the carriers servicing Oakdale industrial development and the downstream trunk sewers meet dry weather flow depth criteria (Hmax/d<0.6) under both 2020 and 2036 flow condition with exception of a small number of sewers where Hmax/d marginally exceed the value of 0.6. However these are not considered severe enough to warrant augmentation.
- The system within the Oakdale industrial development and the downstream trunk system will comply with the wet weather overflow frequency limit of 35 overflows in 10 years for the 2036 planning horizon.
- The overall wet weather performance of St Marys system for existing and all future milestones exceeds the system licence limit of 35 overflows in 10 years (40 events in existing and 50 events in 2036 scenario).
- The number of bypass events at the St Marys WWTP remains within the licence limit of 153 events in 10 years for the 2036 planning horizon. The existing system performance is 100 bypass events in 10 years and in 2036 will increase to 142 bypass events in 10 years.
- With 2014 GSS recommended upgrade the downstream pumping station SP0204 will meet the minimum detention time of 4 hours for 2036 flow condition.

5. Staging Plan for Future Infrastructure

The staging for the future gravity sewers will be in line with the proposed timing of the development. Sydney Water Cost Estimation tool employed in order to estimate the preliminary capital cost for each development.

The infrastructure required to service the new development areas along with their proposed timing and cost is presented in Table 7 and in Figure 6.

Table 7 Required Infrastructure to Service the Development Areas

Development Site	Timing	Capital Cost ($M)	Gravity Sewer Length (m)			
			DN225	DN300	DN375	DN450
Oakdale Central	2016-2017	1.6	-	-	728	-
Oakdale East	2022-2024	2.2	-	-	1,018	-
Oakdale West	2019-2020	7.8	227	1,472	2,317	-
Oakdale South	2017-2019	7.4	1,271	453	1,246	715
Jacfin	2016-2017	2.0	1,124	168		
CSR	2017-2020	0.9			415	
Total	**2016-2024**	**21.9**	**2,622**	**2,093**	**5,724**	**715**

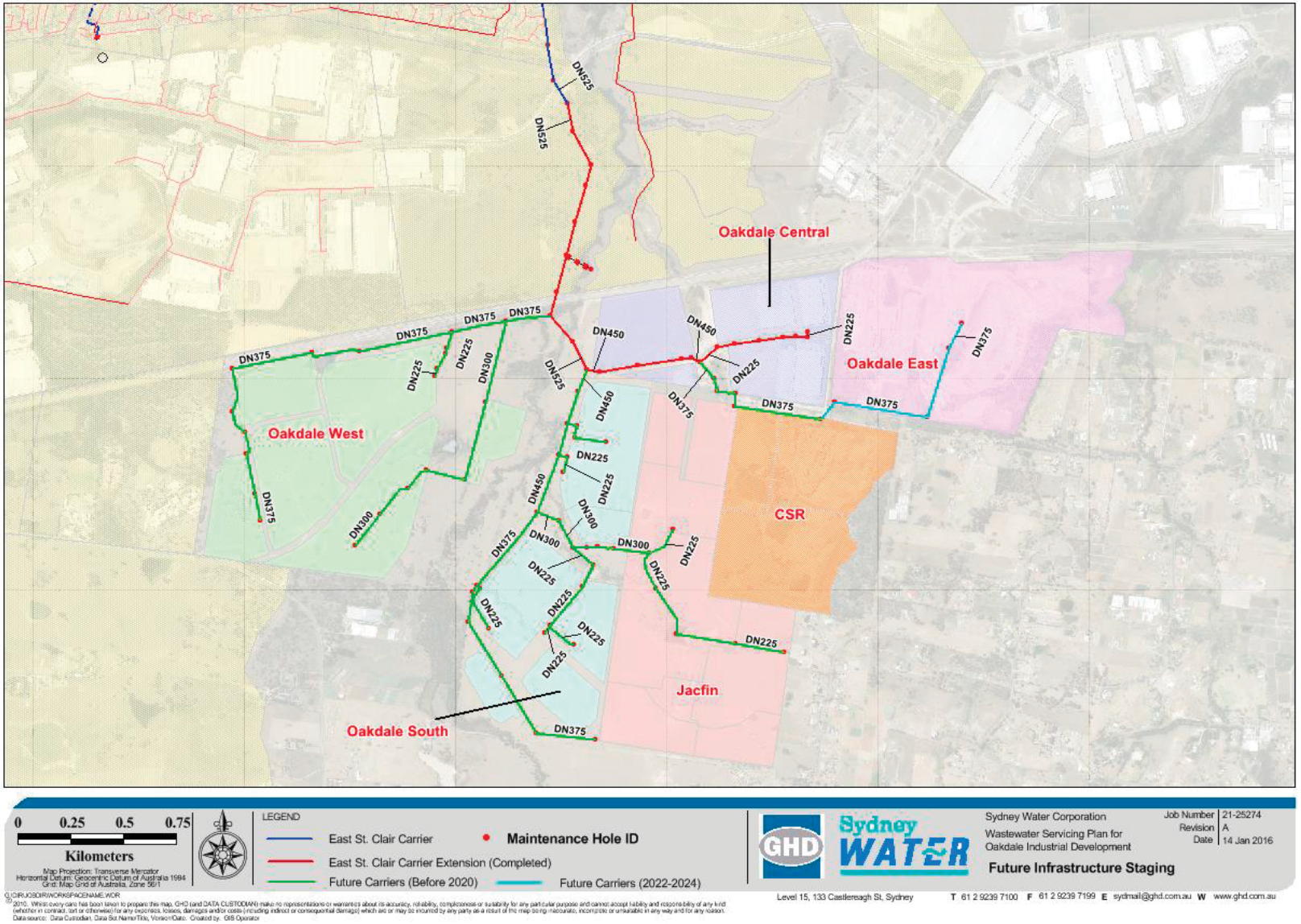


Figure 6 Future Infrastructure Staging

Appendices

Appendix A – Wastewater Planning Criteria

This Appendix details the planning criteria to be adopted for the wastewater component of the project. The following documents, referenced in Table 8, were consulted in developing the wastewater planning criteria:

Reference 1 Hydraulic Design Guidelines for Wastewater System Detail Planning, Sydney Water Corporation, June 2010

Reference 2 Sewerage Code of Australia (WSA-02-2002.2.2 – Sydney Water Edition 1, Version 3)

Reference 3 Sewage Pumping Station Code (WSA 04-2005-2.1, Sydney Water edition 1)

Reference 4 Wastewater Network Growth Servicing Strategy – Criteria and Guidelines 2012

Reference 5 Pressure Sewerage Code of Australia (WSA 07-2007 Version 1.1)

Reference 6 Wastewater Network Growth Servicing Strategy Criteria and Guideline (2012)

Table 8 Wastewater Planning Criteria

Item	Design Criteria	Units	Wastewater	Source
Growth forecasts (future growth areas)				
Residential	Equivalent Population (Dwellings)	EP	Future residential dwellings growth forecast within Oakdale industrial site to be obtained from agreed growth forecast provided and endorsed by Sydney Water. An occupancy ratio of 3.5 EP/dwelling to be used	Reference 6
Light Industrial	Equivalent Population	EP/ Gross Ha	75	Reference 6
Commercial	Equivalent Population	EP/ Gross Ha	75	Reference 6
Model validation				
Wastewater system models	Model performance	N/A	Scenarios to be modelled are for 2020 and 2036 planning horizons. Use St. Marys Jacfin project model, run code: SMJA as 2036 base model. This model is endorsed by Sydney Water for use. Remove the preferred GSS options (2036) of storages and pipe duplications from this model. The extension of East St Clair Carrier will be incorporated as per the concept design (Case No: 134866WW) For 2020 base model, update SMJA with dry and wet	Sydney Water

Item	Design Criteria	Units	Wastewater	Source
			weather parameters from 2020 GSS model , run code SMSC located in: P:\GSS2013-14WW\STS\StMarys\Network\Sewer Update the future growth within Oakdale industrial site using the endorsed growth forecast.	
Dry weather flow loading from future growth				
Residential and commercial dry weather flow loading from future growth	Wastewater flow rate	L/EP/day	150 L/capita/day for detailed planning for new development sites. Diurnal curve adopted is RES1.	Reference 1
Dry weather flow loading from existing properties				
Existing res and com dry weather flow loading	Wastewater flow rate	L/EP/day	No reduction in residential and commercial flow rates for the existing properties in future scenarios as advised by Sydney Water	Sydney Water
Rainfall dependent inflow & infiltration (RDII) from new growth areas				
Existing development and sewerage networks	Flow rate/ growth area	% I/I	Low infiltration sewerage system. Assume 2% I/I over 20 years.	Reference 1 Reference 4
Rainfall dependent inflow & infiltration (RDII) from existing areas				
Existing development and sewerage networks	Flow rate/ existing area	% I/I	No deterioration in the existing areas for future scenarios. Use the existing I/I	Agreed through endorsement of this tech memo
Design flow calculations for new assets				
Design flow - average dry weather flow (ADWF)	Residential EP and other contributions	L/s	ADWF will be determined within the MOUSE model.	Reference 2
Design flow - dry weather peaking factor (d)	Dry weather peaking factor (d) is a function of the gross development area in hectares		Determined within the MOUSE model. Residential curve ‘RES1’ and commercial curve ‘COM1’ will be used to generate the residential and commercial flow patterns for Oakdale industrial site.	Agreed through endorsement of this tech memo
Design flow-peak dry weather flow (PDWF)	ADWF and peaking factor (d)	L/s	Determined within the MOUSE model.	Reference 2
Design flow - rainfall dependent inflow and infiltration (RDII)	Inflow and infiltration flow (IIF) is the peak rainfall dependent inflow and infiltration	L/s	Low infiltration sewer system Assume 2% I/I	Reference 4

Item	Design Criteria	Units	Wastewater	Source
Contributing area to WW flow				
Contributing area to WW flow	Residential	m2	Whole lot area to upper limit of 600 m2 per lot to be adopted as contributing area.	Agreed through endorsement of this tech memo
	Non- residential	m2	Total area of the footprint of the development to be adopted as contributing area. This is assumed to be 85% of the lot area.	
Design flow - peak wet weather flow (PWWF)	PDWF and IIF	L/s	PWWF = PDWF + IIF and will be determined within the MOUSE model.	Reference 1 Reference 4
Pumping station capacity design				
Pumping units	Pump capacity	L/s	2.5 × PDWF (existing SPS's) to be adopted for low infiltration sewers.	Reference 1
Pumping station storage	Operating storage	m3	To be determined based on number of pump starts per hour as determined by the MOUSE model.	Agreed through endorsement of this tech memo
Pumping station storage	Emergency storage / wet weather (WW) storage	m3	In general, the containment of dry weather (DW) emergency storage for a minimum period of four hours will be required. The time series DW flow data covering both weekday and weekend patterns will be used to estimate storage volume for a period of maximum four hours. The storage shall also be sized to meet WW overflow performance. From the two requirements, the larger volume storage shall be the basis for planning and design.	Reference 3
Pumping station total head	Maximum pump head	m	70 m, based on industry standards for centrifugal pump design, otherwise assume pumps in series required.	Agreed through endorsement of this tech memo
Performance criteria for existing assets (used to consider additional investments)				
Gravity main	Dry weather performance	% full	Secondary Criteria: 60% pipe full (by depth) during PDWF causing increase in wet weather overflows. For noting only.	Reference 4
Gravity main	Minimum self-cleaning velocity	m/s	0.7 m/s at PDWF. This will be an indicator only. Unless there is surcharge/discharge issues no investment will be considered.	Reference 2
Overflow frequency	DW overflows		No Dry Weather overflows	Agreed through

Item	Design Criteria	Units	Wastewater	Source
Overflow frequency	WW overflows	Events per 10 years	35 events per 10 years for designed overflows and maintenance holes not within private properties. 5 events per 10 years for maintenance holes within private properties	endorsement of this tech memo
Pipeline design				
Gravity main	Minimum self-cleaning velocity	m/s	0.7 m/s at PDWF.	Reference 2
	Maximum allowable EP	pipe size mm	150 (600 EP) 225 (1600 EP) 300 (3200 EP)	Reference 2
	Dry weather performance	% full	Dry weather flow depth should be no greater than 60 % of pipe full (by depth)	Reference 4
Pressure main	Minimum velocity	m/s	0.9	Reference 2
	Target velocity	m/s	1.2 – 1.8	Reference 2
	Maximum velocity	m/s	3.5	Reference 2
Pressure main	Maximum detention time	hrs	2 hrs (maximum). Where this is exceeded, suitable control measures need to be investigated and incorporated within the design to reduce and eliminate odour problems in the downstream reaches.	Reference 4
Overflow frequency	Designed Overflows	Events per 10 years	System License: Within the development area designed overflows will have no more than 35 events per 10 years in line with St. Marys STP system license (as advised by Sydney Water). LTS model run to confirm compliance with overflow criteria.	Agreed through endorsement of this tech memo
	Other than designed overflows	Events per 10 years	Maintenance holes outside the private properties will be limited to 35 events in 10 years. Maintenance holes inside the private properties will be limited to 5 events in 10 years.	
Growth forecasts (future growth areas)				
Residential	Equivalent Population (Dwellings)	EP	Future residential dwellings growth forecast within Oakdale industrial site to be obtained from agreed growth forecast provided and endorsed by Sydney Water. An occupancy ratio of 3 EP/dwelling to be used	Sydney Water

Item	Design Criteria	Units	Wastewater	Source
Non-residential	Equivalent Population (Floor Space) (FS)	EP	Future non-residential growth forecast within development areas to be obtained from agreed growth forecast provided and endorsed by Sydney Water	Sydney Water
Model validation				
Wastewater system models	Model performance	N/A	Scenarios to be modelled are for 2020 and 2036 planning horizons. Use St. Marys Jacfin project model, run code: SMJA as 2036 base model. This model is endorsed by Sydney Water for use. Remove the preferred GSS options (2036) of storages and pipe duplications from this model. The extension of East St Clair Carrier will be incorporated as per the concept design (Case No: 134866WW) For 2020 base model, update SMJA with dry and wet weather parameters from 2020 GSS model , run code SMSC located in: P:\GSS2013-14WW\STS\StMarys\Network\Sewer Update the future growth within Oakdale industrial site using the endorsed growth forecast.	Sydney Water
Dry weather flow loading from future growth				
Residential and commercial dry weather flow loading from future growth	Wastewater flow rate	L/EP/day	150 L/capita/day for detailed planning for new development sites. Diurnal curve adopted is RES1.	Reference 1
Dry weather flow loading from existing properties				
Existing res and com dry weather flow loading	Wastewater flow rate	L/EP/day	No reduction in residential and commercial flow rates for the existing properties in future scenarios as advised by Sydney Water	Sydney Water
Rainfall dependent inflow & infiltration (RDII) from new growth areas				
Existing development	Flow rate/ growth area	% I/I	Low infiltration sewerage system. Assume 2% I/I over 20 years.	Reference 1

Item	Design Criteria	Units	Wastewater	Source
and sewerage networks				Reference 4
Rainfall dependent inflow & infiltration (RDII) from existing areas				
Existing development and sewerage networks	Flow rate/ existing area	% I/I	Included in the base model provided by Sydney Water.	Agreed through endorsement of this tech memo
Design flow calculations for new assets				
Design flow - average dry weather flow (ADWF)	Residential EP and other contributions	L/s	ADWF will be determined within the MOUSE model.	Reference 2
Design flow - dry weather peaking factor (d)	Dry weather peaking factor (d) is a function of the gross development area in hectares		Determined within the MOUSE model. Residential curve 'RES1' and commercial curve 'COM1' will be used to generate the residential and commercial flow patterns for Oakdale industrial site.	Agreed through endorsement of this tech memo
Design flow- peak dry weather flow (PDWF)	ADWF and peaking factor (d)	L/s	Determined within the MOUSE model.	Reference 2
Design flow - rainfall dependent inflow and infiltration (RDII)	Inflow and infiltration flow (IIF) is the peak rainfall dependent inflow and infiltration	L/s	Low infiltration sewer system Assume 2% I/I	Reference 4
Contributing area to WW flow				
Contributing area to WW flow	Residential	m2	Whole lot area to upper limit of 600 m2 per lot to be adopted as contributing area.	Agreed through endorsement of this tech memo
	Non- residential	m2	Total area of the footprint of the development to be adopted as contributing area. This is assumed to be 85% of the lot area.	
Design flow - peak wet weather flow (PWWF)	PDWF and IIF	L/s	PWWF = PDWF + IIF and will be determined within the MOUSE model.	Reference 1 Reference 4
Pumping station capacity design				
Pumping units	Pump capacity	L/s	2.5 × PDWF (existing SPS's) to be adopted for low infiltration sewers.	Reference 1
Pumping station storage	Operating storage	m3	To be determined based on number of pump starts per hour as determined by the MOUSE model.	Agreed through endorsement of this tech memo
Pumping station storage	Emergency storage / wet weather (WW)	m3	In general, the containment of dry weather (DW) emergency	Reference 3

Item	Design Criteria	Units	Wastewater	Source
	storage		storage for a minimum period of four hours will be required. The time series DW flow data covering both weekday and weekend patterns will be used to estimate the maximum storage volume for the agreed retention hours. The storage shall also be sized to meet WW overflow performance. From the two requirements, the larger volume storage shall be the basis for planning and design.	
Pumping station total head	Maximum pump head	m	70 m, based on industry standards for centrifugal pump design, otherwise assume pumps in series required.	Agreed through endorsement of this tech memo
Performance criteria for existing assets (used to consider additional investments)				
Gravity main	Dry weather performance	% full	Secondary Criteria: less than 60% pipe full (by depth) during PDWF causing increase in wet weather overflows. For noting only.	Reference 4
Gravity main	Minimum self-cleaning velocity	m/s	0.7 m/s at PDWF. This will be an indicator only. Unless there is surcharge/discharge issues no investment will be considered.	Reference 2
Overflow frequency	DW overflows		No Dry Weather overflows	Agreed through endorsement of this tech memo
Overflow frequency	WW overflows	Events per 10 years	35 events per 10 years for designed overflows and maintenance holes not within private properties. 5 events per 10 years for maintenance holes within private properties	
Pipeline design				
Gravity main	Minimum self-cleaning velocity	m/s	0.7 m/s at PDWF.	Reference 2
	Maximum allowable EP	pipe size mm	150 (600 EP) 225 (1600 EP) 300 (3200 EP)	Reference 2
	Dry weather performance	% full	Dry weather flow depth should be no greater than 60 % of pipe full (by depth)	Reference 4
Pressure main	Minimum velocity	m/s	0.9	Reference 2
	Target velocity	m/s	1.2 – 1.8	Reference 2
	Maximum velocity	m/s	3.5	Reference 2
Pressure main	Maximum detention time	hrs	2 hrs (maximum). Where this is exceeded, suitable control measures need to be	Reference 4

Item	Design Criteria	Units	Wastewater	Source
			investigated and incorporated within the design to reduce and eliminate odour problems in the downstream reaches.	
Overflow frequency	Designed Overflows	Events per 10 years	System License: Within the development area designed overflows will have no more than 35 events per 10 years in line with St. Marys STP system license (as advised by Sydney Water). LTS model run to confirm compliance with overflow criteria.	Agreed through endorsement of this tech memo
	Other than designed overflows	Events per 10 years	Maintenance holes outside the private properties will be limited to 35 events in 10 years. Maintenance holes inside the private properties will be limited to 5 events in 10 years.	

Appendix B – Model Update

2036 Scenario

The 2036 Post GSS model (run code: **SMJA** located in: **P:\GSS2013-14WW\STS\StMarys\Post GSS model updates\Jacfin\Network\Sewer**) was used as the base model for this project. The following changes were made to the base model as shown in Figure 7.

- Storage at SP0262 and SP0366 are removed as were part of an option and do not exist in the network.
- Duplicate pipe from MH1273705 to MH1276269 is removed as was part of an option and does not exist in the network.
- The size and alignment of the East St. Clair Carrier SEC.2 (from NEWMH01 to NEWMH15) is updated as per the work as executed drawing (Case No. 134866WW)
- The size and alignment of the East St. Clair Carrier Extension (from NEWMH15 to NEWMH24) is added as per the drawing of Oakdale Servicing Plan.
- All the other future sewers are added as per "PM11329S-J baseplan only Bound-Model.pdf" provided by AT&L. The size of these sewers are estimated with flow schedule and the ground level of the maintenance holes are taken from ground level contours.
- The size and slope of all the sewers servicing Oakdale industrial development are presented in Appendix D.

The following changes were made to the catchments and its design loadings in the base model.

- The size, location and the design loadings of the existing catchments within the Oakdale industrial development were based on previous assumptions and are significantly different from the current plan. Hence these catchments are deleted from the model.
- Among all the developments, Oakdale East is planned to develop at the latest in 2022-2024. A master plan is not yet developed for this site. This catchment is added into the model as per Figure 1 (provided by AT&L) with an estimated EP of 8,906 and ADWF of 1.34 ML/D.
- Oakdale West, Oakdale South and Oakdale Central catchments are added as per the Masterplan prepared by Goodman (see Figure 9, Figure 10 and Figure 11 respectively) with an estimated EP of 8,480, 6,581 and 4,236 respectively and ADWF of 1.27, 0.99 and 0.64 ML/D respectively.
- The catchments for the CSR site are added as per the proposed subdivision prepared by Brown Consulting (see Figure 12) with an estimated EP of 5,944 and ADWF of 0.89 ML/D.
- The catchments for the Jacfin site are added as per the proposed development plan provided by Jacfin (see Figure 13) with an estimated EP of 6,960 and ADWF of 1.04 ML/D.

2020 Scenario

The following changes were made to the updated 2036 scenario model to get the 2020 scenario model as shown in Figure 8.

- As Oakdale East is planned to be developed beyond 2020, this catchment and its loading is deleted.
- The dry and wet weather parameters of all catchments outside the Oakdale industrial development are replaced with the same parameters from 2020 GSS model (run code: **SMSC** located in: **P:\GSS2013-14WW\STS\StMarys\Network\Sewer**)

The description of the run codes for the base case and the updated models are presented in Appendix A. The location of all these models in the server is **P:\GSS2013-14WW\STS\StMarys\Post GSS model updates\Oakdale Development**.

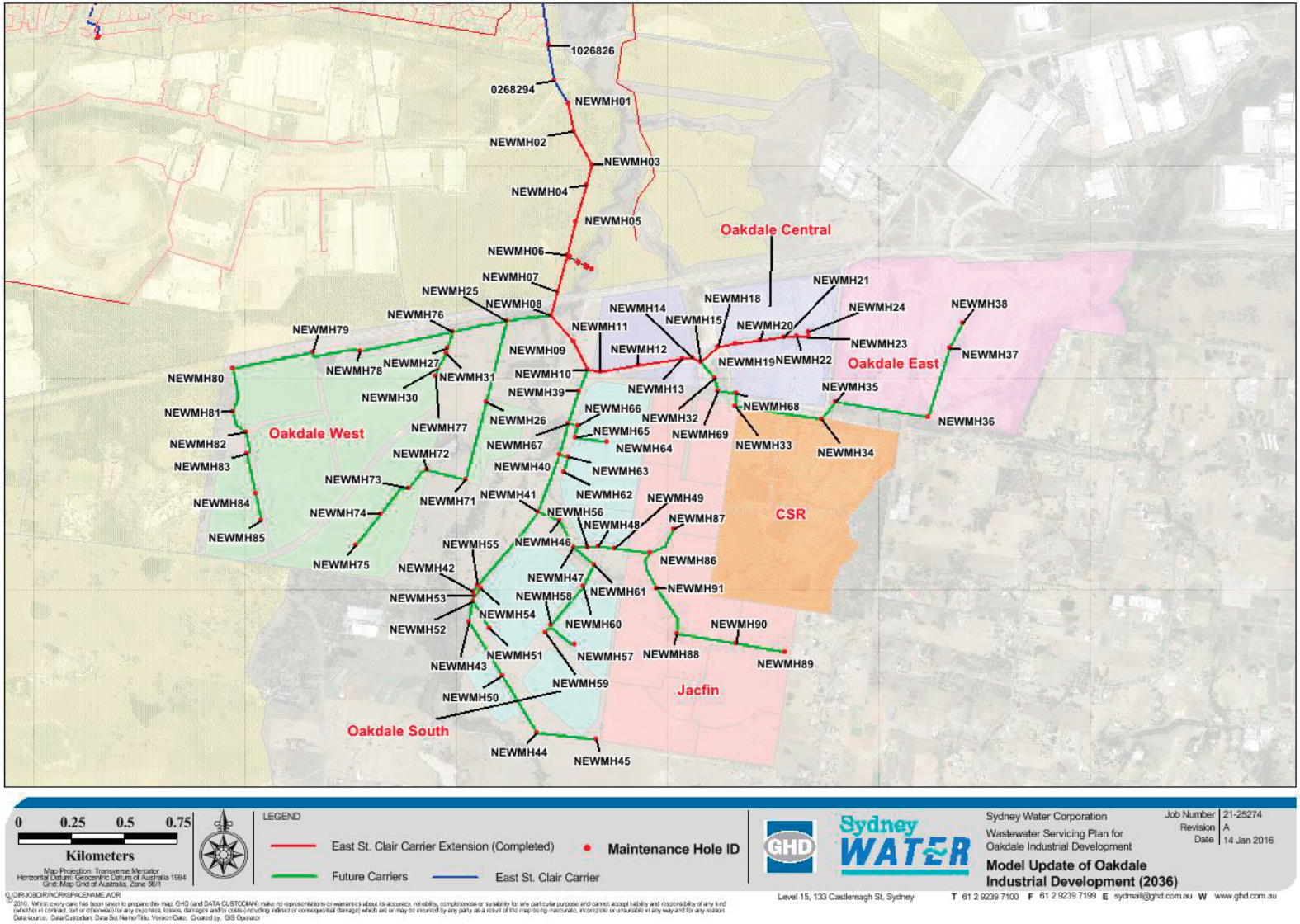


Figure 7 Model Update to 2036 Scenario

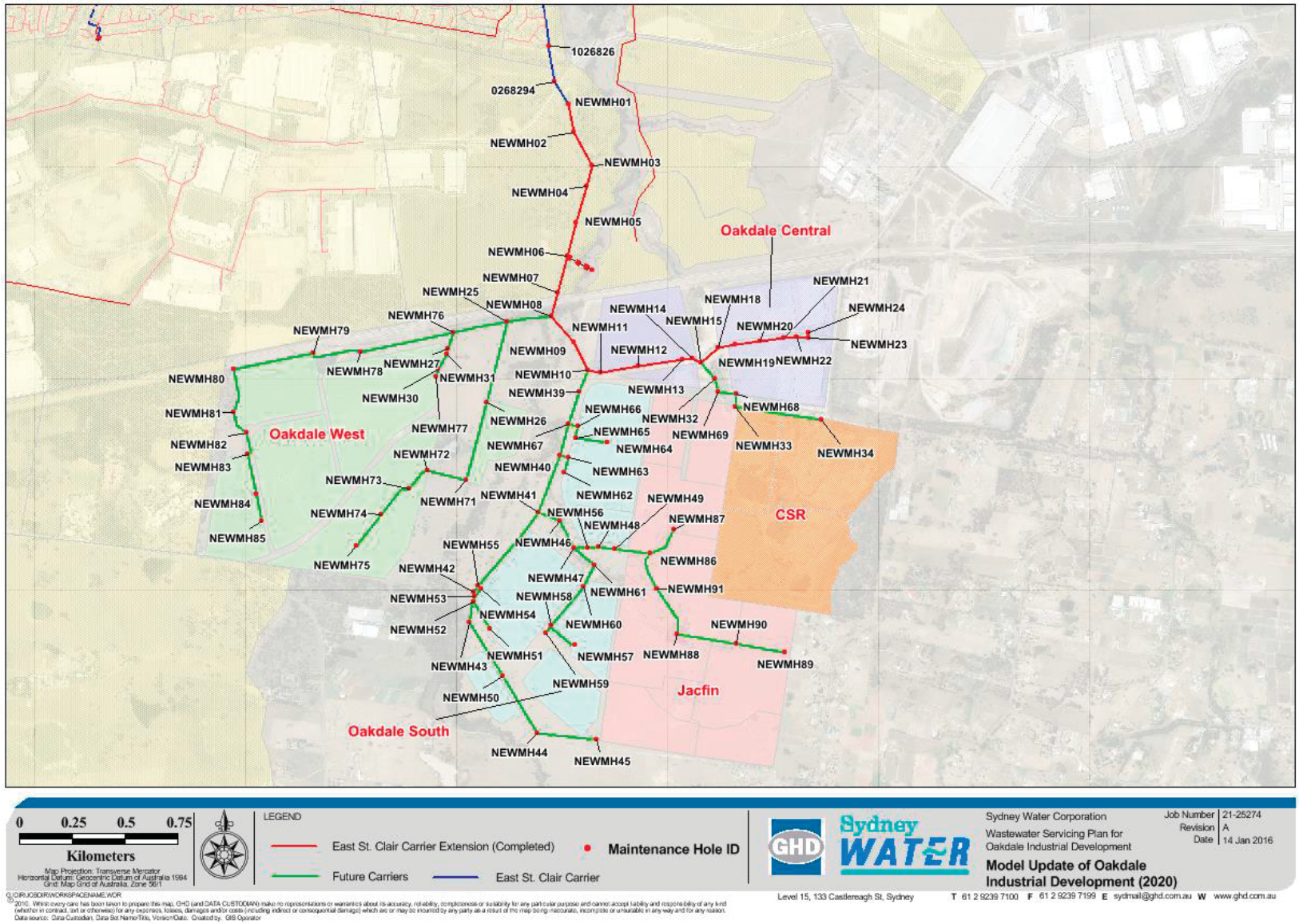


Figure 8 Model Update to 2020 Scenario

Figure 9 Oakdale West Estate Masterplan

Figure 10 Oakdale South Estate Masterplan

CENTRAL Area Schedule		
TOTAL LAND AREA		612,065 sqm
Lot	Site Area	Building Area
Lot 1A	41,368 sqm	20,220 sqm
Lot 1B	58,760 sqm	31,745 sqm*
Lot 1C	46,417 sqm	27,145 sqm*
Lot 2A	74,693 sqm	36,570 sqm
Lot 2B	60,010 sqm	31,080 sqm*
Lot 3A	16,016 sqm	7,283 sqm*
Lot 3B	58,493 sqm	36,965 sqm*
Lot 3C	55,622 sqm	33,426 sqm*
Lot 3D	18,795 sqm	8,275 sqm*
SUB TOTAL	414,158 sqm	232,709 sqm*
Lot 4	21,615 sqm	0 sqm*
CENTRAL TOTAL	435,773 sqm	232,709 sqm*
Services Lot	10,000 sqm	
Biodiversity Lot A	18,367 sqm	
Biodiversity Lot B	40,812 sqm	
Biodiversity Lot C	41,533 sqm	
Road Widening Lots	4,572 sqm	

* Areas subject to Survey.

Figure 11 Oakdale Central Estate Masterplan

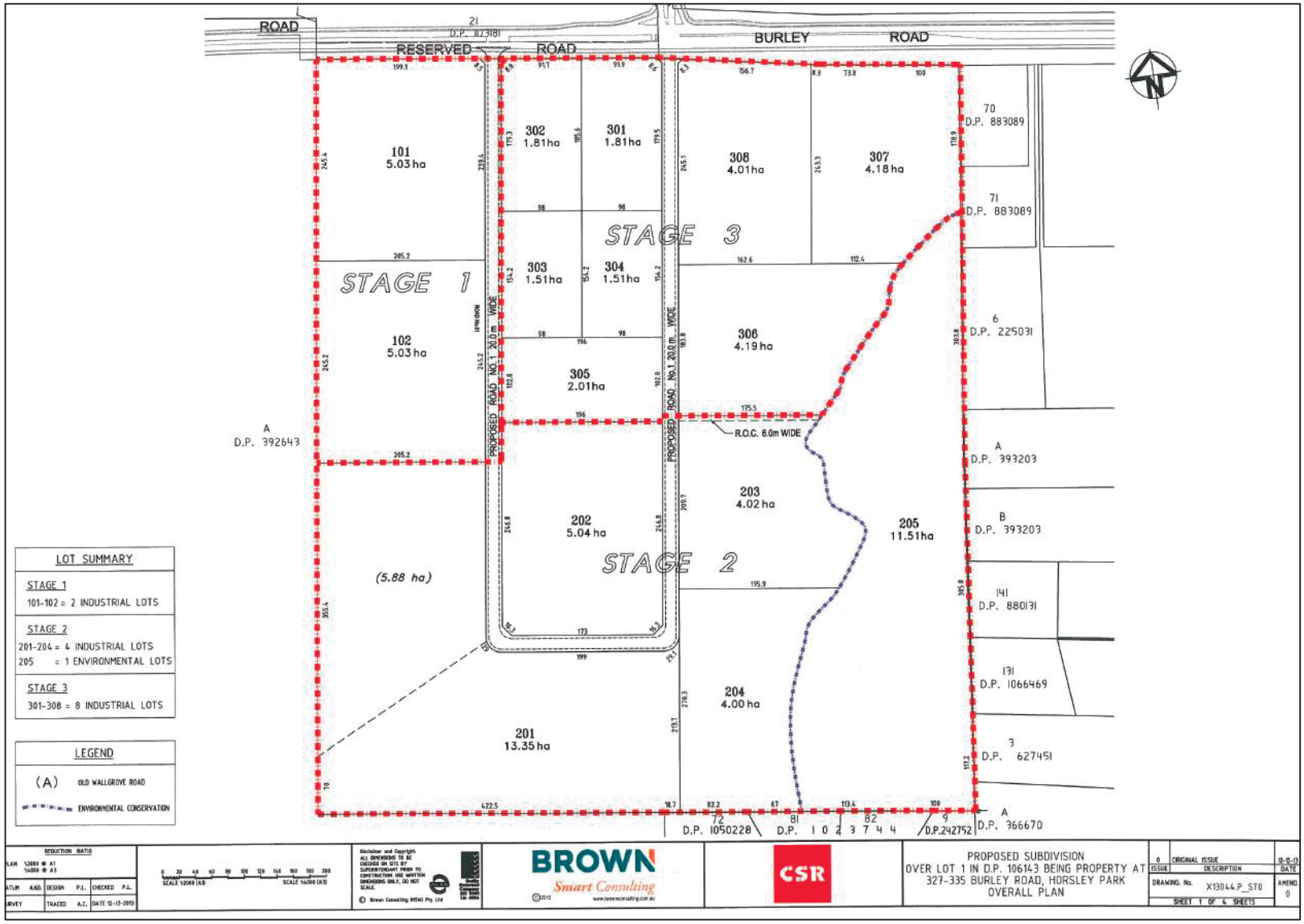


Figure 12 Proposed Subdivision of CSR Site

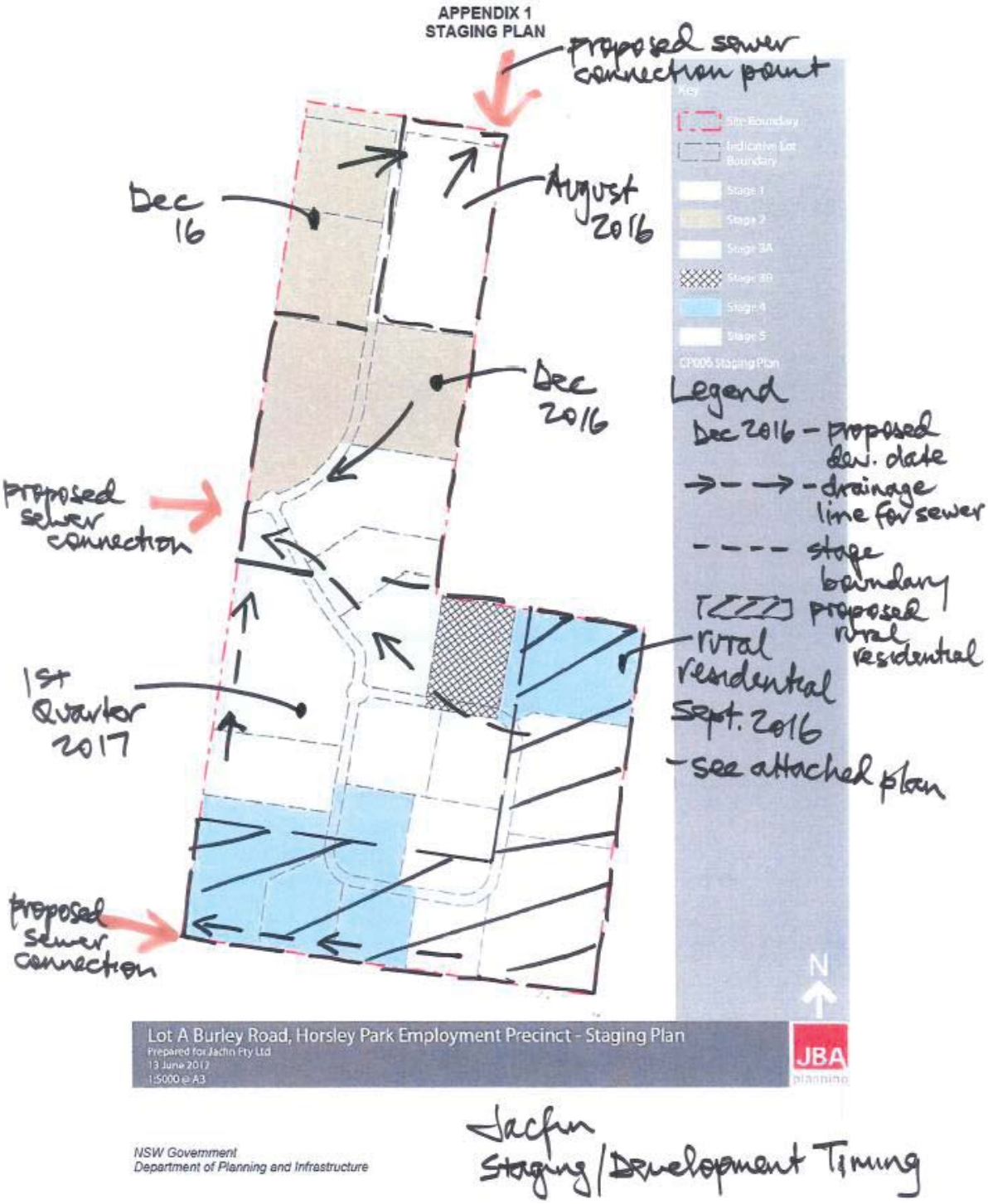


Figure 13 Proposed Development Plan for Jacfin Site

Appendix C – Wastewater Modelling Run Codes

The run codes used for the base and the updated models (2020 and 2036 scenarios) are presented in the following Table.

Planning Year	Base Model	Updated with Oakdale Industrial Development
2036	SMJA	SMJD
2020	SMJD	SMJE

Appendix D – Dry Weather System Performance

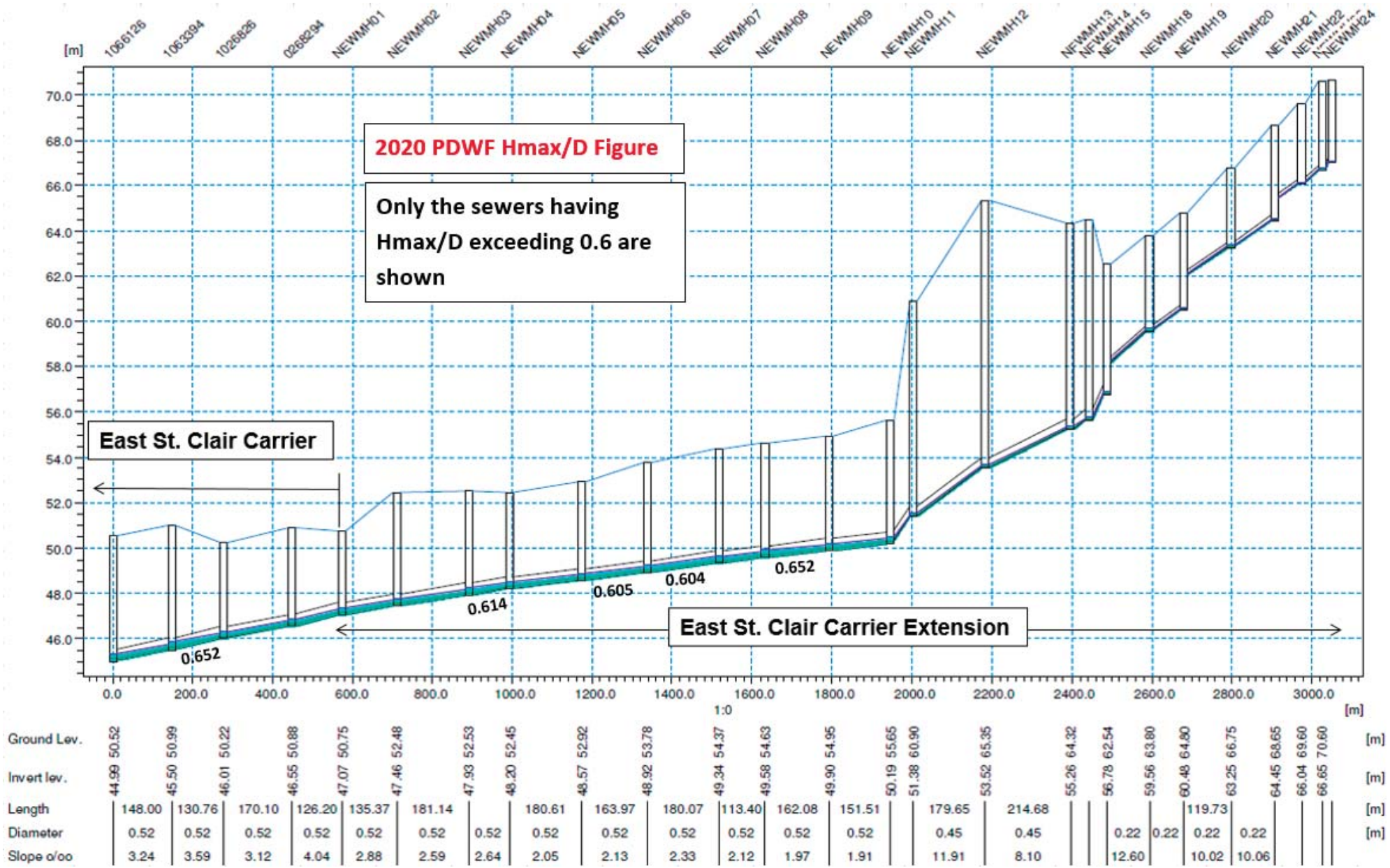
U/s Node	D/s Node	Pipe Dia (mm)	Slope (%)	2020 (Runcode: SMJE)			2036 (Runcode: SMJE)		
				PDWF (l/s)	Hmax/ D	Max Velocity (m/s)	PDWF (l/s)	Hmax/ D	Max Velocity (m/s)
East St. Clair Carrier Extension									
NEWMH24	NEWMH23	225	1.02	5	0.212	0.8	5	0.212	0.8
NEWMH23	NEWMH22	225	1.02	5	0.212	0.8	5	0.212	0.8
NEWMH22	NEWMH21	225	0.95	5	0.216	0.78	5	0.216	0.78
NEWMH21	NEWMH20	225	1.01	5	0.213	0.8	5	0.213	0.8
NEWMH20	NEWMH19	225	1.00	9	0.296	0.96	9	0.296	0.96
NEWMH19	NEWMH18	225	1.01	9	0.295	0.96	9	0.295	0.96
NEWMH18	NEWMH15	225	1.26	9	0.279	1.04	9	0.279	1.04
NEWMH15	NEWMH14	450	2.58	23	0.339	0.77	55	0.531	0.99
NEWMH14	NEWMH13	450	0.83	23	0.297	0.75	55	0.458	0.97
NEWMH13	NEWMH12	450	0.81	24	0.386	0.62	55	0.573	0.83
NEWMH12	NEWMH11	450	1.19	29	0.36	0.79	60	0.524	1
NEWMH11	NEWMH10	450	1.81	29	0.374	1.14	60	0.499	1.41
NEWMH10	NEWMH09	525	0.19	81	0.531	0.77	113	0.643	0.84
NEWMH09	NEWMH08	525	0.20	81	0.652	0.65	113	0.756	0.74
NEWMH08	NEWMH07	525	0.21	112	0.596	0.89	143	0.693	0.95
NEWMH07	NEWMH06	525	0.23	112	0.604	0.9	143	0.704	0.96
NEWMH06	NEWMH05	525	0.21	112	0.605	0.89	143	0.705	0.94
NEWMH05	NEWMH04	525	0.20	112	0.594	0.89	143	0.691	0.95
NEWMH04	NEWMH03	525	0.26	112	0.614	0.89	143	0.71	0.96
NEWMH03	NEWMH02	525	0.26	112	0.587	0.94	143	0.679	1
NEWMH02	NEWMH01	525	0.29	112	0.578	0.96	143	0.664	1.03
Oakdale Central									
NEWMH24	NEWMH23	225	1.02	5	0.212	0.8	5	0.212	0.8
NEWMH23	NEWMH22	225	1.02	5	0.212	0.8	5	0.212	0.8
NEWMH22	NEWMH21	225	0.95	5	0.216	0.78	5	0.216	0.78
NEWMH21	NEWMH20	225	1.01	5	0.213	0.8	5	0.213	0.8
NEWMH20	NEWMH19	225	1.00	9	0.296	0.96	9	0.296	0.96
NEWMH19	NEWMH18	225	1.01	9	0.295	0.96	9	0.295	0.96
NEWMH18	NEWMH15	225	1.26	9	0.279	1.04	9	0.279	1.04
Oakdale East									
NEWMH38	NEWMH37	375	0.51	-	-	-	32	0.377	0.96
NEWMH37	NEWMH36	375	0.51	-	-	-	32	0.553	0.68
NEWMH36	NEWMH35	375	0.50	-	-	-	32	0.489	0.75
NEWMH35	NEWMH34	375	0.50	-	-	-	32	0.328	1.01
NEWMH34	NEWMH33	375	0.83	7	0.139	0.76	39	0.324	1.25
NEWMH33	NEWMH68	375	2.10	10	0.14	1.12	42	0.279	1.68
NEWMH68	NEWMH69	375	2.13	12	0.141	1.23	43	0.27	1.81

U/s Node	D/s Node	Pipe Dia (mm)	Slope (%)	2020 (Runcode: SMJE)			2036 (Runcode: SMJE)		
				PDWF (l/s)	Hmax/ D	Max Velocity (m/s)	PDWF (l/s)	Hmax/ D	Max Velocity (m/s)
NEWMH69	NEWMH32	375	2.65	12	0.134	1.33	43	0.255	1.95
NEWMH32	NEWMH15	375	0.99	14	0.184	0.97	45	0.339	1.38
Oakdale West									
NEWMH85	NEWMH84	375	0.49	4	0.15	0.42	4	0.15	0.42
NEWMH84	NEWMH83	375	0.50	4	0.251	0.26	4	0.251	0.26
NEWMH83	NEWMH82	375	0.50	10	0.256	0.54	10	0.256	0.54
NEWMH82	NEWMH81	375	0.50	10	0.258	0.54	10	0.258	0.54
NEWMH81	NEWMH80	375	0.50	10	0.361	0.4	10	0.361	0.4
NEWMH80	NEWMH79	375	0.50	13	0.295	0.61	13	0.295	0.61
NEWMH79	NEWMH78	375	0.50	13	0.294	0.61	13	0.294	0.61
NEWMH78	NEWMH76	375	0.50	13	0.417	0.45	13	0.417	0.45
NEWMH76	NEWMH25	375	0.46	21	0.47	0.55	21	0.47	0.55
NEWMH25	NEWMH08	375	0.54	30	0.334	0.93	30	0.338	0.93
NEWMH77	NEWMH30	225	1.31	7	0.452	0.59	7	0.452	0.59
NEWMH30	NEWMH31	225	1.18	7	0.439	0.6	7	0.439	0.6
NEWMH31	NEWMH76	225	0.96	7	0.262	0.88	7	0.262	0.88
NEWMH75	NEWMH74	300	1.21	8	0.32	0.56	8	0.32	0.56
NEWMH74	NEWMH73	300	1.20	8	0.318	0.56	8	0.318	0.56
NEWMH73	NEWMH72	300	1.21	8	0.347	0.52	8	0.347	0.52
NEWMH72	NEWMH71	300	1.20	8	0.345	0.52	8	0.345	0.52
NEWMH71	NEWMH26	300	1.21	8	0.359	0.5	8	0.359	0.5
NEWMH26	NEWMH25	300	1.18	10	0.587	0.38	10	0.587	0.38
Oakdale South									
NEWMH45	NEWMH44	375	1.50	2	0.184	0.27	2	0.184	0.27
NEWMH44	NEWMH50	375	0.48	4	0.198	0.4	4	0.198	0.4
NEWMH50	NEWMH43	375	1.09	5	0.176	0.58	5	0.176	0.58
NEWMH43	NEWMH42	375	0.59	5	0.164	0.54	5	0.164	0.54
NEWMH42	NEWMH55	375	0.53	5	0.303	0.36	5	0.303	0.36
NEWMH55	NEWMH41	375	0.51	11	0.502	0.65	11	0.502	0.65
NEWMH41	NEWMH40	450	0.51	45	0.394	0.9	45	0.394	0.9
NEWMH40	NEWMH67	450	0.51	47	0.505	0.75	47	0.505	0.75
NEWMH67	NEWMH39	450	0.48	53	0.397	1	53	0.397	1
NEWMH39	NEWMH10	450	0.53	53	0.327	1.17	53	0.327	1.17
Oakdale South									
NEWMH49	NEWMH48	300	2.86	26	0.262	1.78	26	0.262	1.78
NEWMH48	NEWMH56	300	1.23	26	0.327	1.31	26	0.327	1.31
NEWMH56	NEWMH47	300	4.12	26	0.236	2.06	26	0.236	2.06
NEWMH47	NEWMH46	300	1.29	34	0.384	1.37	34	0.384	1.37
NEWMH46	NEWMH41	300	2.03	34	0.351	1.54	34	0.351	1.54
NEWMH59	NEWMH58	225	0.29	5	0.551	0.28	5	0.551	0.28

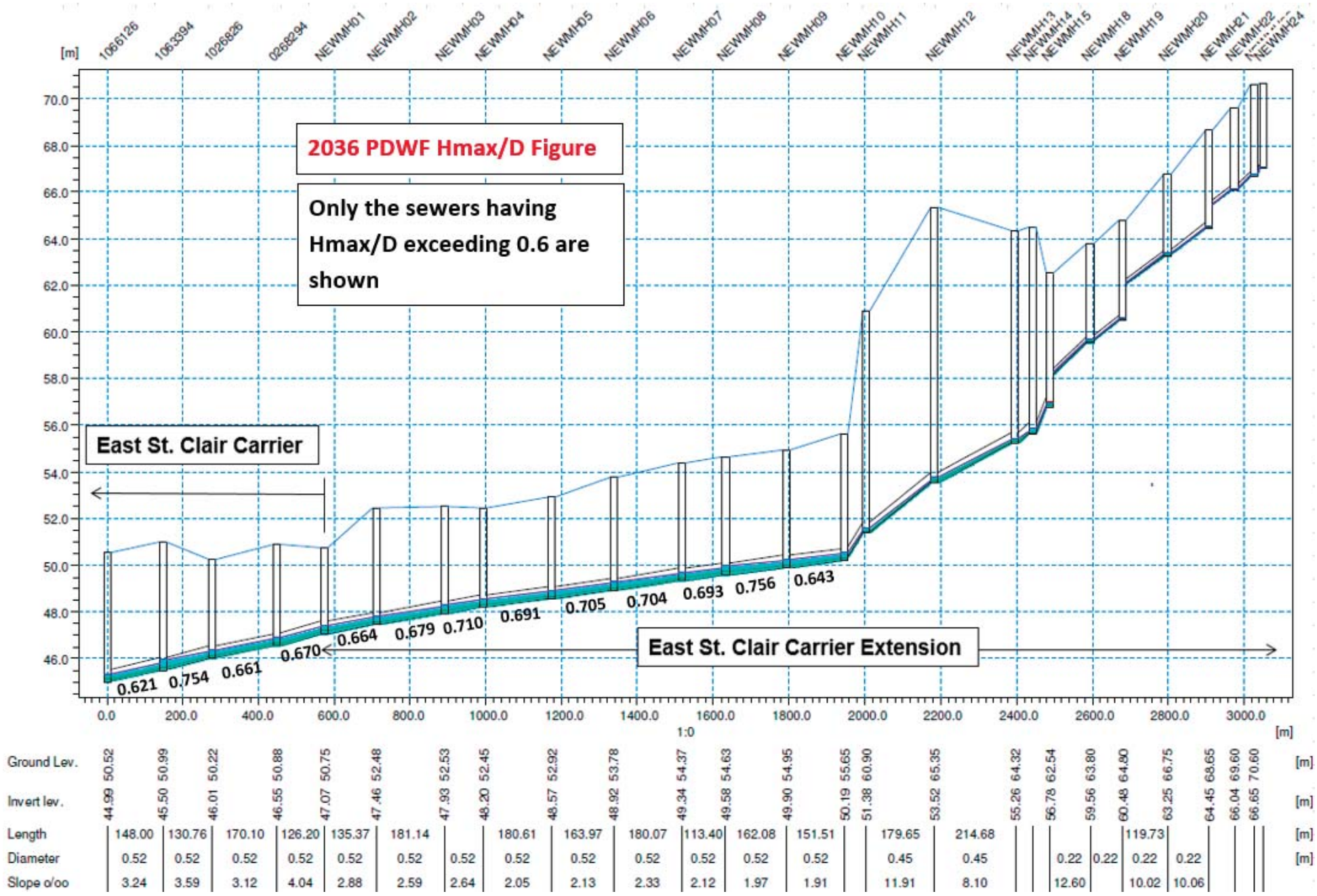
U/s Node	D/s Node	Pipe Dia (mm)	Slope (%)	2020 (Runcode: SMJE)			2036 (Runcode: SMJE)		
				PDWF (l/s)	Hmax/ D	Max Velocity (m/s)	PDWF (l/s)	Hmax/ D	Max Velocity (m/s)
NEWMH57	NEWMH58	225	1.16	3	0.166	0.74	3	0.166	0.74
NEWMH58	NEWMH60	225	0.67	8	0.447	0.58	8	0.447	0.58
NEWMH60	NEWMH61	225	2.17	8	0.52	0.59	8	0.52	0.59
NEWMH61	NEWMH47	225	0.51	8	0.321	0.72	8	0.321	0.72
NEWMH51	NEWMH52	225	1.40	6	0.249	0.81	6	0.249	0.81
NEWMH52	NEWMH53	225	0.63	6	0.265	0.66	6	0.265	0.66
NEWMH53	NEWMH54	225	0.62	6	0.37	0.5	6	0.37	0.5
NEWMH54	NEWMH55	225	0.66	6	0.263	0.67	6	0.263	0.67
NEWMH62	NEWMH63	225	0.70	1	0.238	0.29	1	0.238	0.29
NEWMH63	NEWMH40	225	0.70	1	0.129	0.49	1	0.129	0.49
NEWMH64	NEWMH65	225	3.79	6	0.465	0.58	6	0.465	0.58
NEWMH65	NEWMH66	225	1.24	6	0.456	0.52	6	0.456	0.52
NEWMH66	NEWMH67	225	1.25	6	0.228	0.93	6	0.228	0.93
Jacfin Extension									
NEWMH89	NEWMH90	225	5.55	3	0.327	0.47	3	0.327	0.47
NEWMH90	NEWMH88	225	1.41	4	0.349	0.47	4	0.349	0.47
NEWMH88	NEWMH91	225	0.41	4	0.569	0.35	4	0.569	0.35
NEWMH91	NEWMH86	225	1.04	11	0.425	0.98	11	0.425	0.98
NEWMH86	NEWMH49	300	0.65	26	0.59	1.05	26	0.59	1.05
NEWMH87	NEWMH86	225	2.63	4	0.425	0.84	4	0.425	0.84
Downstream East St. Clair Carrier									
NEWMH01	268294	525	0.40	111	0.58	1.01	143	0.67	1.08
268294	1026826	525	0.31	112	0.571	0.99	143	0.661	1.05
1026826	1063394	525	0.36	112	0.652	0.9	143	0.754	0.96
1063394	1066126	525	0.32	112	0.536	1.04	144	0.621	1.11
1066126	1394278	525	0.32	113	0.453	1.2	145	0.533	1.25
1394278	1394282	600	0.19	114	0.456	0.94	146	0.526	1
1394282	1394286	600	0.32	115	0.421	1.03	146	0.493	1.09
1394286	1063358	600	0.27	115	0.506	0.9	146	0.579	0.96
1063358	1063366	600	0.25	115	0.472	0.93	146	0.542	0.99
1063366	1066102	600	0.26	117	0.479	0.96	147	0.548	1.01
1066102	1063374	600	0.27	118	0.469	0.99	149	0.535	1.06
1063374	1066110	600	0.26	119	0.398	1.19	149	0.45	1.28
1066110	1065994	600	0.15	120	0.467	0.96	150	0.533	1.01
1065994	1063274	750	0.15	120	0.369	0.84	151	0.423	0.88
1063274	1063286	750	0.15	120	0.387	0.78	151	0.441	0.82
1063286	1066022	750	0.18	120	0.425	0.72	151	0.476	0.78
1066022	1394274	750	0.24	125	0.368	0.88	156	0.416	0.93
1394274	1394290	800	0.20	125	0.322	0.91	156	0.36	0.97
1394290	1394294	800	0.20	125	0.29	1.1	156	0.324	1.18

U/s Node	D/s Node	Pipe Dia (mm)	Slope (%)	2020 (Runcode: SMJE)			2036 (Runcode: SMJE)		
				PDWF (l/s)	Hmax/ D	Max Velocity (m/s)	PDWF (l/s)	Hmax/ D	Max Velocity (m/s)
1394294	1394298	1200	0.24	125	0.165	1.05	156	0.183	1.12
1394298	1063298	900	0.28	125	0.306	0.89	156	0.342	0.95
1063298	1066026	900	0.28	125	0.327	0.82	156	0.366	0.87
1066026	1225433	900	0.28	125	0.303	0.89	156	0.338	0.95
1225433	1225013	900	0.28	125	0.3	0.9	156	0.335	0.96
1225013	1227493	900	0.28	125	0.298	0.91	156	0.333	0.97
1227493	1224765	900	0.28	125	0.232	1.13	156	0.259	1.2
1224765	1227497	900	0.18	125	0.252	1.04	156	0.283	1.08
1227497	1278268	1200	0.13	127	0.225	0.73	158	0.249	0.78
1278268	1281000	1200	0.15	131	0.224	0.75	160	0.248	0.8
1281000	1277995	1200	0.15	131	0.225	0.75	160	0.249	0.79
1277995	1280483	1200	0.15	131	0.233	0.73	160	0.258	0.77
1280483	1280111	1200	0.13	131	0.217	0.74	160	0.239	0.78
1280111	1280115	1200	0.32	131	0.227	0.82	160	0.251	0.86
1280115	1608413	1050	0.31	132	0.265	0.82	161	0.293	0.87
1608413	1279791	1050	0.30	132	0.255	0.87	161	0.281	0.92
1279791	1282311	1050	0.30	132	0.256	0.87	161	0.283	0.92
1282311	1279583	1050	0.30	132	0.254	0.87	161	0.28	0.92
1279583	1279371	1050	0.30	132	0.202	1.09	161	0.223	1.15
1279371	1279103	1050	0.32	133	0.279	0.81	162	0.308	0.86
1279103	1281835	1050	0.30	136	0.204	1.1	164	0.225	1.16
1281835	1279107	1500	0.15	194	0.226	0.71	243	0.253	0.75
1279107	1281839	1500	0.10	194	0.224	0.69	243	0.25	0.74
1281839	1281603	1500	0.10	194	0.224	0.69	243	0.251	0.74
1281603	1281199	1500	0.10	194	0.24	0.66	243	0.269	0.7
1281199	1278471	1050	0.13	194	0.316	0.84	243	0.353	0.9
1278471	1280983	1050	0.45	194	0.344	0.96	243	0.384	1.02
1280983	1280786	1050	0.15	215	0.284	1.17	267	0.317	1.24
1280786	1277646	1200	0.11	223	0.324	0.77	277	0.364	0.82
1277646	1280378	1200	0.09	223	0.318	0.75	277	0.356	0.79
1280378	1280086	1200	0.09	223	0.3	0.79	277	0.334	0.84
1280086	1280090	1200	0.10	223	0.267	0.93	277	0.298	0.99
1280090	1279614	1200	0.11	223	0.265	0.93	277	0.295	1
1279614	1282026	1200	0.10	236	0.265	1.12	291	0.294	1.19
1282026	1282022	1200	0.50	236	0.184	1.65	291	0.204	1.75
1282022	1279294	1200	0.50	236	0.477	0.56	291	0.516	0.59
1279294	1281374	1350	0.09	405	0.393	0.84	471	0.427	0.85
1281374	1275321	1350	0.12	403	0.368	0.9	468	0.397	0.94
1275321	1276981	1350	0.11	403	0.341	0.95	468	0.366	1
1276981	1276849	1350	0.11	404	0.303	1.26	466	0.325	1.32

U/s Node	D/s Node	Pipe Dia (mm)	Slope (%)	2020 (Runcode: SMJE)			2036 (Runcode: SMJE)		
				PDWF (l/s)	Hmax/ D	Max Velocity (m/s)	PDWF (l/s)	Hmax/ D	Max Velocity (m/s)
1276849	1273977	1350	0.13	411	0.366	0.99	468	0.391	1.04
1273977	1276705	1350	0.15	411	0.296	1.3	468	0.315	1.35
1276705	1404019	1350	2.36	502	0.223	2.36	542	0.236	2.36
1404019	SPS0204	1350	13.55	502	0.554	8.99	542	0.559	6.07
RMTND01	RMTND03	2000	0.20	501	0.186	1.81	542	0.196	1.78
RMTND03	OUTLET1	3000	0.20	810	0.124	1.61	904	0.131	1.66

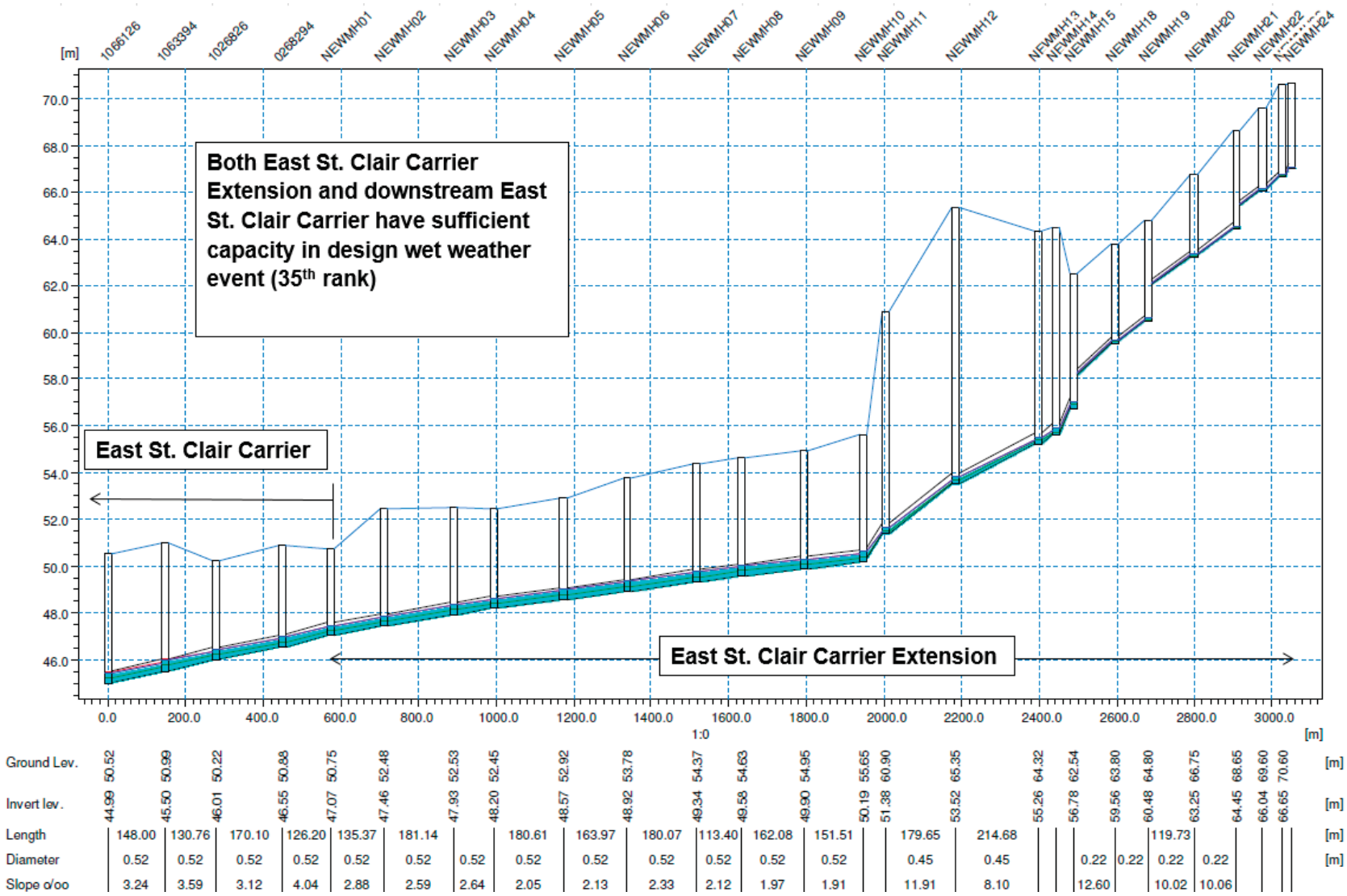


HGL along East St. Clair Carrier Extension and downstream East St. Clair Carrier in 2020 PDWF



HGL along East St. Clair Carrier Extension and downstream East St. Clair Carrier in 2036 PDWF

Appendix E – Wet Weather (Design Event) System Performance (2036)



HGL along East St. Clair Carrier Extension and downstream East St. Clair Carrier in 2036 Design Wet Weather Event (35th rank)

Appendix F – Cost Estimates

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central	Estimate Date:	**05/05/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**26/05/2016 15:36**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Gravity Sewer Greenfield PVC 1.5m deep		225 dia	m	0	228	0
2		Gravity Sewer Greenfield PVC 1.5m deep		300 dia	m	0	275	0
3		Gravity Sewer Greenfield PVC 1.5m deep		375 dia	m	750	386	289,828
4		Gravity Sewer Greenfield PP 2.0m deep		450 dia	m	0	621	0
5		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	0	18	0
6		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	0	21	0
7		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	750	25	18,621
8		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
9		EO Road Restoration Trench Std Depth		250 dia	m	0	434	0
10		EO Road Restoration Trench Std Depth		300 dia	m	0	485	0
11		EO Road Restoration Trench Std Depth		375 dia	m	188	513	96,163
12		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
	H1	**Scope Contingency**						
13		Urban Detailed Planning		75	%	404,612	0.75	303,459
		Sub Total Direct Costs						**708,072**
		INDIRECT COSTS				**%**		
14		Contractor Design Costs (% of Direct Costs)				10.00%		70,807
15		Contractor Indirect Costs (% of Direct Costs)				20.00%		141,614
16		Contractor Margin (% of DC+Indirect Costs)				15.00%		138,074
17		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		370,498
		Total Construction Cost						**1,429,065**
		SWC CLIENT COSTS				**% of ConstC**		
18		SWC Costs to Date	Current as at:					
19		SWC Design Costs (% of Construction Costs)				1.00%		14,291
20		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name:	Oakdale Central	Estimate Date:	**05/05/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**26/05/2016 15:36**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
21		SWC Planning Costs (% of Construction Costs)			5.00%		71,453
22		SWC Project Management Costs (% of Construction Costs)			5.00%		71,453
23		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		7,860
24		SWC Land Acquisition/Easement Costs					
25		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**1,644,122**

Sydney WATER **COST ESTIMATOR**

Job Name: Oakdale East — Estimate Date: **05/05/2016**

Estimator: Amir Rashidi — Print Date/Time: **26/05/2016 15:39**

Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Gravity Sewer Greenfield PVC 1.5m deep		225 dia	m	0	228	0
2		Gravity Sewer Greenfield PVC 1.5m deep		300 dia	m	0	275	0
3		Gravity Sewer Greenfield PVC 1.5m deep		375 dia	m	1,020	386	394,166
4		Gravity Sewer Greenfield PP 2.0m deep		450 dia	m	0	621	0
5		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	0	18	0
6		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	0	21	0
7		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	1,020	25	25,325
8		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
9		EO Road Restoration Trench Std Depth		250 dia	m	0	434	0
10		EO Road Restoration Trench Std Depth		300 dia	m	0	485	0
11		EO Road Restoration Trench Std Depth		375 dia	m	255	513	130,782
12		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
	H1	**Scope Contingency**						
13		Urban Detailed Planning		75	%	550,273	0.75	412,705
		Sub Total Direct Costs						**962,977**
		INDIRECT COSTS				**%**		
14		Contractor Design Costs (% of Direct Costs)				10.00%		96,298
15		Contractor Indirect Costs (% of Direct Costs)				20.00%		192,595
16		Contractor Margin (% of DC+Indirect Costs)				15.00%		187,781
17		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		503,878
		Total Construction Cost						**1,943,529**
		SWC CLIENT COSTS				**% of ConstC**		
18		SWC Costs to Date	Current as at:					
19		SWC Design Costs (% of Construction Costs)				1.00%		19,435
20		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name: Oakdale East

Estimator: Amir Rashidi

Estimate Date: **05/05/2016**

Print Date/Time: **26/05/2016 15:39**

Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
21		SWC Planning Costs (% of Construction Costs)			5.00%		97,176
22		SWC Project Management Costs (% of Construction Costs)			5.00%		97,176
23		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		10,689
24		SWC Land Acquisition/Easement Costs					
25		SWC Risk Contingency (% of the SWC Client Future Costs only)				of Client Costs	
		TOTAL PROJECT BUDGET REQUIREMENT					**2,218,005**

Sydney WATER

COST ESTIMATOR

Job Name: Oakdale West

Estimator: Amir Rashidi

Estimate Date: **05/05/2016**

Print Date/Time: **26/05/2016 15:40**

Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Gravity Sewer Greenfield PVC 1.5m deep		225 dia	m	250	228	57,075
2		Gravity Sewer Greenfield PVC 1.5m deep		300 dia	m	1,500	275	413,142
3		Gravity Sewer Greenfield PVC 1.5m deep		375 dia	m	2,320	386	896,533
4		Gravity Sewer Greenfield PP 2.0m deep		450 dia	m	0	621	0
5		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	250	18	4,421
6		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	1,500	21	32,141
7		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	2,320	25	57,602
8		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
9		EO Road Restoration Trench Std Depth		250 dia	m	63	434	27,128
10		EO Road Restoration Trench Std Depth		300 dia	m	375	485	181,800
11		EO Road Restoration Trench Std Depth		375 dia	m	580	513	297,466
12		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
	H1	**Scope Contingency**						
13		Urban Detailed Planning		75	%	1,967,308	0.75	1,475,481
		Sub Total Direct Costs						**3,442,789**
		INDIRECT COSTS				**%**		
14		Contractor Design Costs (% of Direct Costs)				10.00%		344,279
15		Contractor Indirect Costs (% of Direct Costs)				20.00%		688,558
16		Contractor Margin (% of DC+Indirect Costs)				15.00%		671,344
17		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		1,801,440
		Total Construction Cost						**6,948,410**
		SWC CLIENT COSTS				**% of ConstC**		
18		SWC Costs to Date	Current as at:					
19		SWC Design Costs (% of Construction Costs)				1.00%		69,484
20		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name:	Oakdale West	Estimate Date:	**05/05/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**26/05/2016 15:40**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
21		SWC Planning Costs (% of Construction Costs)			5.00%		347,421
22		SWC Project Management Costs (% of Construction Costs)			5.00%		347,421
23		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		38,216
24		SWC Land Acquisition/Easement Costs					
25		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**7,800,952**

Sydney WATER

COST ESTIMATOR

Job Name: Oakdale South

Estimator: Amir Rashidi

Estimate Date: **05/05/2016**

Print Date/Time: **26/05/2016 15:39**

Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Gravity Sewer Greenfield PVC 1.5m deep		225 dia	m	1,280	228	292,226
2		Gravity Sewer Greenfield PVC 1.5m deep		300 dia	m	450	275	123,943
3		Gravity Sewer Greenfield PVC 1.5m deep		375 dia	m	1,250	386	483,046
4		Gravity Sewer Greenfield PP 2.0m deep		450 dia	m	720	621	447,136
5		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	1,280	18	22,638
6		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	450	21	9,642
7		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	1,250	25	31,035
8		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	720	10	7,102
9		EO Road Restoration Trench Std Depth		250 dia	m	320	434	138,896
10		EO Road Restoration Trench Std Depth		300 dia	m	113	485	54,540
11		EO Road Restoration Trench Std Depth		375 dia	m	313	513	160,272
12		EO Road Restoration Trench Std Depth		450 dia	m	180	579	104,172
	H1	**Scope Contingency**						
13		Urban Detailed Planning		75	%	1,874,649	0.75	1,405,986
		Sub Total Direct Costs						**3,280,635**
		INDIRECT COSTS				**%**		
14		Contractor Design Costs (% of Direct Costs)				10.00%		328,063
15		Contractor Indirect Costs (% of Direct Costs)				20.00%		656,127
16		Contractor Margin (% of DC+Indirect Costs)				15.00%		639,724
17		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		1,716,592
		Total Construction Cost						**6,621,141**
		SWC CLIENT COSTS				**% of ConstC**		
18		SWC Costs to Date	Current as at:					
19		SWC Design Costs (% of Construction Costs)				1.00%		66,211
20		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name: Oakdale South

Estimator: Amir Rashidi

Estimate Date: **05/05/2016**

Print Date/Time: **26/05/2016 15:39**

Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
21		SWC Planning Costs (% of Construction Costs)			5.00%		331,057
22		SWC Project Management Costs (% of Construction Costs)			5.00%		331,057
23		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		36,416
24		SWC Land Acquisition/Easement Costs					
25		SWC Risk Contingency (% of the SWC Client Future Costs only)				of Client Costs	
		TOTAL PROJECT BUDGET REQUIREMENT					**7,435,882**

Sydney WATER **COST ESTIMATOR**

Job Name:	Jacfin	Estimate Date:	**05/05/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**26/05/2016 15:38**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Gravity Sewer Greenfield PVC 1.5m deep		225 dia	m	1,250	228	285,377
2		Gravity Sewer Greenfield PVC 1.5m deep		300 dia	m	170	275	46,823
3		Gravity Sewer Greenfield PVC 1.5m deep		375 dia	m	0	386	0
4		Gravity Sewer Greenfield PP 2.0m deep		450 dia	m	0	621	0
5		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	1,250	18	22,107
6		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	170	21	3,643
7		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
8		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
9		EO Road Restoration Trench Std Depth		250 dia	m	313	434	135,641
10		EO Road Restoration Trench Std Depth		300 dia	m	43	485	20,604
11		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
12		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
	H1	**Scope Contingency**						
13		Urban Detailed Planning		75	%	514,195	0.75	385,646
		Sub Total Direct Costs						**899,841**
		INDIRECT COSTS				**%**		
14		Contractor Design Costs (% of Direct Costs)				10.00%		89,984
15		Contractor Indirect Costs (% of Direct Costs)				20.00%		179,968
16		Contractor Margin (% of DC+Indirect Costs)				15.00%		175,469
17		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		470,842
		Total Construction Cost						**1,816,104**
		SWC CLIENT COSTS				**% of ConstC**		
18		SWC Costs to Date	Current as at:					
19		SWC Design Costs (% of Construction Costs)				1.00%		18,161
20		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name: Jacfin

Estimator: Amir Rashidi

Estimate Date: **05/05/2016**

Print Date/Time: **26/05/2016 15:38**

Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
21		SWC Planning Costs (% of Construction Costs)			5.00%		90,805
22		SWC Project Management Costs (% of Construction Costs)			5.00%		90,805
23		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		9,989
24		SWC Land Acquisition/Easement Costs					
25		SWC Risk Contingency (% of the SWC Client Future Costs only)				of Client Costs	
		TOTAL PROJECT BUDGET REQUIREMENT					**2,075,864**

Sydney WATER **COST ESTIMATOR**

Job Name:	Jacfin	Estimate Date:	**05/05/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**26/05/2016 15:36**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Gravity Sewer Greenfield PVC 1.5m deep		225 dia	m	1,250	228	285,377
2		Gravity Sewer Greenfield PVC 1.5m deep		300 dia	m	170	275	46,823
3		Gravity Sewer Greenfield PVC 1.5m deep		375 dia	m	0	386	0
4		Gravity Sewer Greenfield PP 2.0m deep		450 dia	m	0	621	0
5		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	1,250	18	22,107
6		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	170	21	3,643
7		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
8		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
9		EO Road Restoration Trench Std Depth		250 dia	m	313	434	135,641
10		EO Road Restoration Trench Std Depth		300 dia	m	43	485	20,604
11		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
12		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
	H1	**Scope Contingency**						
13		Urban Detailed Planning		75	%	514,195	0.75	385,646
		Sub Total Direct Costs						**899,841**
		INDIRECT COSTS				**%**		
14		Contractor Design Costs (% of Direct Costs)				10.00%		89,984
15		Contractor Indirect Costs (% of Direct Costs)				20.00%		179,968
16		Contractor Margin (% of DC+Indirect Costs)				15.00%		175,469
17		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		470,842
		Total Construction Cost						**1,816,104**
		SWC CLIENT COSTS				**% of ConstC**		
18		SWC Costs to Date	Current as at:					
19		SWC Design Costs (% of Construction Costs)				1.00%		18,161
20		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name: Jacfin

Estimator: Amir Rashidi

Estimate Date: **05/05/2016**

Print Date/Time: **26/05/2016 15:36**

Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
21		SWC Planning Costs (% of Construction Costs)			5.00%		90,805
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24		SWC Land Acquisition/Easement Costs					
25		SWC Risk Contingency (% of the SWC Client Future Costs only)				of Client Costs	
		TOTAL PROJECT BUDGET REQUIREMENT					**2,075,864**

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Oakdale Industrial Development - Planning of Water Related Services

Final Report - Water

July 2016

Commercial in Confidence

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GHD

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Rev. 01	A Rashidi	M Healey		M Healey		15/06/16
Rev. 02	A Rashidi	M Healey		M Healey		5/07/16
Final	A Rashidi	M Healey, Sydney Water, Goodmans		M Healey		28/07/2016

Document Status

Oakdale Industrial Development - Planning of Water Related Services July 2016

This report has been prepared by GHD

Approved for issue

Signature	Date	Signature	Date	Signature	Date
	29/07/16		29/07/16.		
Kym Dracopoulos		Russell Hogan		Amir Rashidi	
Manager, Technical		Project Manager		Project Manager	
Goodman Property Services (AUST) Pty Ltd		AT&L Associates		GHD	

Endorsed

I confirm that impacted parties within my business have been consulted, their inputs have been considered and the decisions have been communicated to relevant parties.

Signature	Date	Signature	Date
Suhanti Thirunavukarasu		Richard Schuil	
Principal Planner		Engineering & Planning Manager	
Engineering & Environmental Services		Growth Centres	
Sydney Water		Sydney Water	

Approved

Signature	Date
Jim Price	
Development Services Officer	
Liveable City Solutions	
Sydney Water	

Executive Summary

The Oakdale industrial site is part of the existing Western Sydney Employment Area (WSEA 8 – Area South of Pipeline Precinct), located approximately 40 kms west of the Sydney CBD, adjacent to the M7 and M4 intersection. The site was rezoned in September 2009 through the WSEA SEPP 2009, and Goodman is the lead developer of the precinct. An overview of study area is presented in Figure 1.

The initial water servicing plan scheme was to supply Oakdale from existing DN450 lead-in main within Cecil Park supply system.

This Local Area Servicing Plan (LASP) for potable water has been prepared at the request of Sydney Water to provide a servicing strategy for the existing WSEA Precinct No. 8–Area South of Pipeline, including Goodman's Oakdale development. This servicing strategy identifies the Sydney Water infrastructure required to service the Oakdale Precinct, anticipated costs, sizing, preliminary alignments and trigger points (i.e. development timing and staging) for the delivery of potable water infrastructure required to service the Oakdale Precinct.

Growth and water demand projections

Oakdale Estate is an ongoing industrial development with approximately 452 nett hectares of developable area. This includes Goodman, CSR and Jacfin lands. Their lands are predominately zoned IN1 'General Industrial' under the State Environmental Planning Policy (Western Sydney Employment Area) 2009. The site spans two local government areas of Penrith and Fairfield.

The growth projections listed for this study are supplied by AT&L in conjunction with Jacfin, CSR and Goodman. The list of the growth projection within the Oakdale Industrial Development is summarised in Table 1.

Table 1 Growth Projections

Development site	Nett Development (ha)	Development type	Connection (1)
Oakdale Central	45.2	IN1- General Industrial (2)	2016- 2017
Jacfin	87.8	IN1- General Industrial/ Residential	2016- 2017
Oakdale South	70.2	IN1- General Industrial	2017- 2019
CSR	63.4	IN1- General Industrial	2017-2020
Oakdale West	90.5	IN1- General Industrial	2019- 2021
Oakdale East	95.0	IN1- General Industrial	2022- 2024
Total	**452**		

Note 1: The proposed timing of connection is subject to change

Note 2: water demand assessed based on Light industrial / warehouse

An evidence based approach to forecasting future demands in the study area, based on observed demands in an adjacent water supply system, was adopted as per the "Water System Planning Guidelines 2014". Table 2 below summarises the projected water demands for the Oakdale Industrial Development. Total projected max day demand in the Oakdale Precinct is 7.5 ML/d.

Table 2 Summary of Water Demand - Oakdale Industrial Development

Development site	Timing	Average Day Demand (ML/d)	Max Day Demand (ML/d)
Oakdale Central	2016-2017	0.42	0.7
Jacfin	2016-2017	1.04	2.12
Oakdale South	2017-2019	0.65	1.0
CSR	2017-2020	0.58	0.93
Oakdale West	2019-2021	0.83	1.3
Oakdale East	2022-2024	0.87	1.4
Total		**4.4**	**7.5**

The key opportunities and constraints associated with water servicing of the Oakdale Industrial Development is summarised below.

Opportunities

- Based on the supplied Oakdale growth projections, Cecil Park reservoir and Prospect Creek pumping station WP0184B have sufficient capacity to supply the entire Cecil Park zone including Oakdale Development for the 2020 demand scenario.
- A DN450 lead-in water main has been constructed as part of previous site works and has sufficient capacity to supply the entire Oakdale Development.
- Minchinbury Elevated supply zone has 2.5 ML/d transferable capacity to provide supply contingency to Oakdale Industrial.
- The Growth Servicing Strategy (GSS) proposed augmentations are adequate to supply the entire Cecil Park zone including Oakdale Development for the post 2031 demand scenario.

Constraints

- Cecil Park reservoir and pumping station WP0184 has insufficient capacity to supply the entire Cecil Park zone including Oakdale Development post 2020 demand scenario, when Austral and Leppington North will be rezoned to Cecil Park supply system. Sydney Water will address growth servicing requirements in the broader region.
- Erskine Park Elevated supply system has insufficient head to supply Oakdale Industrial system.

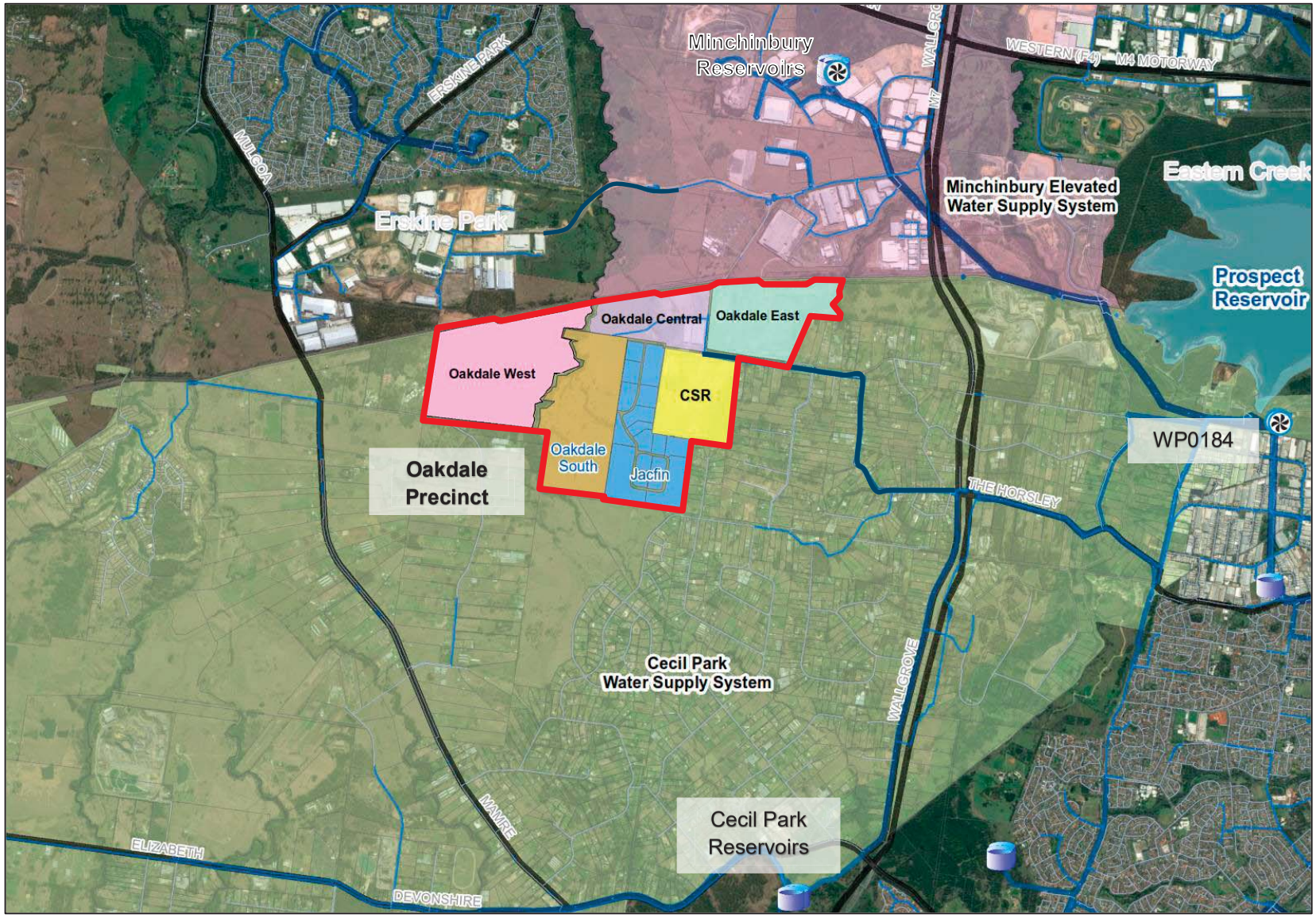

Figure 1 Oakdale Industrial Development Overview

The Oakdale Servicing Strategy is made up of the following:

Oakdale Central

Oakdale Central is currently supplied from the existing DN250 potable water main within Millner Avenue (refer section 3-4 on figure 2) which is supplied from the Cecil Park Supply System. To improve system reliability, it is proposed to supply Oakdale Central from the Minchinbury Elevated supply system via a proposed DN300 connection (refer section 4-7 on Fig. 2) between the existing DN250 potable water main within Millner Avenue (refer section 3-4 on Fig. 2) to the proposed DN300 within Oakdale West (refer section 7-8 on Fig. 2) which ultimately connects to the existing DN300 within Erskine Park Link Road (EPLR). The proposed DN300 is proposed to be delivered at the same time as the Oakdale West development.

Oakdale South

Oakdale South will be supplied via extension (refer section 4-6 on Fig. 2) of the existing DN250 potable water main (Refer Section 3-4 on Fig. 2) within Millner Avenue which is supplied from the Cecil Park Supply System.

Oakdale West

Oakdale West will be supplied via a proposed DN300 (refer section 8-9 on Fig. 2) connection to the existing DN300 within Erskine Park Link Road (EPLR). This proposed DN300 will be supplied from the Minchinbury Elevated Supply System. As mentioned above, a DN300 cross connection (refer section 4-7 on Fig. 2) to Oakdale Central will be delivered at the same time as the Oakdale West development to supply Oakdale Central from the Minchinbury Elevated Supply System which will improve the system reliability.

Oakdale East

Oakdale East will be supplied off the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System.

CSR

CSR lands will be supplied via a proposed DN300 connected to the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System.

Jacfin

Jacfin lands will be supplied via a proposed DN300 connected to the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System. Jacfin internal reticulation will be via a proposed DN250 which will be connected to the proposed DN250 within Oakdale South to improve the system reliability.

The preliminary capital cost estimates associated with Oakdale Industrial water servicing is presented in Table 3. The Oakdale servicing plan overview is presented in Figure 2.

Table 3 Preliminary capital cost estimates

Section	Description	Delivery Date	Capital Cost ($M)
2-4	1.2 km DN300	2016-2017	$2.21 M
4-5	0.9 km DN250	2016-2017	$1.34 M
5-6	0.85 km DN200	2016-2017	$1.08 M
4-7	0.7 km DN300	2017-2018	$ 1.31 M
7-8	1.2 km DN300	2018-2019	$2.21 M
8-9	1.6 km DN300	2018-2019	$2.93 M

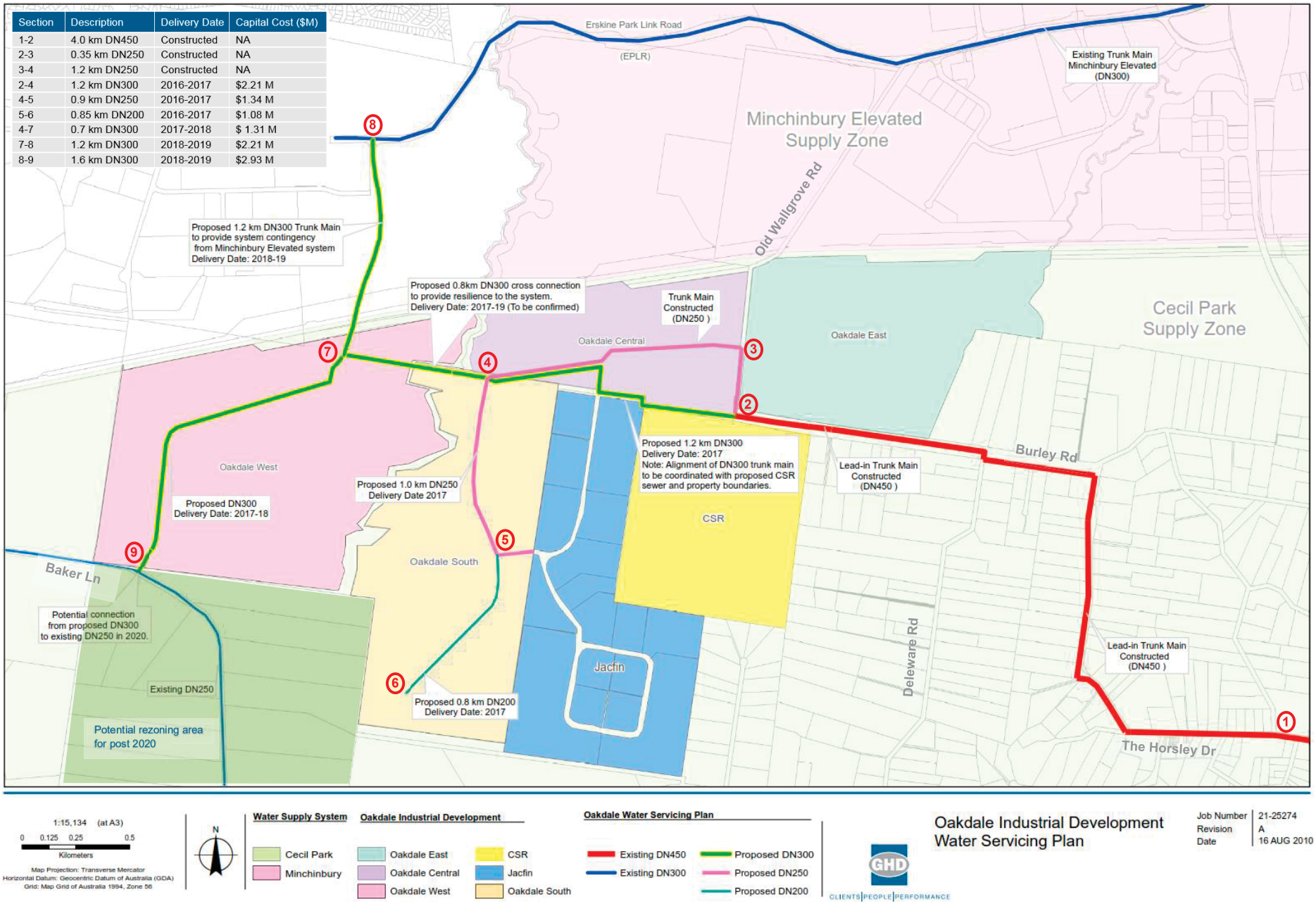

Figure 2- Oakdale Industrial Water Servicing Plan

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Appendices

1. Introduction

1.1 Background

The Oakdale industrial site is part of the existing Western Sydney Employment Area (WSEA 8 – Area South of Pipeline Precinct), located approximately 40 kms west of the Sydney CBD, adjacent to the M7 and M4 intersection. The site was rezoned in September 2009 through the WSEA SEPP 2009, and Goodman is the lead developer of the precinct. An overview of study area is presented in Figure 1.

The initial water servicing plan scheme was to supply Oakdale from existing DN450 lead-in main within Cecil Park supply system. Minchinbury Elevated supply system also will provide connection to Oakdale from the existing DN300 within Erskine Park Link Road (EPLR).

Assets required to service proposed Goodman, Jacfin and CSR developments within Oakdale precinct are to be staged to meet development timeframes, with lead-in infrastructure funded up front and delivered by the lead developer and to be reimbursed by Sydney Water in accordance with its policy on Funding Infrastructure to Service Growth.

1.2 Purpose of this report

The purpose of this report is to document the:

- Revised growth and water demand forecasts,
- Key opportunities and constraints,
- Outcomes of the assessment work undertaken, and
- Water servicing plan for the Oakdale Industrial Development.

This Local Area Servicing Plan (LASP) for potable water has been prepared at the request of Sydney Water to provide a servicing strategy for the existing WSEA Precinct No. 8–Area South of Pipeline, including Goodman's Oakdale development. This servicing strategy identifies the Sydney Water infrastructure required to service the Oakdale Precinct, anticipated costs, sizing, preliminary alignments and trigger points (i.e. development timing and staging) for the delivery of potable water infrastructure required to service the Oakdale Precinct.

2. Growth Projections

This section provides details of growth and water demand projections within the study area including the expected timing, and scale of growth.

2.1 Summary of Growth

Growth forecasts are a key input into the planning process and provide an insight into future infrastructure needs as well as future capital investment needs.

Oakdale Estate is an ongoing industrial development with approximately 452 nett hectares of development area. This includes Goodman, CSR and Jacfin lands. There lands are predominately zoned IN1 'General Industrial' under the State Environmental Planning Policy (Western Sydney Employment Area) 2009 The site spans two local government areas of Penrith and Fairfield.

The growth projections listed for this study are supplied by AT&L in conjunction with Jacfin, CSR and Goodman. The list of the growth projection within the Oakdale Industrial Development is summarised in Table 4.

Table 4 Growth Projections

Development site	Precinct	Nett Development (ha)	Development type	Connection
Oakdale South	1	18.8	IN1- General Industrial (5)	2017-2018
	2	4.4		2018
	3	16.5		2017-2019
	4	9.5		2019
	5	14.0		2017
	6	7.0		2019
	Total	**70.2**		
Oakdale East	1	95.0 (3)	IN1- General Industrial	2022-2024 (1)
Oakdale West	1	21.7		2019
	2	21.6		2019-2020
	3	18.5		2020
	4	22.6		2020-2021
	5	6.1		2020
	Total	**90.5**		
Oakdale Central	1A	4.1	IN1- General Industrial	Built
	1B	5.9		Built
	1C	4.6		Q1-2016
	2A	7.5		Built

Development site	Precinct	Nett Development (ha)	Development type	Connection
	2B	6.0		Q1-2016
	3A	1.6		2017
	3B	5.8		Q4-2016
	3C	5.6		2017
	3D	1.9		2017
	Lot 4	2.2		2017
	Total	**45.2**		
Jacfin	1	3.6	IN1- General Industrial	2016
	2	17.4		2016
	3	21.6		2017
	4	25.7	Residential low density (2)	2016
	5	19.5		2016
	Total	**87.8**		
CSR	1	10.1	IN1- General Industrial	2017
	2	20.8		2018
		11.5		
	3	21.0		2020 (1)
	Total	**63.4**		
Grand Total		**452**		

Note 1: The proposed timing of infrastructure proposed is subject to change

Note 2: Rural Residential

Note 3: Further growth listed for this study is in addition to current East Oakdale development plan

Note 4: The above growth projections have been provided be the following:

Developer	Contact(s) – Role	Received	Date received
CSR	Wayne Pasalich – CSR Senior Development Manager	Via Email	1st March 2016
Jacfin	Emma Sunderland – Calibre Consulting on behalf of Jacfin	Via Email	29th Feb 2016
Goodman	Richard Seddon – Goodman Development Manager	Via Email	29th Feb 2016

Note 5: Water demand assessed based on Light industrial / warehouse

2.2 Water Demand Projections

An evidence based approach to forecasting future demands in the study area, based on observed demands in an adjacent water supply system, was adopted as per the "Water System Planning Guidelines 2014". The Growth Servicing Strategy (GSS) demand estimation revised based on the following updated growth data:

- The proposed Oakdale Industrial demand within GSS model (i.e. 0.2 ML/d) will be replaced with evidence based industrial demand assumptions. i.e. 9.2 ML/d. the proposed demand previously calculated for this development removed from the model.
- Additional forecast growth within the Parkbridge Estate i.e. 264 dwellings
- Defer rezoning from Austral to Cecil Park supply system to post 2020 i.e. 450 dwellings. The 2020 sensitivity analysis with Austral demand will be developed.
- Potable top-up transfers into the Hoxton Park recycled water scheme reduced from 1.2 ML/d to 1.1 ML/d

The revised future demand projections for the Cecil Park supply system are presented in Table 5.

Table 5 Summary of revised future water demand- Cecil Park Supply System

Demand Category	2016 MDD ML/d	2020 MDD ML/d	2031 MDD ML/d	2036 MDD ML/d
Residential (LD)	6.2	10.2	31.7	47.7
Residential (HD)	0.03	4.9	5.3	5.4
Dual Retic Res (LD)	0.2	1.1	1.2	1.4
Dual Retic Res (HD)	0.03	0.1	0.1	0.1
Industrial	1.6	1.8	4.1	7.7
Commercial	8.6	13.8	24.7	40.6
Other	2.1	2.1	5.6	5.64
Oakdale Industrial	0.0	5.8	7.5	7.5
Total	**18.8**	**39.8**	**80.3**	**116.0**

The detailed methodology for projecting average day and maximum day demands is described in Tech Memo 1 (Appendix A).

Table 6 summarises the projected water demands for the Oakdale Industrial Development. Total projected max day demand in the Oakdale Precinct is 7.5 ML/d.

Table 6 Summary of Water Demand - Oakdale Industrial Development

Development site	Timing	Average Day Demand (ML/d)	Max Day Demand (ML/d)
Oakdale South	2017-2019	0.65	1.0
Oakdale West	2019-2021	0.83	1.3
Oakdale East	2022-2024	0.87	1.4
Oakdale Central	2016-2017	0.42	0.7
Jacfin	2016-2017	1.04	2.12
CSR	2017-2020	0.58	0.93
Total		**4.4**	**7.5**

3. Opportunities and constraints

The following is a summary of the key opportunities and constraints associated with water servicing of the Oakdale Industrial Development.

3.1 Opportunities

- Based on the supplied Oakdale growth projections, Cecil Park reservoir and Prospect Creek pumping station WP0184B have sufficient capacity to supply the entire Cecil Park zone including Oakdale Development for the 2020 demand scenario.
- A DN450 lead-in water main has been constructed as part of previous site works and has sufficient capacity to supply the entire Oakdale Development.
- Minchinbury Elevated supply zone has 2.5 ML/d transferable capacity to provide supply contingency to Oakdale Industrial. Extensions off Sydney Water's existing DN300 trunk main will need to be built. i.e. approx. 1.2 Km.
- The Growth Servicing Strategy (GSS) proposed augmentations are adequate to supply the entire Cecil Park zone including Oakdale Development for the post 2031 demand scenario. Additional augmentations as a result of the GSS study include 30 ML new reservoir will provide system reliability.
- Customers along Aldington Rd that experiencing low pressure under current maximum day demand could be rezoned to Oakdale development. i.e. 1.0 ML/d

3.2 Constraints

- Cecil Park reservoir and pumping station WP0184 has insufficient capacity to supply the entire Cecil Park zone including Oakdale Development post 2020 demand scenario, when Austral and Leppington North will be rezoned to Cecil Park supply system. The GSS system augmentations (i.e. Prospect Creek pumping station WP0184B and raising main upgrade) proposed for 2031 demand scenario will address the long term system capacity issues within Cecil Park supply system.
- Erskine Park Elevated supply system has insufficient head to supply Oakdale Industrial system.

The opportunities and constraints identified in Oakdale Industrial water servicing plan is presented in Figure 3.

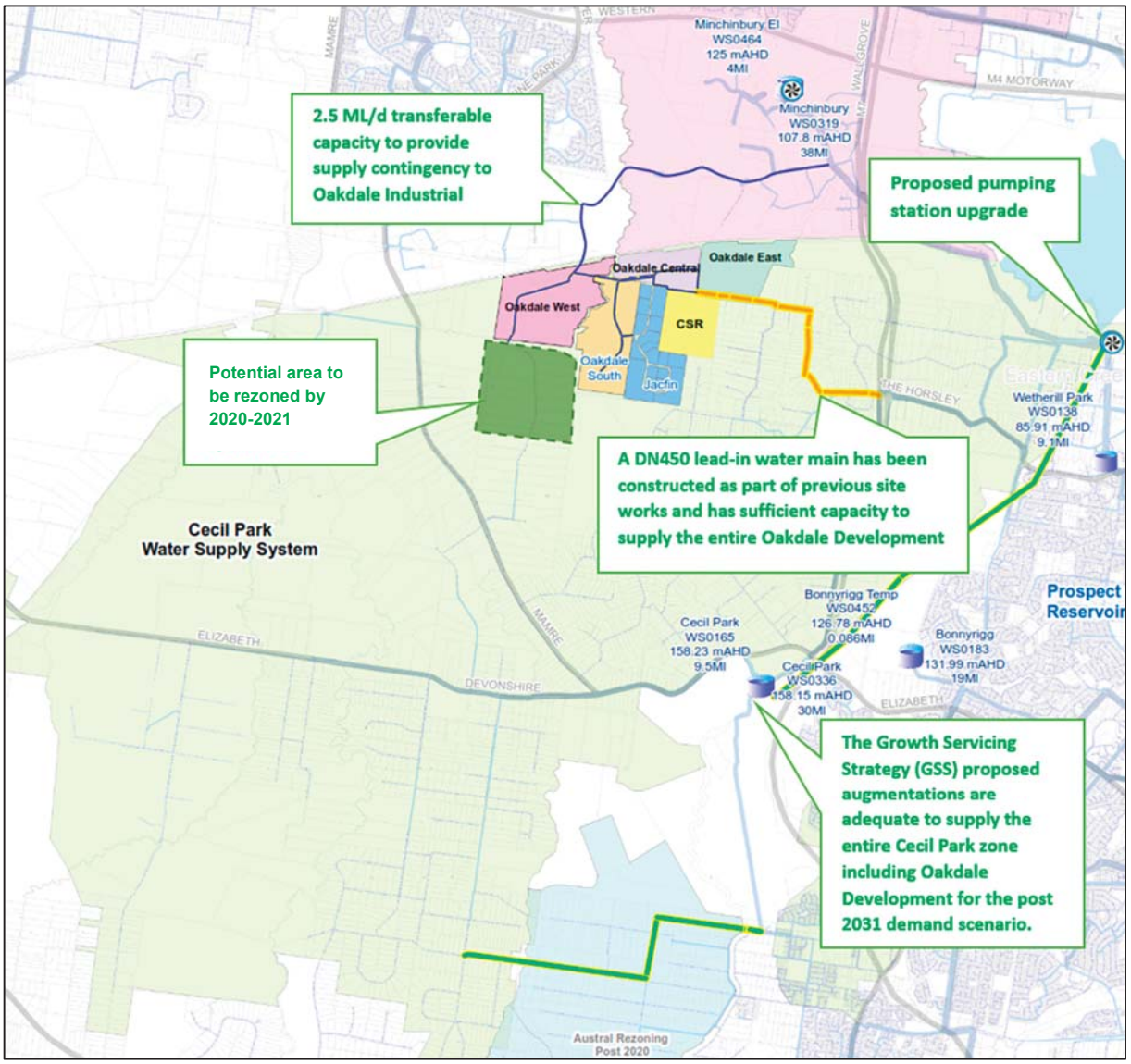

Figure 3 Opportunities and constraints

4. Water servicing

4.1 Oakdale Industrial water servicing

4.1.1 Oakdale Central

Oakdale Central is currently supplied from the existing DN250 potable water main within Millner Avenue (refer section 3-4 on figure 4) which is supplied from the Cecil Park Supply System. To improve system reliability, it is proposed to supply Oakdale Central from the Minchinbury Elevated supply system via a proposed DN300 connection (refer section 4-7 on Fig. 4) between the existing DN250 potable water main within Millner Avenue (refer section 3-4 on Fig. 4) to the proposed DN300 within Oakdale West (refer section 7-8 on Fig. 4) which ultimately connects to the existing DN300 within Erskine Park Link Road (EPLR). The proposed DN300 is proposed to be delivered at the same time as the Oakdale West development.

4.1.2 Oakdale South

Oakdale South will be supplied via extension (refer section 4-6 on Fig. 4) of the existing DN250 potable water main (Refer Section 3-4 on Fig. 4) within Millner Avenue which is supplied from the Cecil Park Supply System.

4.1.3 Oakdale West

Oakdale West will be supplied via a proposed DN300 (refer section 8-9 on Fig. 2) connection to the existing DN300 within Erskine Park Link Road (EPLR). This proposed DN300 will be supplied from the Minchinbury Elevated Supply System. As mentioned above, a DN300 cross connection (refer section 4-7 on Fig. 2) to Oakdale Central will be delivered at the same time as the Oakdale West development to supply Oakdale Central from the Minchinbury Elevated Supply System which will improve the system reliability.

4.1.4 Oakdale East

Oakdale East will be supplied off the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System.

4.1.5 CSR

CSR lands will be supplied via a proposed DN300 connected to the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System.

4.1.6 Jacfin

Jacfin lands will be supplied via a proposed DN300 connected to the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System. Jacfin internal reticulation will be via a proposed DN250 which will be connected to the proposed DN250 within Oakdale South to improve the system reliability.

4.2 Short-term servicing plan (Current- 2020)

Under this short-term supply configuration, Oakdale development will be supplied from Cecil Park supply system using existing DN450 lead-in main. The proposed internal pipework within Oakdale South need to be completed. i.e. 850 m DN250 and 850 m DN200.

Cecil Park reservoirs have sufficient capacity to supply the Cecil Park zone for the current max day scenario including proposed 2020 growth in the Oakdale Development as summarised below:

- Oakdale South, (i.e. 2020 MDD: 1.0 ML/d)
- Oakdale Central, (i.e. 2020 MDD: 0.7 ML/d)
- Oakdale West, (i.e. 2020 MDD: 1.0 ML/d)
- Jacfin, (i.e. 2020 MDD: 2.1 ML/d) and
- CSR. (i.e. 2020 MDD: 0.9 ML/d)

4.3 Mid-term servicing plan (2020- 2031)

Cecil Park reservoirs and transfer system have capacity to supply Cecil Park zone for the 2020 max day scenario including proposed 2020 growth in the Oakdale Development.

Between 2020 and 2024 the following actions are proposed:

- Rezoning to occur @ 2020 of Austral onto Cecil park (MDD: 2.8 ML/d @ 2020 and through to MDD: 4.8 ML/d @ 2024-25) (South West Priority Land Release Area "SWPLRA"; May 2016)
- Further growth within the Oakdale Development 1.7 ML/d (Oakdale Industrial will be fully developed at 2024)

The above contribute to significant capacity deficiencies within the system. i.e. WP0184 and Cecil Park reservoirs cannot keep up with a max week demand. By rezoning Oakdale West and Central on to Minchinbury Elevated relieves demand of 1.6 ML/d provides sufficient capacity relief to accommodate the forecasted demand and rezoning up to 2024.

Therefore, under mid-term servicing plan, Oakdale West and Oakdale Central will be supplied from Minchinbury Elevated supply zone using existing DN300 trunk main (i.e. gravity supply from elevated reservoir). Extensions off Sydney Water's existing DN300 trunk main will need to be built. i.e. approx. 1.2 Km. Customers along Aldington Rd (i.e. approx. 28 customers) that experiencing low pressure under current maximum day demand could also be rezoned to Minchinbury Elevated supply zone using the proposed DN300 trunk main within Oakdale West.

The Oakdale Industrial remainder including Jacfin and CSR would be supplied from Cecil Park using existing DN450 and proposed DN300 lead-in main.

From 2024 through to 2030 there is insufficient capacity within both the Minchinbury Elevated and Cecil Park supply systems to accommodate growth within the Oakdale Industrial area. Between 2024 and 2030 the following actions are proposed:

- Further growth in the Austral rezoned area now being fed from Cecil Park
- Rezoning to occur @ 2024 of Leppington North onto Cecil Park (7.3 ML/d @ 2024) (South West Priority Land Release Area "SWPLRA"; May 2016)

Accordingly, further investigation into the proposed rezoning and or required amplification of the system prior to this date is required.

4.4 Long-term servicing plan (Post 2030)

The Oakdale Industrial development will be supplied from Cecil Park and Minchinbury Elevated supply systems. Cecil Park reservoirs (i.e. including any proposed new reservoir) and upgraded Prospect Creek pumping station WP0184B have sufficient capacity to supply the Cecil Park zone for the 2036 max day scenario including ultimate growth within the Oakdale Development. This is based on an indicative scheme included in the GSS but subject to detailed planning before finalisation of preferred option.

The Oakdale servicing plan overview is presented in Figure 4.

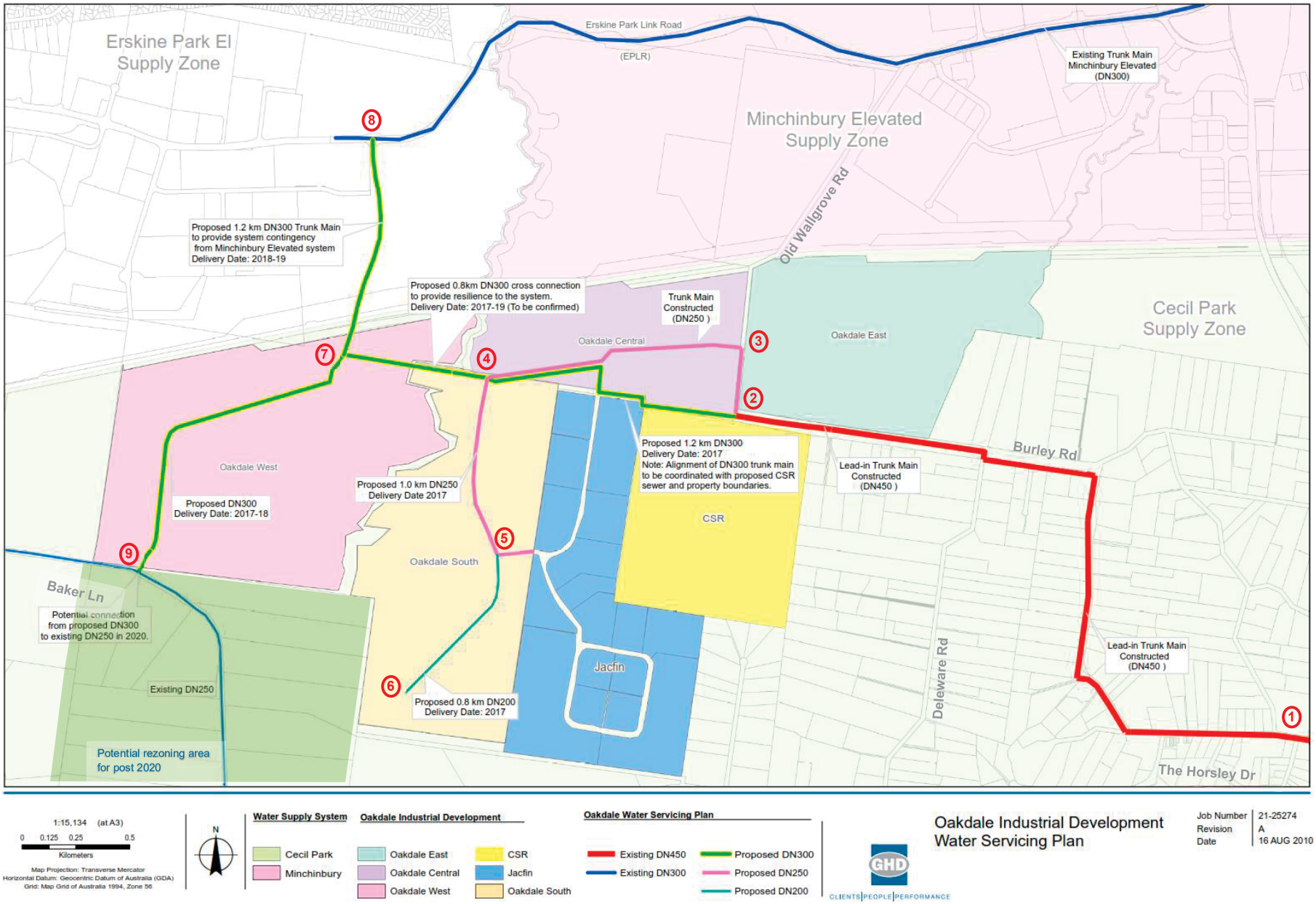

Figure 4- Oakdale Industrial Water Servicing Plan

4.5 Preliminary capital cost assessment

Preliminary capital cost estimates were developed for Oakdale Development. The water mains indirect and total delivery costs were estimated using the Sydney Water Cost Estimator tool (version 09-2015.11). The following assumptions were adopted for preliminary cost estimation:

- 75% scope contingency was adopted for all options as per advice from Sydney Water
- An allowance was made for rock excavation for 30% of the length of the water mains
- 25% Road restoration was allowed for all pipework

A summary of the preliminary capital cost estimates associated with Oakdale Industrial water servicing is presented in Table 7. Detailed cost estimates are provided in Appendix B.

Table 7 Preliminary capital cost estimates

Section	Description	Delivery Date	Capital Cost ($M)
1-2	4.0 km DN450	Constructed	NA
2-3	0.35 km DN250	Constructed	NA
3-4	1.2 km DN250	Constructed	NA
2-4	1.2 km DN300	2016-17	$2.21 M
4-5	0.9 km DN250	2016-17	$1.34 M
5-6	0.85 km DN200	2016-2017	$1.08 M
4-7	0.7 km DN300	2017-2018	$ 1.31 M
7-8	1.2 km DN300	2018-2019	$2.21 M
8-9	1.6 km DN300	2018-2019	$2.93 M

5. Conclusions and Recommendations

This study investigated the assets required to service the proposed Goodman, Jacfin and CSR developments within the Oakdale Precinct to meet development timeframes. The water servicing plan for the Oakdale Industrial Development is made up of the following:

Oakdale Central

Oakdale Central is currently supplied from the existing DN250 potable water main within Millner Avenue which is supplied from the Cecil Park Supply System. To improve system reliability, it is proposed to supply Oakdale Central from the Minchinbury Elevated supply system via a proposed DN300 connection between the existing DN250 potable water main within Millner Avenue to the proposed DN300 within Oakdale West which ultimately connects to the existing DN300 within Erskine Park Link Road (EPLR). The proposed DN300 is proposed to be delivered at the same time as the Oakdale West development.

Oakdale South

Oakdale South will be supplied via extension of the existing DN250 potable water main within Millner Avenue which is supplied from the Cecil Park Supply System.

Oakdale West

Oakdale West will be supplied via a proposed DN300 connection to the existing DN300 within Erskine Park Link Road (EPLR). This proposed DN300 will be supplied from the Minchinbury Elevated Supply System. As mentioned above, a DN300 cross connection to Oakdale Central will be delivered at the same time as the Oakdale West development to supply Oakdale Central from the Minchinbury Elevated Supply System which will improve the system reliability.

Oakdale East

Oakdale East will be supplied off the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System.

CSR

CSR lands will be supplied via a proposed DN300 connected to the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System.

Jacfin

Jacfin lands will be supplied via a proposed DN300 connected to the existing DN450 within Burley Road which is supplied from the Cecil Park Supply System. Jacfin internal reticulation will be via a proposed DN250 which will be connected to the proposed DN250 within Oakdale South to improve the system reliability.

Appendices

Appendix A –Revised Basis of Water Planning

Memorandum

25 May 2016

To	Amir Rashidi		
Copy to	Russell Hogan, Suhanti Thirunavukarasu, Suganthini Niranjan		
From	Amir Rashidi	Tel	02 92397010
Subject	Oakdale Industrial- Revised Basis of Water Planning	Job no.	21/25274

1. Introduction

1.1 Purpose of this memorandum

The purpose of this memorandum is to document and seek endorsement from Sydney Water on the design and system performance criteria to be adopted for the investigation associated with the water system within the Oakdale Industrial development. It is important that Sydney Water agrees to these criteria prior to substantial commencement of the planning tasks.

1.2 Background

The Oakdale industrial site is part of the existing Western Sydney Employment Area (WSEA 8 – Area South of Pipeline Precinct), located approximately 40 kms west of the Sydney CBD, adjacent to the M7 and M4 intersection, adjacent south to the Eastern Creek Precinct and Warragamba Water Pipeline at Horsley Park. The site was rezoned in September 2009 through the WSEA SEPP 2009, and Goodman is the lead developer of the precinct. An overview of study area is presented in Figure 1.

Water: The initial scheme was to supply the site from Cecil Park; however, there is an alternative option to supply Oakdale through a combination of the Minchinbury and Cecil Park supply zones. Extensions off Sydney Water's existing system will need to be built to provide the full site with drinking water services.

Assets required to service proposed Goodman development at Oakdale are to be staged to meet development timeframes, with lead-in infrastructure funded up front and delivered by the lead developer and to be reimbursed by Sydney Water in accordance with its policy on Funding Infrastructure to Service Growth.

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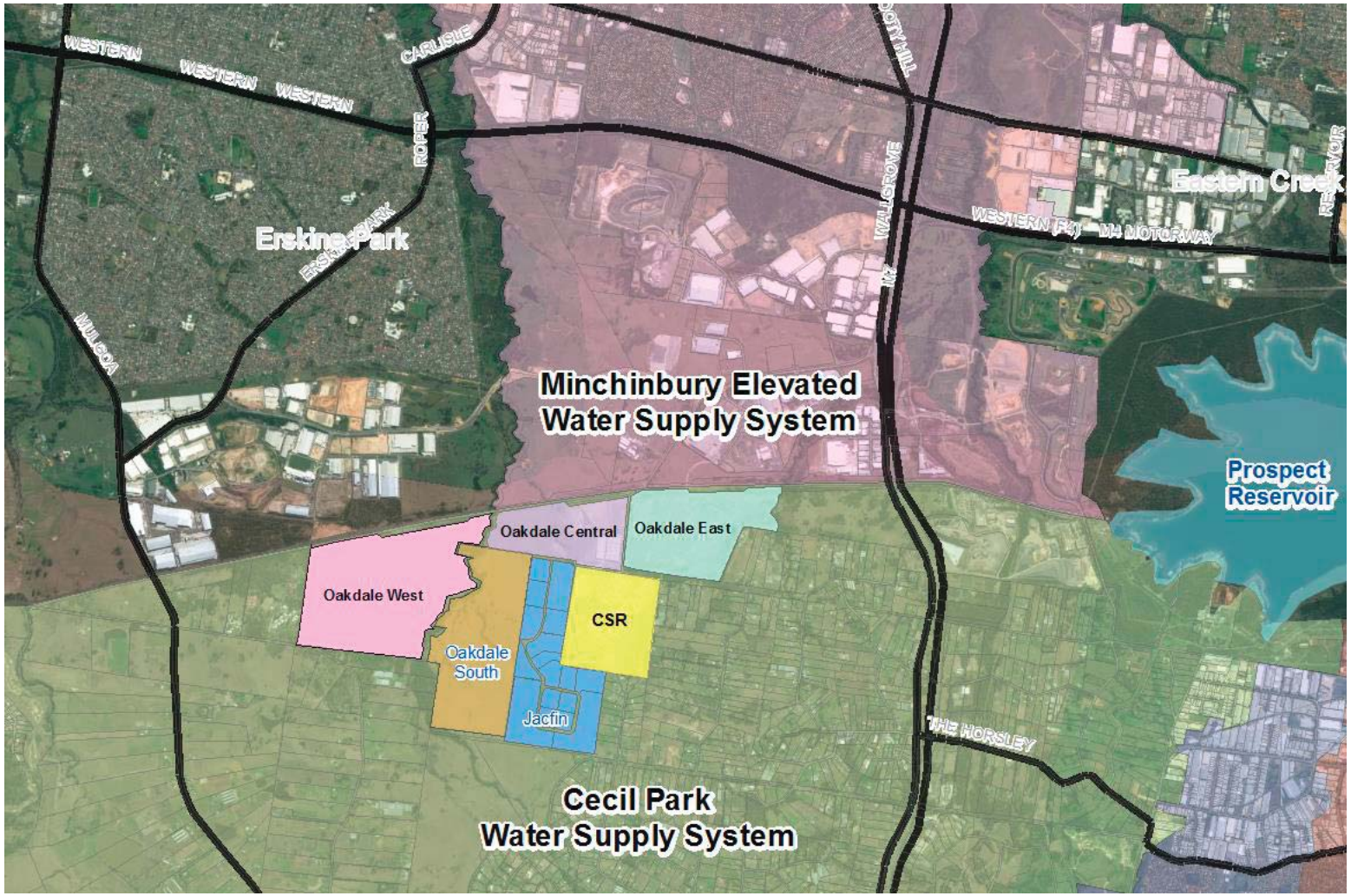

Figure 1 Oakdale Industrial Development Overview

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2. Summary of Growth

This section provides details of growth projections within the study area including the expected timing, and scale of growth.

2.1 Growth

Population growth forecasts are a key input into the planning process and provide an insight into future infrastructure needs as well as future capital investment needs.

Oakdale Estate is a future industrial development with approximately 300 nett hectares of development lots anticipated in the ultimate stage. The site spans two local government areas of Penrith and Fairfield.

The growth projections listed for this study are supplied by AT&L in conjunction with Jacfin, CSR and Goodman. The list of the growth projection within the Oakdale Industrial Development is summarised in Table 1. Detailed figures for each of the developments are included in Appendix A.

Table 1 Growth projections

Development site	Precinct	Nett Development (ha)	Development type	Timing
Oakdale South	1	18.8	Light industrial/warehouse	2017-2018
	2	4.4		2018
	3	16.5		2017-2019
	4	9.5		2019
	5	14.0		2017
	6	7.0		2019
	Total	**70.2**		
Oakdale East	**1**	**95.0** (3)	Light industrial/warehouse	2022-2024 (1)
Oakdale West	1	21.7	Light industrial/warehouse	2019
	2	21.6		2019-2020
	3	18.5		2020
	4	22.6		2020-2021
	5	6.1		2020
	Total	**90.5**		

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Development site	Precinct	Nett Development (ha)	Development type	Timing
Oakdale Central	1A	4.1	Light industrial/warehouse	Built
	1B	5.9		Built
	1C	4.6		Q1-2016
	2A	7.5		Built
	2B	6.0		Q1-2016
	3A	1.6		2017
	3B	5.8		Q4-2016
	3C	5.6		2017
	3D	1.9		2017
	Lot 4	2.2		2017
	Total	**45.2**		
Jacfin	1	3.6	Light industrial/warehouse	2016
	2	17.4		2016
	3	21.6		2017
	4	25.7	Residential low density [2]	2016
	5	19.5		2016
	Total	**87.8**		
CSR	1	10.1	Light industrial/warehouse	2017
	2	32.3		2018
		11.5	Environmental /Open Space	
	3	21.0	Light industrial/warehouse	2020 [1]
	Total	**74.9**		
Grand Total		**463.6**		

Note 1: The timeframes are subject to change

Note 2: Rural Residential

Note 3: Further growth listed for this study is in addition to current East Oakdale development plan

Note 4: The above growth projections have been provided be the following:

Developer	Contact(s) - Role	Received	Date received
CSR	Wayne Pasalich – CSR Senior Development Manager	Via Email	1st March 2016
Jacfin	Emma Sunderland – Calibre Consulting on behalf of Jacfin	Via Email	29th Feb 2016
Goodman	Richard Seddon – Goodman Development Manager Russell Hogan – AT&L on behalf of Goodman	Via Email	29th Feb 2016

3. Planning criteria

3.1 Water planning criteria

This section details the water planning criteria relevant to this investigation. We request Sydney Water's endorsement of the design criteria as a hold point for the project prior to commencement of the system performance assessment.

3.2 Water planning references

The following documents, referenced in Table 2, were consulted in developing the planning criteria:

1. Water and Recycled Water System Growth Servicing Strategy – Criteria and Guidelines 2012
2. Water System Planning Guideline (ver. 1- September 2014)
3. Water Supply Code of Australia (WSA 03-2011-3.1 - Sydney Water Edition 2012)
4. Recommendation – Water-main renewal program interim sizing rules to address fire-fighting needs
5. Precinct Structure Plan

Table 2 Water Planning Criteria

Item	Design Criteria	Units	Water	Reference
System Demands (existing areas)				
Max Day Demand (MDD)	Max Day Demand /Average Day Demand (MDD/ADD) Factor	NA	An analysis of the last ten consecutive financial years of IICATS data to select the day with the highest demand over 24 hours. The peaking factor will be derived from calculated MDD and ADD. (i.e. peaking factor: MDD/ADD) • Cecil Park Supply System peaking factor: 2.8 • Cecil Park maximum day demand : 18.75 ML/d • Minchinbury Supply System peaking factor: 1.6 • Minchinbury maximum day demand : 5.2 ML/d	Reference 2 See Appendix C
Max Hour Demand	Max Hour Demand /Max Day Demand Factor	NA	An analysis of the last ten years of 15 minutes of IICATS data to select the maximum hour event. If the results are inconsistent then the default WMS maximum day demand diagram will be adopted	Reference 2
Performance Requirements				
Trunk Mains	Minimum Pressure	Meter	Trunk mains (no customer connections) will maintain 3 m at all times under max day demand condition	Reference 1

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Item	Design Criteria	Units	Water	Reference
Reticulation Mains	Minimum Pressure	m	Maintain at the property boundary: >25 m residual pressure (desirable) (2)	
	Maximum Pressure	m	The long-term aim is to reduce to 60 m or less where financially viable	Reference 2
	Maximum headloss	km/ hr.	Maximum headloss of 5 m/km for ≤ DN150 and 3 m/km for ≥ DN200. (secondary criteria)	Reference 3
	Maximum Velocity	m/s	>2 m/s (i.e. The optimum velocity is in the range 0.8 m/s to 1.4 m/s.)	
Critical water-mains (Fire flow criteria)	Fire-Fighting Enquiries	L/s	High density residential, major special uses and heavy commercial and industrial : Not less than 10 m residual head with assume flow of 25 L/s (at 95th percentile domestic demand)	Reference 4
Minimum Pipe Size	Flow rates & residual pressure	mm	Industrial and Commercial: Cast iron outside diameter series: 150; Steel and Polyethylene pipes: 180	Reference 3
WMS model for water planning purposes (1)				
Minchinbury			***Current MDD***: > Potable Retic>04. Prospect South>4.1 Minchinbury>Minchinbury-Minchinbury Elevated>20 Projects>GSS 2013-14>HP2 System Performance>Max Day>GSS - Current Max Day Run 1.1 ***2031 MDD Model Run:*** >Potable Retic>04. Prospect South>4.1 Minchinbury>Minchinbury-Minchinbury Elevated>20 Projects>GSS 2013-14>HP2 System Performance>Max Day>GSS - 2031 Max Day Run 1.1 ***2036 MDD Model Run:*** >Potable Retic>04. Prospect South>4.1 Minchinbury>Minchinbury-Minchinbury Elevated>20 Projects>GSS 2013-14>HP2 System Performance>Max Day>GSS - 2036 Max Day Run 1.1	
Cecil Park			***Current MDD :*** >Potable Retic>04. Prospect South>4.4 Cecil Park>Cecil Park>20 Projects>WSEA - Structure Plan Update>GSS Run Group>Current Max Day ***2031 MDD Model Run :*** >Potable Retic>04. Prospect South>4.4 Cecil Park>Cecil Park>20 Projects>GSS>Run Group>2031 Max week GSS_Solutions ***2036 MDD Model Run*** : >Potable Retic>04. Prospect South>4.4 Cecil Park>Cecil Park>20 Projects>GSS>Run Group>2036 Max week_Solutions_N	

Note 1: The GSS model for Minchinbury was used as this was the latest study in the local area and included an update of key assets and system demands. This will be validated and forecast demands updated as part of this project. The GSS model for Cecil Park was referenced in the recent SWPLRA / SWGC 2nd release precincts detailed planning investigation and is the latest version of the Cecil Park model available. This will be validated and forecast demands updated to reflect latest data. This has been discussed and confirmed with Sydney Water.

Note 2: The minimum pressure specified in the Operating Licence is 15 metres, however, some exceedances of this limit are permitted. Refer to Sydney Water Operating Licence. A lower minimum service pressure may be provided based on financial and risk considerations, and is subject to Sydney Water approval.

4. Water demand assessment

A baseline maximum day demand of 40 kL/Nha/day for light industrial new development was employed from Water System Planning Guideline to estimate the Oakdale Industrial water demand. During this assessment, it was observed that new development that anticipated occurring in Oakdale industrial will be typically warehouses with commercial / office land use. Consequently, Sydney Water advice to reassess the Oakdale industrial future demand based upon the Moorebank and Wetherill Park industrial areas that exhibit a similar type of development. The evidence based average day water demand summarised in Table 3. Figure 2 also shows the location of the Moorebank and Wetherill Park industrial areas in relation to the Oakdale Industrial precinct. .

Table 3 Evidence based average day water demand for comparable Industrial Areas [(1)]

Average Day Demand	Units	Moorebank	Wetherill Park	Weighted Average
Area demand (average)	kL/day	1,324	4,520	-
Area	Hectares	182	456	-
Demand per net hectare	kL/net ha/day	7.3	9.9	9.2

Note 1: The evidence based industrial demand employed from Broader WSEA Water Services Study (Nov 2013)

4.1 Summary of Oakdale Industrial water demand forecasts

The following outline of potable water demand provides predicted average day (ADD), maximum day (MDD) and maximum hour demand (MHD) based on projected development yield.

The calculations are based on the forecast development yield (i.e. Table 1) and evidence base design demands (Table 3). Detailed calculations for MDD and MHD demand are provided in Appendix B. The Oakdale Industrial demand forecast summarised in Table 4.

Table 4 Summary of revised water demand- Oakdale Industrial fully developed

Development site	Demand Scenario (ML/d)		
	ADD	**MDD**	**MHD**
Oakdale South	0.65	1.0	1.65
Oakdale West	0.83	1.3	2.13
Oakdale East	0.87	1.4	2.24
Oakdale Central	0.42	0.7	1.08
Jacfin	1.04	2.12	4.1
CSR	0.58	0.93	1.49
Total	**4.4**	**7.5**	**12.7**

Note 1: the maximum demand was estimated based on Industrial peaking factor of 1.6 (i.e. MDD/ADD)

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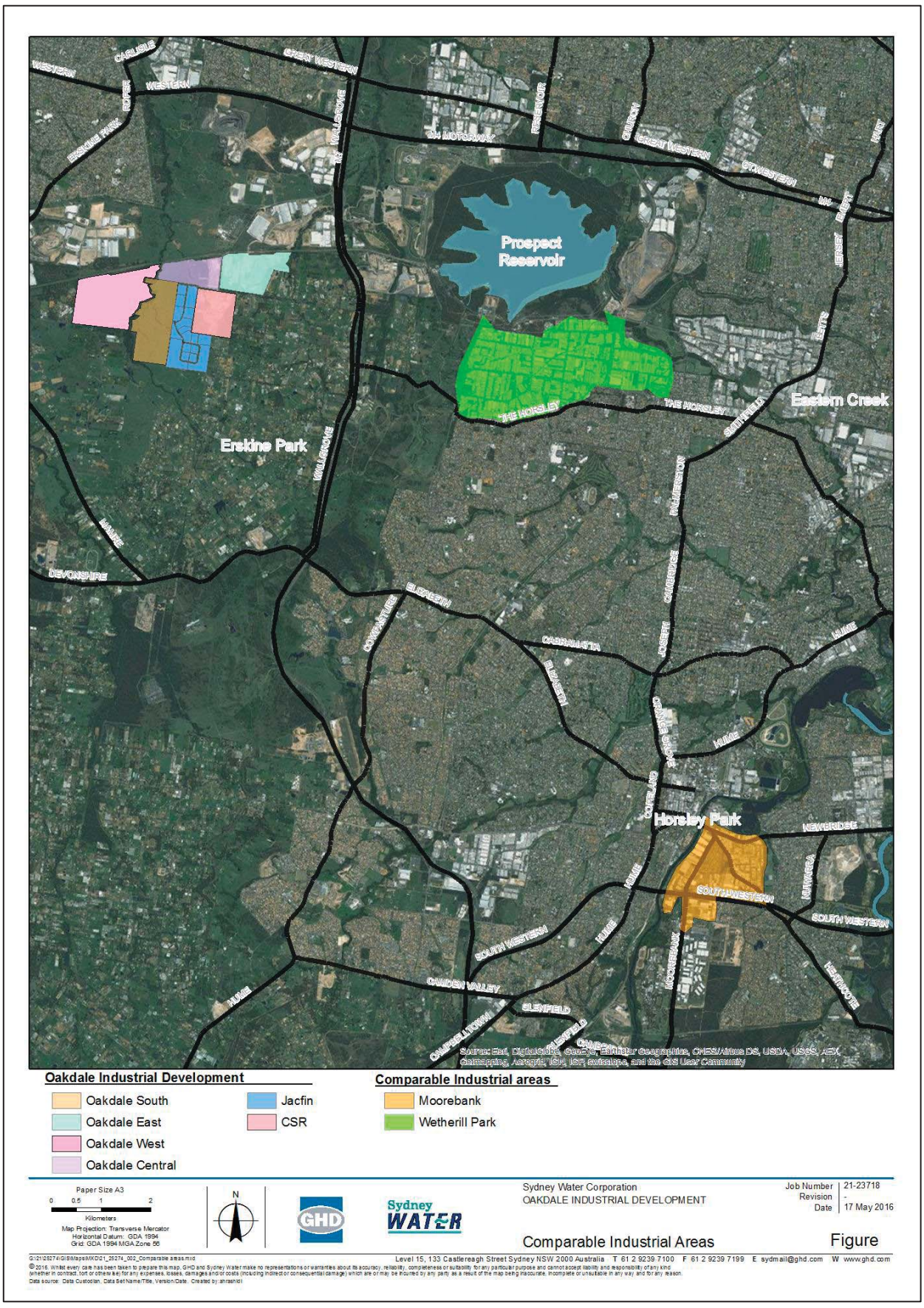

Figure 2- Comparable Industrial Areas

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4.2 Future Max Day Demand Projections

The Growth Servicing Strategy (GSS) demand estimation revised based on the following updated growth data:

- Additional forecast growth within the Parkbridge Estate i.e. 264 dwellings
- Defer rezoning from Austral to Cecil Park supply system to post 2020 i.e. 450 dwellings. The 2020 sensitivity analysis with Austral demand will be developed.
- Potable top-up transfer into the Hoxton Park recycled water scheme reduced from 1.2 ML/d to 1.1 ML/d (i.e. The Hoxton Park Recycled Water top-up water demand pattern will be employed)
- The proposed Oakdale Industrial demand within GSS model (i.e. 0.2 ML/d) will be replaced with revised demand assumptions (Table 4)

The revised future demand projections are presented in Table 5. The residential growth sites details are provided in Appendix D.

Table 5 Summary of revised future water demand- Cecil Park Supply System

Demand Category	2016 MDD ML/d	2020 MDD ML/d	2031 MDD ML/d	2036 MDD ML/d
Residential (LD)	6.2	10.2	31.7	47.7
Residential (HD)	0.03	4.9	5.3	5.4
Dual Retic Res (LD)	0.2	1.1	1.2	1.4
Dual Retic Res (HD)	0.03	0.1	0.1	0.1
Industrial	1.6	1.8	4.1	7.7
Commercial	8.6	13.8	24.7	40.6
Other	2.1	2.1	5.6	5.64
Oakdale Industrial	0.0	5.8	7.5	7.5
Total	**18.8**	**39.8**	**80.3**	**116.0**

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Appendix A- Oakdale Industrial Detailed Development

GHD
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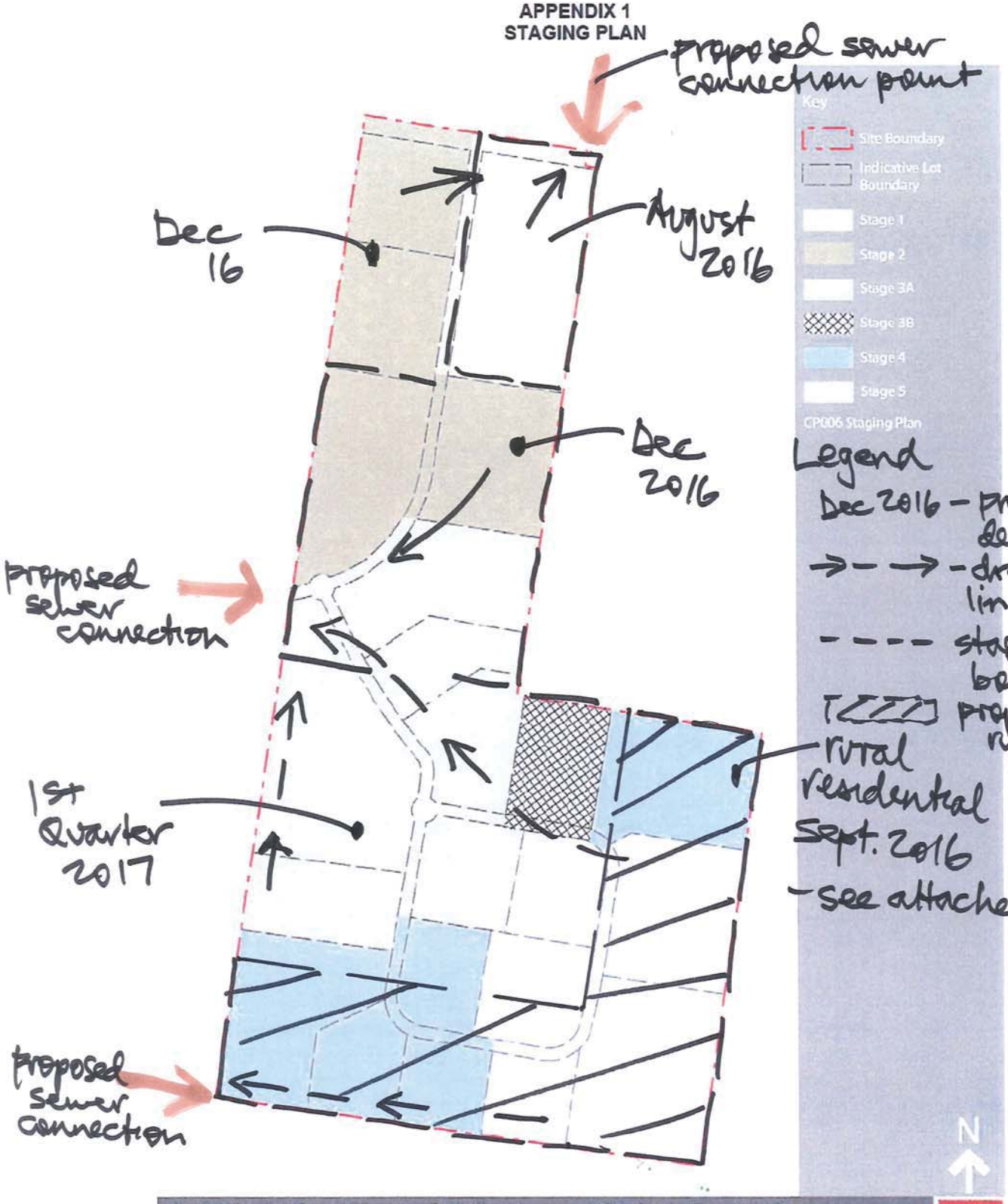
CENTRAL Area Schedule

TOTAL LAND AREA		612,065 sqm
Lot	**Site Area**	**Building Area**
Lot 1A	41,368 sqm	20,220 sqm
Lot 1B	58,760 sqm	31,745 sqm*
Lot 1C	46,417 sqm	27,145 sqm*
Lot 2A	74,693 sqm	36,570 sqm
Lot 2B	60,010 sqm	31,080 sqm*
Lot 3A	16,016 sqm	7,283 sqm*
Lot 3B	58,493 sqm	36,965 sqm*
Lot 3C	55,622 sqm	33,426 sqm*
Lot 3D	18,795 sqm	8,275 sqm*
SUB TOTAL	414,158 sqm	232,709 sqm*
Lot 4	21,615 sqm	0 sqm*
CENTRAL TOTAL	435,773 sqm	232,709 sqm*
Services Lot	10,000 sqm	
Biodiversity Lot A	18,367 sqm	
Biodiversity Lot B	40,812 sqm	
Biodiversity Lot C	41,533 sqm	
Road Widening Lots	4,572 sqm	

* Areas subject to Survey.

APPENDIX 1
STAGING PLAN



Lot A Burley Road, Horsley Park Employment Precinct - Staging Plan
Prepared for Jachn Pty Ltd
13 June 2012
1:5000 @ A3

JBA planning

NSW Government
Department of Planning and Infrastructure

Jacfin
Staging/Development Timing

Road = DC Date

Site Area Schedule

Total Site Area	**117.00 ha**
Less:	
Non Developable Land	35.85 ha
Easements	3.73 ha
Regional Roads	1.74 ha
Services Lot	1.66 ha
Estate Roads	5.38 ha
	48.36 ha
Development Areas	
Precinct 1	18.81 ha
Precinct 2	4.38 ha
Precinct 3	16.53 ha
Precinct 4	9.45 ha
Precinct 5	14.01 ha
Precinct 6	7.09 ha
Total Developable	**70.28 ha**
Total Warehouse	376,295 sqm
Total Office	19,585 sqm
Total Facility	395,880 sqm

SBA ARCHITECTS

Oakdale South Estate
Horsley Park

SSDA Masterplan

1:2500 @ A1
1:5000 @ A3
04 Sept 2015

OAK MP 02 (K)

OAKDALE WEST
- ESTIMATED TABLE UP FOR SERVICING

SEE DRAWING OAK MP03 FOR CONTINUATION

Site Area Schedule

Total Site Area	154.10 ha
Less:	
Non Developable Land	32.01 ha
Easements	22.55 ha
Regional Roads	6.43 ha
Estate Roads	8.74 ha
	69.73 ha
Development Areas	
Precinct 1	21.72 ha
Precinct 2	21.61 ha
Precinct 3	18.51 ha
Precinct 4	22.56 ha
Precinct 5	6.05 ha
Total Developable	90.45 ha
Total Warehouse	455,233 sqm
Total Office	22,685 sqm
Total Facility	477,918 sqm

PRELIMINARY

Goodman
BRICKWORKS

SBA ARCHITECTS

Oakdale West Estate
Horsley Park

SSDA Estate Masterplan

1:2500 @ A1
1:5000 @ A3
03 Feb 2016

OAK MP 02 (G)

Russell Hogan

From: Russell Hogan
Sent: Wednesday, March 2, 2016 3:11 PM
To: Mahmood Hossain (Mahmood.Hossain@ghd.com); 'Amir Rashidi (Amir.Rashidi@ghd.com)'
Subject: RE: Oakdale LASP update
Attachments: Appendix 2 Subdivision Development Application Plans.pdf

Gents,

Please see below staging horizons for CSR land.

Goodman information to follow shortly.

Also please see attached CSR proposed staging plan.

Regards,

Russell Hogan
Civil Project Manager

at&l

Level 7, 153 Walker Street
North Sydney NSW 2060

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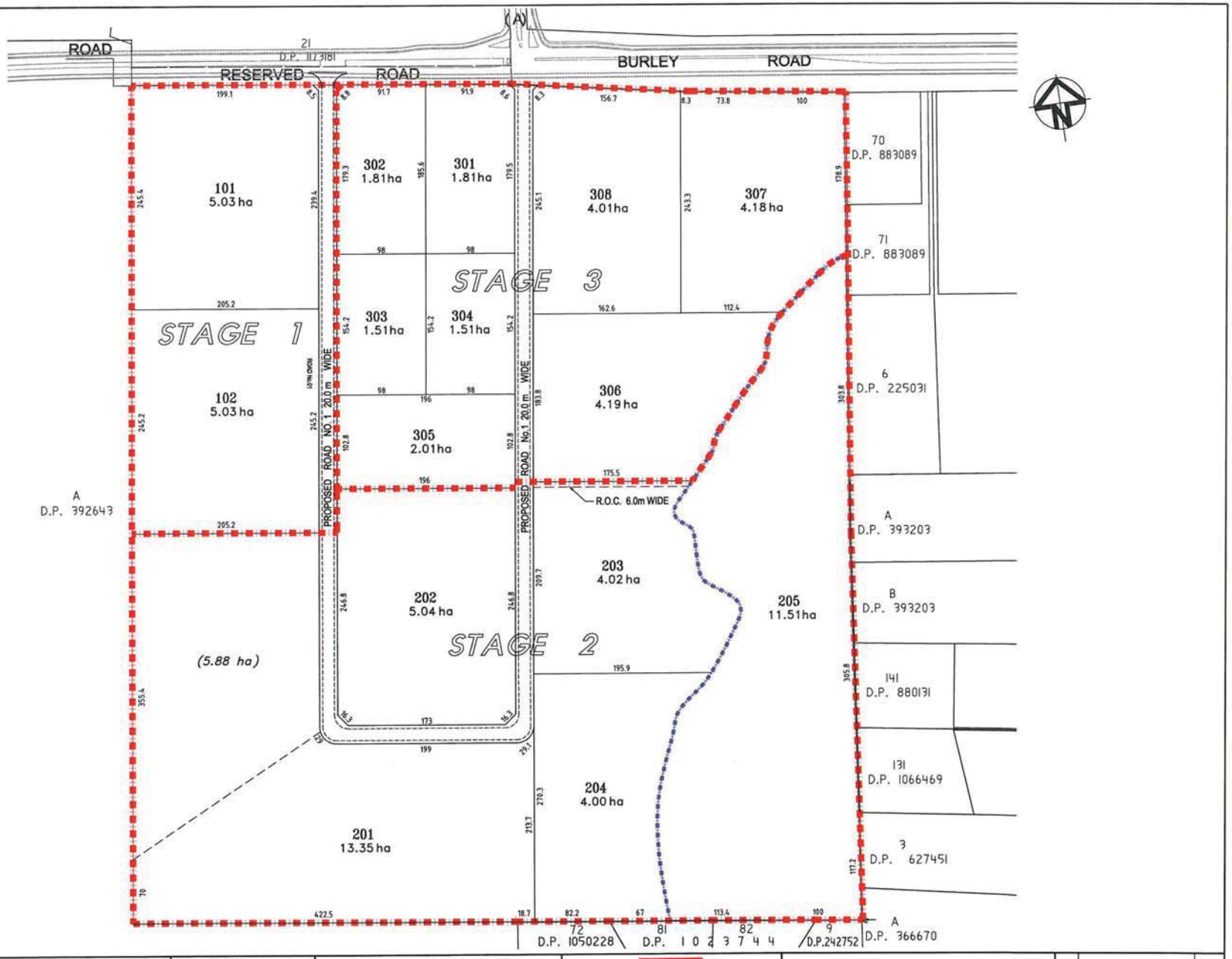
M 0424 441 231
F 02 9923 1055
russell@atl.net.au
www.atl.net.au

From: Pasalich, Wayne [mailto:WPASALICH@csr.com.au]
Sent: Tuesday, March 1, 2016 5:52 PM
To: Russell Hogan <Russell@atl.net.au>; Claire Kollaras <Claire.Kollaras@calibreconsulting.co>
Cc: Rachel Owen <Rachel.Owen@calibreconsulting.co>; Stuart Green <Stuart.Green@calibreconsulting.co>; Inbox <inbox1@atl.net.au>
Subject: RE: Oakdale LASP update

Russell

Claire is away on leave currently so I can address any queries you have. The current anticipated deliver program is as follows;

Stage	Registration Date	Notes
1	Q2 2017	Earlier connection would be beneficial as we have sold the property and the new owners are looking to make an early start on the works
2	Q1 2018	
3	TBA	No fixed date for this stage as the business does not currently have any plans to shut down the factory in the short term



LOT SUMMARY
STAGE 1 101-102 = 2 INDUSTRIAL LOTS
STAGE 2 201-204 = 4 INDUSTRIAL LOTS 205 = 1 ENVIRONMENTAL LOTS
STAGE 3 301-308 = 8 INDUSTRIAL LOTS

LEGEND	
(A)	OLD WALLGROVE ROAD
	ENVIRONMENTAL CONSERVATION

REDUCTION RATIO
PLAN 1:2000 @ A1
1:4000 @ A3

DATUM A.H.D. | DESIGN P.L. | CHECKED P.L.
SURVEY | TRACED A.C. | DATE 12-12-2013

SCALE 1:2000 (A1) SCALE 1:4000 (A3)

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CSR

PROPOSED SUBDIVISION
OVER LOT 1 IN D.P. 106143 BEING PROPERTY AT
327-335 BURLEY ROAD, HORSLEY PARK
OVERALL PLAN

ISSUE	DESCRIPTION	DATE
0	ORIGINAL ISSUE	12-12-13

DRAWING. No. X13044.P_ST0
AMEND. 0
SHEET 1 OF 4 SHEETS

Appendix B- Detail Water Demand Calculations

Industrial- Max Day Demand	15	kL/Nha/day
Residential- Max Day Demand	2.2	kL/dwelling/day

Development site	Precinct	Area (ha)	Development type	Timing	Average Day Demand (Ml/d)	Maximum Day Demand (Ml/d)	Maximum Hour Demand (Ml/d)
Oakdale South	1	18.8	Light industrial/warehouse	2017-2018	0.17	0.28	0.44
	2	4.4	Light industrial/warehouse	2018	0.04	0.06	0.10
	3	16.5	Light industrial/warehouse	2017-2019	0.15	0.24	0.39
	4	9.5	Light industrial/warehouse	2019	0.09	0.14	0.22
	5	14	Light industrial/warehouse	2017	0.13	0.21	0.33
	6	7	Light industrial/warehouse	2019	0.06	0.10	0.16
Oakdale East	1	95	Light industrial/warehouse	2022-2024	0.87	1.40	2.24
Oakdale West	*1*	21.7	Light industrial/warehouse	2019	0.20	0.32	0.51
	2	21.6	Light industrial/warehouse	2019-2020	0.20	0.32	0.51
	3	18.5	Light industrial/warehouse	2020	0.17	0.27	0.44
	4	22.6	Light industrial/warehouse	2021-2020	0.21	0.33	0.53
	5	6.1	Light industrial/warehouse	2020	0.06	0.09	0.14
Oakdale Central	*1A*	4.1	Light industrial/warehouse	Built	0.04	0.06	0.10
	1B	5.9	Light industrial/warehouse	Built	0.05	0.09	0.14
	1C	4.6	Light industrial/warehouse	Q1-2016	0.04	0.07	0.11
	2A	7.5	Light industrial/warehouse	Built	0.07	0.11	0.18
	2B	6.0	Light industrial/warehouse	Q1-2016	0.06	0.09	0.14
	3A	1.6	Light industrial/warehouse	2017	0.01	0.02	0.04
	3B	5.8	Light industrial/warehouse	Q4-2016	0.05	0.09	0.14
	3C	5.6	Light industrial/warehouse	2017	0.05	0.08	0.13
	3D	1.9	Light industrial/warehouse	2017	0.02	0.03	0.04
	Lot 4	2.2	Commercial/café /light industrial	2017	0.02	0.03	0.05
Jacfin	1	3.6	Light industrial/warehouse	2016	0.03	0.05	0.08
	2	17.4	Light industrial/warehouse	2016	0.16	0.26	0.41
	3	21.6	Light industrial/warehouse	2017	0.20	0.32	0.51
	4	25.7	Residential low density (R4 Rural Residential)	2016	0.37	0.85	1.75
	5	19.5	Residential low density (R4 Rural Residential)	2016	0.28	0.64	1.33
CSR	1	10.1	Light industrial/warehouse	2017	0.09	0.15	0.24
	2	32.34	Light industrial	2018	0.30	0.48	0.76
		11.5	Environmental conservation area (Open Space)		0.00	0.00	0.00
	3	21	Light industrial	2020	0.19	0.31	0.49
Grand Total		**463.6**			**4.39**	**7.48**	**12.7**

Note 1: Timeframes are subject to change

Note 2: No water demand assumed for environmental conservation area within the CSR

Note 3: Additional development within Oakdale East

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Appendix C- Existing system demands assessment

Cecil Park supply system current demand

Historical system demand in the last 10 years was assessed to calculate the average day demand and to identify a suitable maximum day demand (MDD) event. Data from flow meter WF0557 downstream of Prospect Creek Pumping Station WP0184 and the reservoir level trends of Cecil Park Reservoirs were considered for the mass balance (i.e. flow data were not available from 2006 to 2009). The mass balance carried out for the above period indicated the highest max day value in November 2015 (i.e. 21.8 Ml/d).

However, this event is not acceptable due to an open DV between Cecil Park and Liverpool system. Sydney Water advice to adopt the GSS peaking factor (i.e. MDD/ADD: 2.80).

Minchinbury supply system current demand

Analysis of historical Minchinbury system demand in IICATS (i.e. past 10-year data) revealed the highest max day value in 15 January 2015. Details of selected peak demand event is provided in Table 6.

Table 6 Historical demand assessment (Ml/d)

	Cecil Park Supply System	Minchinbury Supply System	Notes
Average day demand (ADD)	6.7	32.1	# Cecil Park: 20 Nov 2015 # Minchinbury: 15 Jan 2014
Maximum day demand (MDD)	21.8	50.2	
MDD/ ADD ratio	**2.80**	**1.56**	

The Table 7 below outlines the calculated MDD per demand category in Cecil Park and Minchinbury models. The individual demand category max day factors were based on the guideline factors applied to the actual MDD/ADD.

Table 7 Current maximum day demand breakdown

Demand Category	Cecil Park Water Supply System			Minchinbury Water Supply System		
	ADD (Ml/d)	MDD factor	MDD (Ml/d)	ADD (Ml/d)	MDD factor	MDD (Ml/d)
Residential (LD)	2.07	3.24	6.40	19.7	1.74	34.4
Residential (HD)	0.02	3.19	0.03	1.9	1.44	2.8
Commercial	3.38	3.05	7.49	1.7	1.52	2.6
Industrial	0.51	3.70	1.58	2.4	1.21	2.9
Other	0.23	1.89	2.54	2.2	1.52	3.3
UFW	0.7	1.0	0.7	4.2	1.0	4.2
Total	**6.87**	**2.80**	**18.75**	**32.1**	**1.56**	**50.2**

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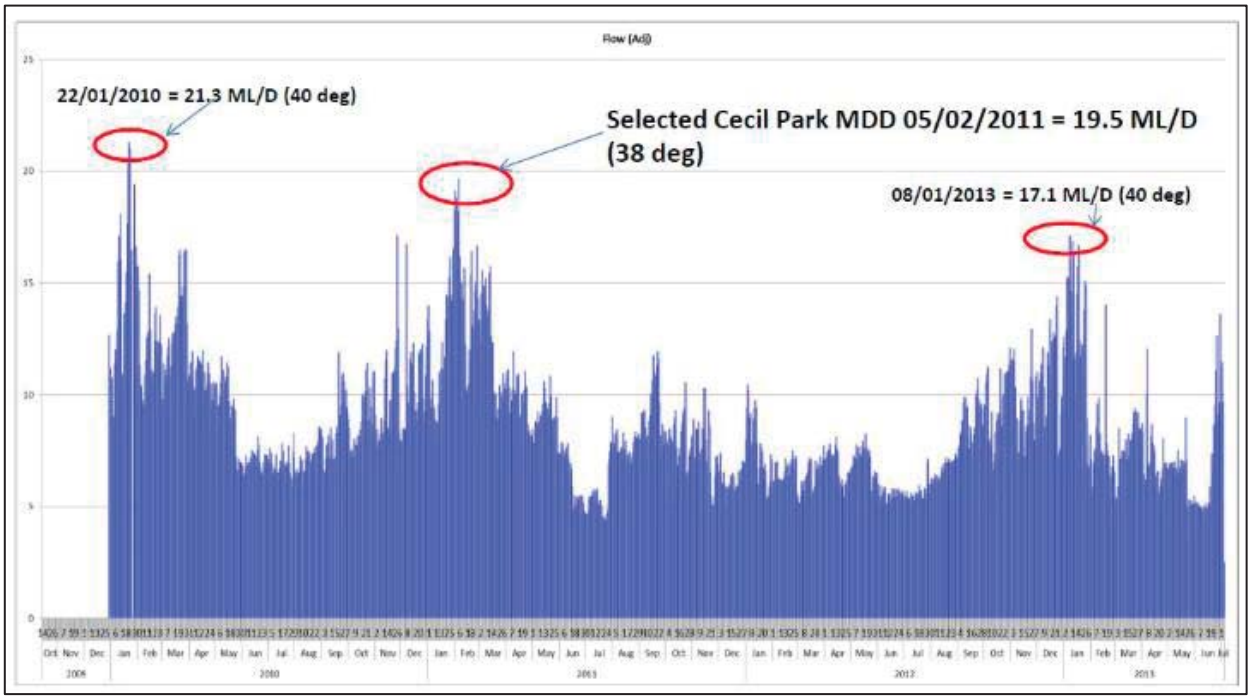
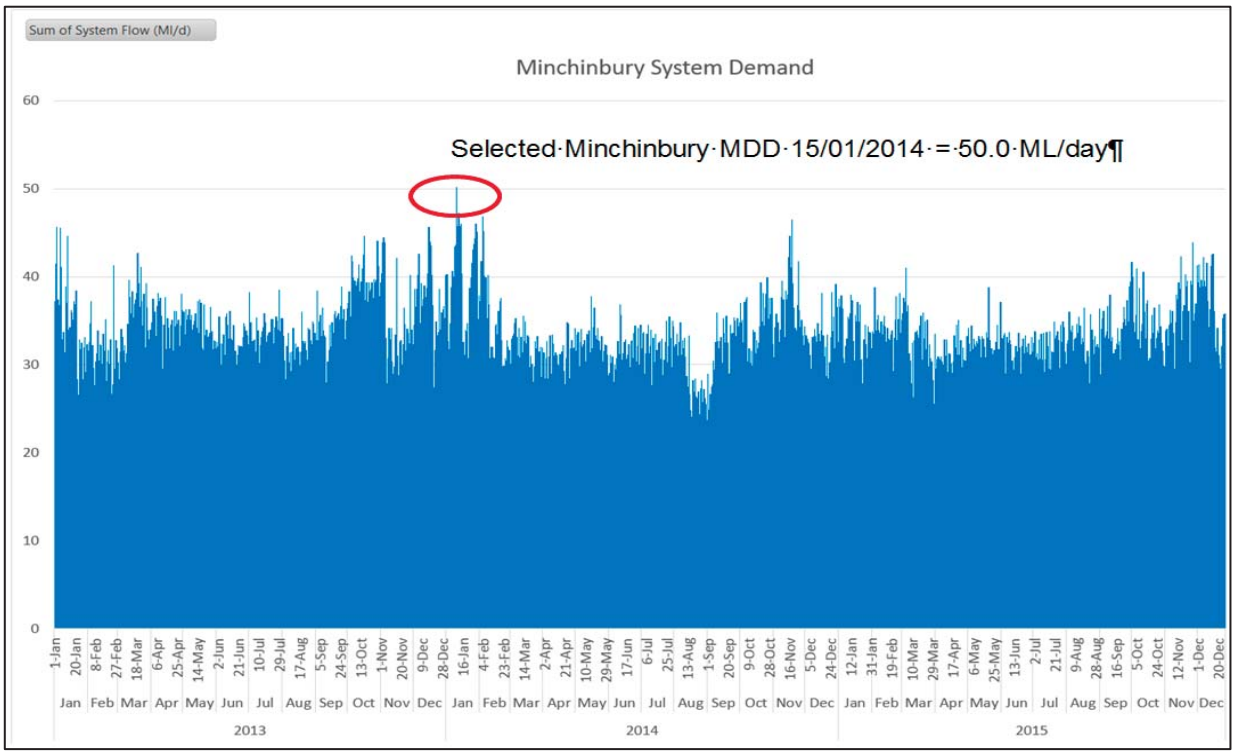
Cecil Park historical system demand analysis within the last 10 years demonstrated in figure below.



IICATS	Average (ML/d)	Maximum (ML/d)	MDD/ADD
Cecil Park	7.9	19.5 (1)	2.46

Note 1: Include 0.7 ML/day recycled water component that is potable water and should be subtracted from IICATS data. Hence, current max day of Cecil Park = 18.8 ML/day

Minchinbury historical system demand analysis demonstrated in figure below.



Appendix D- Residential growth sites

Residential Growth Sites – Dwellings (Cumulative)

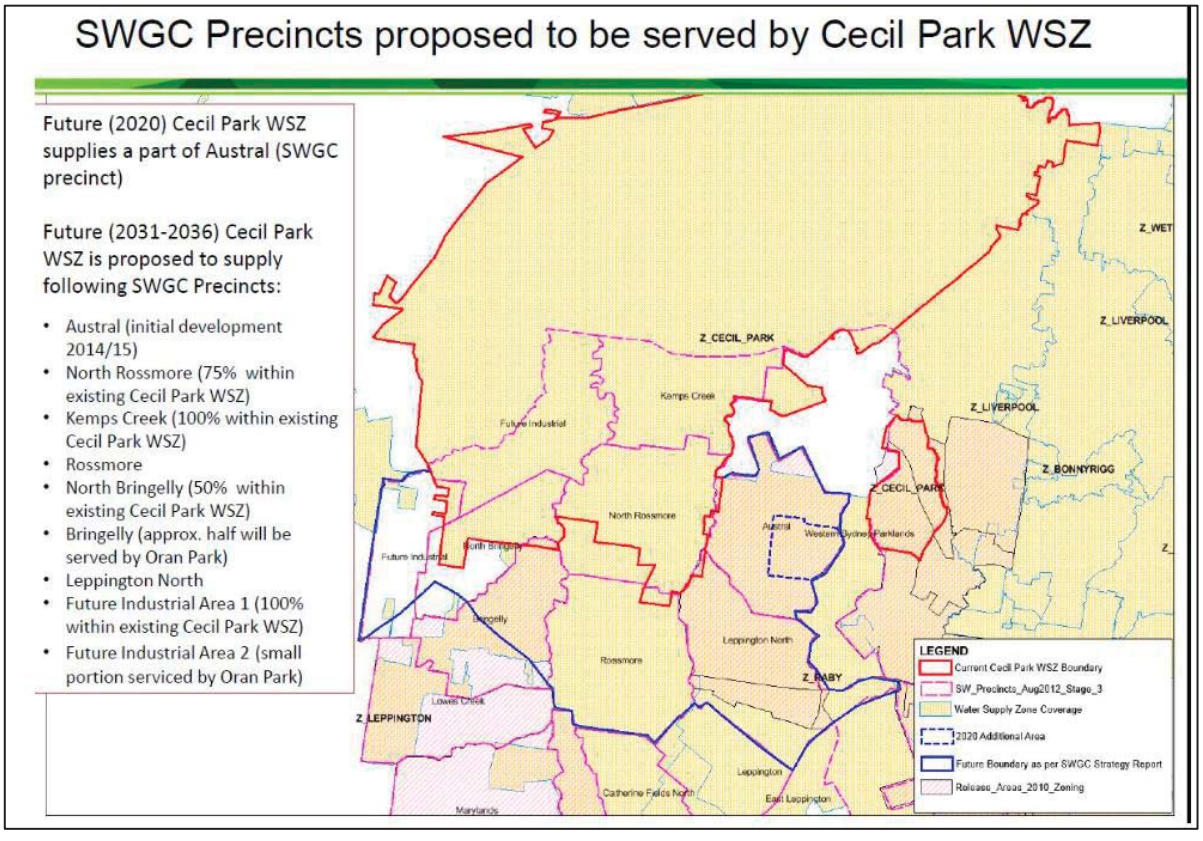
Precincts site names	Short (2011-2015)	Medium (2016-2020)	Comment
MDP Sites and Release Areas*			
Twin Creeks, Luddenham	244	326	-
Capitol Hill Drive, Mt Vernon	0	102	-
Aerodrome	500	850	-
South Hoxton Park	1,115	2,230	Hoxton Park Recycled Water Scheme

SWGC Precincts supplied via Cecil Park WSZ in future* **				
Precincts site names	**2020**	**2031**	**2036**	**Comment**
North Bringelly	0	242	3,434	100% Cecil Park
North Rossmore	0	2272	5,464	100% Cecil Park
Rossmore	0	329	2,882	100% Cecil Park
Austral		3,650	5,200	100% Cecil Park
Bringelly	0	0	1,267	50% Cecil Park and 50% Oran Park (future)
Kemps Creek	0	0	1,132	100% Cecil Park
Leppington North	0**	4,400	5,600	100% Cecil Park

*Growth provided by the Department of Planning and Environment in a form of Housing Supply Forecast Model (HSFM) table which contains an incremental growth per property for 2015 and 2020 planning horizons

** There are 700 dwellings forecast for Leppington North by 2020 however the initial servicing (up to 2020) for Leppington North is from Carnes Hill water supply zone as per the SWGC Servicing Strategy

*** These SWGC precincts are located outside of the existing Cecil Park zone boundary however the Cecil Park zone boundary will be extended in the future to enable supply from Cecil Park Reservoirs to these precincts



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Appendix B – Detailed Cost Estimation

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -2-3-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:32**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Water Main Greenfield PVC		200 dia	m		191	0
2		Water Main Greenfield PVC		250 dia	m	350	238	83,204
3		Water Main Greenfield PVC		300 dia	m		314	0
4		Water Main Greenfield PVC		375 dia	m		407	0
5		Water Main Greenfield DICL		450 dia	m		569	0
6		EO Rock Excav Trench Std Dpth - 200 Dia (1%RK-100%RK)	%RK-->	30	m	0	15	0
7		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	350	18	6,190
8		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	0	21	0
9		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
10		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
11		EO Road Restoration Trench Std Depth		250 dia	m	88	434	37,980
12		EO Road Restoration Trench Std Depth		300 dia	m	0	485	0
13		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
14		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
15		EO Road Restoration Trench Std Depth		200 dia	m	0	409	0
	H1	**Scope Contingency**						
16		Urban Detailed Planning		75	%	127,374	0.75	95,530
		Sub Total Direct Costs						**222,904**
		INDIRECT COSTS				**%**		
17		Contractor Design Costs (% of Direct Costs)				10.00%		22,290
18		Contractor Indirect Costs (% of Direct Costs)				20.00%		44,581
19		Contractor Margin (% of DC+Indirect Costs)				15.00%		43,466
20		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		116,634
		Total Construction Cost						**449,875**
		SWC CLIENT COSTS				**% of ConstC**		
21		SWC Costs to Date	Current as at:					
22		SWC Design Costs (% of Construction Costs)				1.00%		4,499
23		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -2-3-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:32**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
24		SWC Planning Costs (% of Construction Costs)			5.00%		22,494
25		SWC Project Management Costs (% of Construction Costs)			5.00%		22,494
26		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		2,474
27		SWC Land Acquisition/Easement Costs					
28		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**551,836**

Sydney WATER **COST ESTIMATOR**

Job Name: Oakdale Central- 2-4-

Estimator: Amir Rashidi

Estimate Date: **10/06/2016**

Print Date/Time: **04/07/2016 11:29**

Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Water Main Greenfield PVC		200 dia	m		191	0
2		Water Main Greenfield PVC		250 dia	m		238	0
3		Water Main Greenfield PVC		300 dia	m	1,200	314	377,012
4		Water Main Greenfield PVC		375 dia	m		407	0
5		Water Main Greenfield DICL		450 dia	m	0	569	0
6		EO Rock Excav Trench Std Dpth - 200 Dia (1%RK-100%RK)	%RK-->	30	m	0	15	0
7		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	0	18	0
8		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	1,200	21	25,713
9		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
10		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
11		EO Road Restoration Trench Std Depth		250 dia	m	0	434	0
12		EO Road Restoration Trench Std Depth		300 dia	m	300	485	145,440
13		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
14		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
15		EO Road Restoration Trench Std Depth		200 dia	m	0	409	0
	H1	**Scope Contingency**						
16		Urban Detailed Planning		75	%	548,164	0.75	411,123
		Sub Total Direct Costs						**959,287**
		INDIRECT COSTS				**%**		
17		Contractor Design Costs (% of Direct Costs)				10.00%		95,929
18		Contractor Indirect Costs (% of Direct Costs)				20.00%		191,857
19		Contractor Margin (% of DC+Indirect Costs)				15.00%		187,061
20		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		501,947
		Total Construction Cost						**1,936,081**
		SWC CLIENT COSTS				**% of ConstC**		
21		SWC Costs to Date	Current as at:					
22		SWC Design Costs (% of Construction Costs)				1.00%		19,361
23		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central- 2-4-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**04/07/2016 11:29**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
24		SWC Planning Costs (% of Construction Costs)			5.00%		96,804
25		SWC Project Management Costs (% of Construction Costs)			5.00%		96,804
26		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		10,648
27		SWC Land Acquisition/Easement Costs					
28		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**2,209,698**

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -4-5-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:46**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Water Main Greenfield PVC		200 dia	m		191	0
2		Water Main Greenfield PVC		250 dia	m	900	238	213,954
3		Water Main Greenfield PVC		300 dia	m		314	0
4		Water Main Greenfield PVC		375 dia	m		407	0
5		Water Main Greenfield DICL		450 dia	m		569	0
6		EO Rock Excav Trench Std Dpth - 200 Dia (1%RK-100%RK)	%RK-->	30	m	0	15	0
7		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	900	18	15,917
8		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	0	21	0
9		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
10		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
11		EO Road Restoration Trench Std Depth		250 dia	m	225	434	97,662
12		EO Road Restoration Trench Std Depth		300 dia	m	0	485	0
13		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
14		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
15		EO Road Restoration Trench Std Depth		200 dia	m	0	409	0
	H1	**Scope Contingency**						
16		Urban Detailed Planning		75	%	327,533	0.75	245,650
		Sub Total Direct Costs						**573,183**
		INDIRECT COSTS				**%**		
17		Contractor Design Costs (% of Direct Costs)				10.00%		57,318
18		Contractor Indirect Costs (% of Direct Costs)				20.00%		114,637
19		Contractor Margin (% of DC+Indirect Costs)				15.00%		111,771
20		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		299,918
		Total Construction Cost						**1,156,827**
		SWC CLIENT COSTS				**% of ConstC**		
21		SWC Costs to Date	Current as at:					
22		SWC Design Costs (% of Construction Costs)				1.00%		11,568
23		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -4-5-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:46**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
24		SWC Planning Costs (% of Construction Costs)			5.00%		57,841
25		SWC Project Management Costs (% of Construction Costs)			5.00%		57,841
26		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		6,363
27		SWC Land Acquisition/Easement Costs					
28		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**1,340,440**

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -4-7	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**04/07/2016 11:30**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Water Main Greenfield PVC		200 dia	m		191	0
2		Water Main Greenfield PVC		250 dia	m		238	0
3		Water Main Greenfield PVC		300 dia	m	700	314	219,923
4		Water Main Greenfield PVC		375 dia	m	0	407	0
5		Water Main Greenfield DICL		450 dia	m		569	0
6		EO Rock Excav Trench Std Dpth - 200 Dia (1%RK-100%RK)	%RK-->	30	m	0	15	0
7		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	0	18	0
8		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	700	21	14,999
9		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
10		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
11		EO Road Restoration Trench Std Depth		250 dia	m	0	434	0
12		EO Road Restoration Trench Std Depth		300 dia	m	175	485	84,840
13		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
14		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
15		EO Road Restoration Trench Std Depth		200 dia	m	0	409	0
	H1	**Scope Contingency**						
16		Urban Detailed Planning		75	%	319,762	0.75	239,822
		Sub Total Direct Costs						**559,584**
		INDIRECT COSTS				**%**		
17		Contractor Design Costs (% of Direct Costs)				10.00%		55,958
18		Contractor Indirect Costs (% of Direct Costs)				20.00%		111,917
19		Contractor Margin (% of DC+Indirect Costs)				15.00%		109,119
20		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		292,802
		Total Construction Cost						**1,129,380**
		SWC CLIENT COSTS				**% of ConstC**		
21		SWC Costs to Date	Current as at:					
22		SWC Design Costs (% of Construction Costs)				1.00%		11,294
23		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -4-7	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**04/07/2016 11:30**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
24		SWC Planning Costs (% of Construction Costs)			5.00%		56,469
25		SWC Project Management Costs (% of Construction Costs)			5.00%		56,469
26		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		6,212
27		SWC Land Acquisition/Easement Costs					
28		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**1,309,824**

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -5-6-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:47**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Water Main Greenfield PVC		200 dia	m	850	191	162,010
2		Water Main Greenfield PVC		250 dia	m		238	0
3		Water Main Greenfield PVC		300 dia	m		314	0
4		Water Main Greenfield PVC		375 dia	m		407	0
5		Water Main Greenfield DICL		450 dia	m		569	0
6		EO Rock Excav Trench Std Dpth - 200 Dia (1%RK-100%RK)	%RK-->	30	m	850	15	12,431
7		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	0	18	0
8		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	0	21	0
9		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
10		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
11		EO Road Restoration Trench Std Depth		250 dia	m	0	434	0
12		EO Road Restoration Trench Std Depth		300 dia	m	0	485	0
13		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
14		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
15		EO Road Restoration Trench Std Depth		200 dia	m	213	409	86,959
	H1	**Scope Contingency**						
16		Urban Detailed Planning		75	%	261,400	0.75	196,050
		Sub Total Direct Costs						**457,450**
		INDIRECT COSTS				**%**		
17		Contractor Design Costs (% of Direct Costs)				10.00%		45,745
18		Contractor Indirect Costs (% of Direct Costs)				20.00%		91,490
19		Contractor Margin (% of DC+Indirect Costs)				15.00%		89,203
20		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		239,361
		Total Construction Cost						**923,249**
		SWC CLIENT COSTS				**% of ConstC**		
21		SWC Costs to Date	Current as at:					
22		SWC Design Costs (% of Construction Costs)				1.00%		9,232
23		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name:	Oakdale Central -5-6-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:47**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
24		SWC Planning Costs (% of Construction Costs)			5.00%		46,162
25		SWC Project Management Costs (% of Construction Costs)			5.00%		46,162
26		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		5,078
27		SWC Land Acquisition/Easement Costs					
28		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**1,079,883**

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -7-8-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:47**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Water Main Greenfield PVC		200 dia	m		191	0
2		Water Main Greenfield PVC		250 dia	m		238	0
3		Water Main Greenfield PVC		300 dia	m	1,200	314	377,012
4		Water Main Greenfield PVC		375 dia	m		407	0
5		Water Main Greenfield DICL		450 dia	m		569	0
6		EO Rock Excav Trench Std Dpth - 200 Dia (1%RK-100%RK)	%RK-->	30	m	0	15	0
7		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	0	18	0
8		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	1,200	21	25,713
9		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
10		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
11		EO Road Restoration Trench Std Depth		250 dia	m	0	434	0
12		EO Road Restoration Trench Std Depth		300 dia	m	300	485	145,440
13		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
14		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
15		EO Road Restoration Trench Std Depth		200 dia	m	0	409	0
	H1	**Scope Contingency**						
16		Urban Detailed Planning		75	%	548,164	0.75	411,123
		Sub Total Direct Costs						**959,287**
		INDIRECT COSTS				**%**		
17		Contractor Design Costs (% of Direct Costs)				10.00%		95,929
18		Contractor Indirect Costs (% of Direct Costs)				20.00%		191,857
19		Contractor Margin (% of DC+Indirect Costs)				15.00%		187,061
20		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		501,947
		Total Construction Cost						**1,936,081**
		SWC CLIENT COSTS				**% of ConstC**		
21		SWC Costs to Date	Current as at:					
22		SWC Design Costs (% of Construction Costs)				1.00%		19,361
23		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -7-8-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:47**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
24		SWC Planning Costs (% of Construction Costs)			5.00%		96,804
25		SWC Project Management Costs (% of Construction Costs)			5.00%		96,804
26		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		10,648
27		SWC Land Acquisition/Easement Costs					
28		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**2,209,698**

Sydney WATER **COST ESTIMATOR**

Job Name:	Oakdale Central -7-9-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:48**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1	**Option 1**						
1		Water Main Greenfield PVC		200 dia	m		191	0
2		Water Main Greenfield PVC		250 dia	m		238	0
3		Water Main Greenfield PVC		300 dia	m	1,600	314	502,682
4		Water Main Greenfield PVC		375 dia	m		407	0
5		Water Main Greenfield DICL		450 dia	m		569	0
6		EO Rock Excav Trench Std Dpth - 200 Dia (1%RK-100%RK)	%RK-->	30	m	0	15	0
7		EO Rock Excav Trench Std Dpth - 250 Dia (1%RK-100%RK)	%RK-->	30	m	0	18	0
8		EO Rock Excav Trench Std Dpth - 300 Dia (1%RK-100%RK)	%RK-->	30	m	1,600	21	34,284
9		EO Rock Excav Trench Std Dpth - 375 Dia (1%RK-100%RK)	%RK-->	30	m	0	25	0
10		EO Rock Excav Trench Std Dpth - 450 Dia (1%RK-100%RK)	%RK-->	30	m	0	10	0
11		EO Road Restoration Trench Std Depth		250 dia	m	0	434	0
12		EO Road Restoration Trench Std Depth		300 dia	m	400	485	193,920
13		EO Road Restoration Trench Std Depth		375 dia	m	0	513	0
14		EO Road Restoration Trench Std Depth		450 dia	m	0	579	0
15		EO Road Restoration Trench Std Depth		200 dia	m	0	409	0
	H1	**Scope Contingency**						
16		Urban Detailed Planning		75	%	730,885	0.75	548,164
		Sub Total Direct Costs						**1,279,049**
		INDIRECT COSTS				**%**		
17		Contractor Design Costs (% of Direct Costs)				10.00%		127,905
18		Contractor Indirect Costs (% of Direct Costs)				20.00%		255,810
19		Contractor Margin (% of DC+Indirect Costs)				15.00%		249,415
20		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				35.00%		669,263
		Total Construction Cost						**2,581,442**
		SWC CLIENT COSTS				**% of ConstC**		
21		SWC Costs to Date	Current as at:					
22		SWC Design Costs (% of Construction Costs)				1.00%		25,814
23		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000

Sydney WATER

COST ESTIMATOR

Job Name:	Oakdale Central -7-9-	Estimate Date:	**10/06/2016**
Estimator:	Amir Rashidi	Print Date/Time:	**10/06/2016 18:48**
			Ver 09-2015.11

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
24		SWC Planning Costs (% of Construction Costs)			5.00%		129,072
25		SWC Project Management Costs (% of Construction Costs)			5.00%		129,072
26		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		14,198
27		SWC Land Acquisition/Easement Costs					
28		SWC Risk Contingency (% of the SWC Client Future Costs only)				**of Client Costs**	
		TOTAL PROJECT BUDGET REQUIREMENT					**2,929,598**

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