Civil Engineering & Infrastructure Report

Stage 3C: Jordan Springs East

89914020

Prepared for
Lend Lease

29 July 2019

Cardno
Shaping the Future

Contact Information

Cardno Limited
Trading as Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9, The Forum
203 Pacific Highway
St Leonards NSW 2065

Telephone: +61 2 9496 7700
Facsimile: +61 2 9439 5170

www.cardno.com.au

Author(s):
Andrew Morris
Senior Civil Engineer

Approved By:

Document Information

Prepared for	Lend Lease
Project Name	Stage 3C: Jordan Springs East
File Reference	Civil Engineering - Stage 3C.docx
Job Reference	89914020
Date	29 July 2019
Version Number	A
Effective Date	23 July 2019
Date Approved:	23 July 2019

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
A	23 July 19	Issued for Review	NT	AM

Executive Summary

Cardno has been engaged by Maryland Development Corporation to provide Lead Engineering services for the Jordan Springs East (previously Central Precinct) project.

Jordan Springs East is located within the Penrith City Council Local Government Area and covers an area of approximately 135 hectares. Under the Central Precinct Plan, 135 hectares of land will be developed for residential and employment uses.

The development of the Jordan Springs East will be staged. This report addresses the Civil Engineering and Infrastructure components associated with Stage 3C of Jordan Springs East.

Stage 3C covers an area of approximately 1.74 hectares, yielding 59 residential lots and 1 public reserve. In addition, Stage 3C will require the following infrastructure to be delivered:

- Approximately 420 metres of a local road network
- Stormwater drainage infrastructure
- Utility infrastructure reticulation

This report documents the processes undertaken to prepare Development Application design documentation for the Stage 3C civil works. The report aims to outline how the required infrastructure will be delivered in accordance with the Central Precinct Plan, State Regional Environmental Plan 30, the future requirements of Jordan Springs East and relevant authority design guidelines and technical requirements.

Where required, this report also identifies and references relevant background studies that have assisted in the development of the *Jordan Springs East Stage 3C Development Application* (Cardno, July 2019) drawings set.

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1 Introduction

Cardno has been engaged by Maryland Development Corporation to prepare documentation in support of a Development Application (DA) for Stage 3C of Jordan Springs East. Stage 3C of Jordan Springs East is located within the Penrith City Council (Council) Local Government Area (LGA).

1.1 Jordan Springs East Overview

Jordan Springs East forms part of the St Marys development site and covers an area of approximately 135 hectares. Jordan Springs East is bounded by Regional Park to the north and west, South Creek to the east and existing urban development to the south. A site locality plan for Jordan Springs East (formerly known as Central Precinct) is included as **Figure 1-1**.

Figure 1-1 Jordan Springs East Site Locality Plan

Jordan Springs East has been subject to a number of background studies that have been consolidated into *Central Precinct Plan*, JBA, May 2009. A number of DAs have been submitted to Council to cover the early components of the proposed development and several DAs have been lodged

Summaries of the key DAs submitted to date are included in **Table 1-1**.

Table 1-1 Previously Lodged Development Applications

Development Application	DA Reference Number	Description	Current Status
Demolition & Remediation	DA14/0411	Demolition of existing structures, roads and hard surfaces and remediation of land	Approved
Haul Road	DA14/0766	Construction of a temporary haulage road and associated infrastructure upgrades to facilitate the movement of trucks associated with future works	Approved
Hoop Antenna Removal	DA14/0990	Demolition of hoop antenna and surrounding hard stand area	Approved
Earthworks	DA14/1228	Bulk earthworks, interim stormwater infrastructure, landscaping, tree removal and environmental management works including realignment of an existing riparian corridor	Approved
Stage 1	DA15/0299	Proposed road, stormwater and utility servicing infrastructure for Stage 1 development	Approved
Stage 2	DA15/1216	Proposed road, stormwater and utility servicing infrastructure for Stage 2 development	Approved
Stage 3A	DA16/0113	Proposed road, stormwater and utility servicing infrastructure	Approved
Stages 4A & 4B	DA17/0491	Proposed road, stormwater and utility servicing infrastructure	Approved
Stage 3B1	DA17/0675	Proposed road, stormwater and utility servicing infrastructure	Approved
Stage 3B2	DA17/0889	Proposed road, stormwater and utility servicing infrastructures	Approved
Stage 5A	DA17/0920	Proposed road, stormwater and utility servicing infrastructure	Approved
Stage 3D	DA18/0620	Proposed road, stormwater and utility servicing infrastructure	Under Assessment

1.2 Jordan Springs East Stage 3C Overview

The development of Jordan Springs East will be staged. An indicative staging plan for the delivery of civil works and lots is included on Drawing Number CV-CARDNO-ST03C-1021 (refer **Appendix A**).

Stage 3C covers an area of approximately 1.74 hectares. It is located adjacent to the eastern boundary. The extent of Stage 3C is illustrated in **Figure 1-2**. It is expected that Stage 3C will yield approximately 59 residential lots and 1 public reserve.

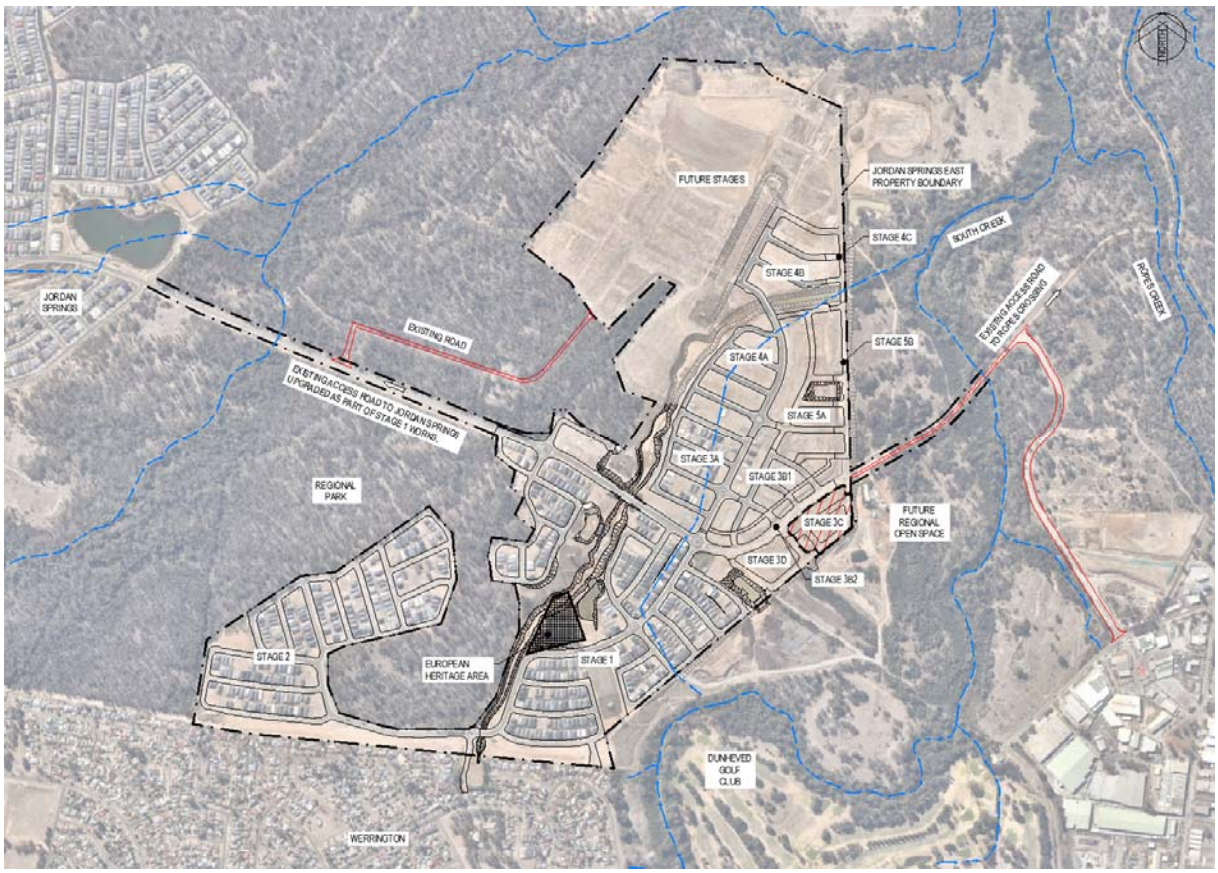
Being the eleventh stage of a development, Stage 3C adjoins the Stage 3B2 and Stage 3D developments, meaning the majority of the works are contained within the Jordan Springs East boundary.

Works to which this report relates are defined by the following:

- Earthworks
    - Boxing out of roads
    - Minor lot grading, although the majority of the site has been graded via the previous bulk earthworks application.
    - Landscape shaping
    - Boundary interfaces
- Roads
    - Internal road network consistent with the Jordan Springs East Masterplan connecting to Stage 3B2 and Stage 3D road network
- Drainage
    - Construction of a piped drainage network
- Open Spaces
    - Shaping of future landscape areas[1]
- Utility Infrastructure
    - Reticulation of utility services (i.e., sewer, water, electricity, telecommunications and gas)
- Sub-division
    - Establishment of lot boundaries for future registration and sale

[1] All landscape works will be subject to future Development Applications

Figure 1-2 Stage 3C Extent



1.3 Construction Program

Prior to the commencement of construction activities for Stage 3C, filling activities within Jordan Springs East (under DA14/1228) as well as construction activities within the Stage 1 area (under DA15/0299), Stage 2 area (under DA15/1216), Stage 3A (under DA16/0113), Stage 3B1 (under DA17/0675) and Stage 4A and 4B (under DA17/0491), Stage 5A (under DA 17/0920), Stage 3B2 (DA 17/0889), Stage 3D (DA 18/0620) will have been completed. Some construction activity within Stage 5B might be undertaken concurrently.

Key dates within the current Jordan Springs East program are provided in **Table 1-2**.

Table 1-2 Jordan Springs East Construction Program Key Dates

Description	Anticipated Start Date	Anticipated End Date
Fill	June 2015	July 2017
Stage 1 Civil Works	May 2016	May 2017
Stage 1 Lot Registration	May 2017	June 2017
Stage 1 Occupation	February 2018	-
Stage 2 Civil Works	December 2016	May 2017
Stage 2 Lot Registration	June 2017	July 2017
Stage 2 Occupation	March 2018	-

Stage 3A Civil Works	June 2017	October 2017
Stage 3A Lot Registration	November 2017	December 2017
Stage 3A Occupation	October 2018	
Stage 4A & 4B Civil Works	October 2017	April 2018
Stage 4A & 4B Lot Registration	May 2018	June 2018
Stage 4A & 4B Occupation	March 2019	
Stage 3B1 Civil Works	November 2017	May 2018
Stage 3B1 Lot Registration	May 2018	June 2018
Stage 3B1 Occupation	March 2019	
Stage 5A Civil Works	October 2018	May 2019
Stage 5A Lot Registration	May 2018	August 2019
Stage 5A Occupation	August 2020	
Stage 3B2 Civil Works	July 2019	November 2019
Stage 3B2 Lot Registration	November 2019	December 2019
Stage 3B2 Occupation	December 2020	
The East West Connector Road opening	Late 2020	
Stage 3D Civil Works	August 2019	November 2019
Stage 3D Lot Registration	November 2019	December 2019
Stage 3D Occupation	N/A	
Lot 3001 Civil Works	September 2019	December 2019
Lot 3001 Lot Registration	January 2020	February 2020
Lot 3001 Occupation	February 2021	
Stage 3C Civil Works	December 2019	April 2020
Stage 3C Lot Registration	May 2020	June 2020
Stage 3C Occupation	June 2021	
Stage 4C Civil Works	January 2020	May 2020
Stage 4C Lot Registration	May 2020	June 2020

Stage 4C Occupation	June 2021	
Stage 5B Civil Works	January 2020	May 2020
Stage 5B Lot Registration	May 2020	June 2020
Stage 5B Occupation	June 2021	

2 Existing Site Conditions

2.1 Pre-development Conditions

Jordan Springs East covers an area of approximately 135 hectares. The existing topography at the site is noticeably flat. Elevations vary between approximately 18 – 40 mAHD (excluding stockpiles). A number of natural and constructed water courses drain the site to South Creek which is located to the east of Jordan Springs East.

The southern boundary of Jordan Springs East is shared with existing residential dwellings.

Previous studies undertaken for the Precinct Plan map indicate that two soil units are located within the site, namely the Luddenham and South Creek soil landscapes.

Previous geotechnical investigations undertaken at Jordan Springs East identified a shallow and deep aquifer system. The outcomes of this assessment are documented within *St Marys Central Precinct Water Soils and Infrastructure Report*, SKM, May 2009.

A significant portion of the Jordan Springs East site is inundated by rising flood waters within South Creek.

Two existing urban catchments discharge through the southern boundary of Jordan Springs East. Runoff from these catchments is conveyed via natural and constructed drainage corridors into South Creek.

The site is largely clear of vegetation. However there were pockets of existing trees across Jordan Springs East. The extent of existing trees is documented within the drawing set *Central Precinct Bulk Earthworks Development Application*, Cardno, July 2014.

Under pre-development conditions, the site contained two storage warehouses and a remnant sealed and unsealed road network. The two warehouses have been demolished under DA14/0411.

Jordan Springs East contains a series of stockpiles towards its northern boundary. These stockpiles contain material generated by previous demolition and remediation work undertaken in the Eastern Precinct (i.e., Ropes Crossing), Western Precinct (i.e., Jordan Springs) and Jordan Springs East. The stockpiled material is likely to be processed and re-used on site as part of future road construction.

Remediation Action Plans and Site Audit Statements for the stockpiled material and the majority of Jordan Springs East have been issued to qualify that the site has been remediated. Site Audit Statements for regions under existing buildings, hardstand areas and stockpiles are currently being prepared and rely upon the demolition of existing assets and structures as well as the relocation of the aforementioned stockpiles.

Jordan Springs East is burdened by four utility services and associated easements, including:

- 500 kV transmission lines owned and operated by Transgrid;
- 600 mm Werrington Carrier sewer main owned and operated by Sydney Water;
- 600 mm recycled water main owned and operated by Sydney Water;
- 450 mm sewer main owned and operated by Sydney Water; and,
- Sewer pump station currently under construction to be owned and operated by Sydney Water.

The location of existing utility infrastructure within Jordan Springs East is included in the drawing set *Central Precinct Bulk Earthworks Development Application*, Cardno, July 2014 (refer **Appendix A**, drawing number 89914020-BE01-1003).

3 Flooding

3.1 Regional Flood Impact Assessment

Jordan Springs East is located on the western banks of South Creek and under pre-development conditions was subject to periodic inundation from rising water levels associated with South Creek. Jacobs (SKM) has been responsible for undertaking appropriate studies to predict the flood behaviour of South Creek to inform the design constraints associated with the urbanisation of Jordan Springs East.

The most recent 1% AEP peak water surface level estimates calculated by SKM are documented within Jordan Springs East *Flood Assessment Report, Final*, Jacobs, February 2015. The 1% AEP water surface profile gradually rises from 19.4 mAHD at the northern extent of Jordan Springs East to 21.0 mAHD at the southern extents of Jordan Springs East.

As part of the Bulk Earthworks DA (DA14/1228) approval was granted for the elevation of the existing natural surface within Jordan Springs East such that future lot levels are a minimum of 500 mm above the predicted 1% AEP South Creek water surface profile. These earthworks have been completed within the footprint of Stage 3C and hence the surface levels through this stage are now above the 1% AEP water surface level.

3.2 Local Flooding

During the preparation of DA design documentation suitable consideration has been given to extreme weather events within the local catchments. Local catchments are the areas that directly drain through Stage 3C of Jordan Springs East, which are summarised under **Section 6**, as well as the Stage 3C area itself. In assessing local flooding within Stage 3C of Jordan Springs East the 1% AEP peak flows have been considered.

A stormwater drainage network has been prepared for the 20% AEP peak flows. For flow rates in excess of the 20% AEP peak flows runoff will be conveyed via a network of identified overland flow paths. Overland flow paths typically take one of two forms:

1. The road reserve; and,
2. Open channels.

In preparing the DA design documentation, overland flow paths have been assessed to determine peak velocities and depths to estimate the flood hazard associated with each overland flow path. Flood hazard has been defined in accordance with the guidance provided in the *Floodplain Development Manual*, April 2005, NSW Department of Infrastructure, Planning and Natural Resources.

It can be confirmed that in the occasions where the road network will be used as an overland flow path for events greater than the 20% AEP, that flows will be contained safely within the road reserve for all events up to the 1% AEP. This will verified as part of detailed modelling undertaken as part of the construction certificate phase of the project.

In some instances, peak flows within open channels will exceed the safe categorisation. In these instances suitable risk mitigation measures will need to be included. These measures will be finalised during detailed design but could include the following, viz:

- Signage
- Public education strategies
- Landscape design.

4 Earthworks & Grading

4.1 Site Grading

The site grading has largely been dictated by the requirement to elevate the site above the regional 1% AEP peak water surface level and the need to evacuate the site for events greater than the 1% AEP flood. Accordingly, all roads along creeks, drainage channels and basins have been set above the estimated 1% AEP peak water surface profile and are then graded in a continually rising manner until road levels are above the predicted PMF water surface level.

A site grading strategy for Jordan Springs East was documented and approved in the Bulk Earthworks DA (DA14/1228).

4.2 Stage 3C Earthworks Quantities

A site grading was undertaken as part of the Bulk Earthworks DA submitted to and approved by Council (DA14/1228). The extent of Bulk Earthworks approved under DA 14/1228 include:

- 570,000 m^3 of cut
- 2,460,000 m^3 of fill
- 1,890,000 m^3 balance (import).

Accordingly, there is minimal additional earthworks required to form Stage 3C, as the bulk earthworks has been completed within this area prior to the commencement of the proposed subdivision works. It is estimated that approximately 1,660 m^3 will be generated from boxing out of the roads. The fill generated is proposed to be stockpiled and used as part of residual fill requirements within future stages.

4.3 Retaining Walls

Retaining walls are not required within Stage 3C of the proposed development.

5 Roads

The proposed road layout within Stage 3C of Jordan Springs East is consistent with *Central Precinct Concept Plan*, JBA, 2009.

5.1 Design Vehicles

The road layout for Stage 3C of Jordan Springs East has taken into to account the following design vehicle:

- 12.5 m SU Truck along all internal roads.

Parameters for the design vehicles were adopted from *Guide to Road Design,* Austroads, 2006.

Design turning paths were used to determine where local increases in pavement width were required to ensure that the design vehicle could satisfactorily negotiate turns and bends without striking or mounting the kerb. Where necessary, 'No Stopping' signs will be provided to ensure that required turning areas are free of parked vehicles.

5.2 Road Geometry and Width

Road geometry design has generally been undertaken in accordance with the *Central Precinct Plan*, JBA, 2009 and *Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments*, Penrith City Council, November 2013.

There are three proposed road cross sections within Stage 3C of Jordan Springs East. Details of the road cross sections are summarised in **Table 5-1**. The proposed street cross sections are generally consistent with the works undertaken as part of the neighbouring Jordan Springs development.

Table 5-1 Road Cross Sections

Road Type	Road Reserve Width (m)	Pavement Width (m)
L1 Minor Local Street	15.6	8.0
V7 Village Centre Local Street	18.4	8.0

The following kerb types will generally be provided:

- Minor Local Street Kerb and gutter both sides
- Village Centre Local Street Kerb and gutter both sides

Kerb returns have been set at a 7.5 metre radius along the face of kerb in accordance with *Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments*, Penrith City Council, November 2013.

Typical road cross sections are presented on sheet 1251 of the drawing set entitled *Jordan Springs East Stage 3C Development Application, Cardno, July 2019*.

5.3 Road Grading

Roads have generally been graded to ensure that parameters as presented within *Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments*, Penrith City Council, November 2013 are met. **Table 5-2** presents minimum, maximum and typical road grades proposed within Stage 3C of Jordan Springs East. All roads have generally been designed with 3% cross fall.

Table 5-2 Summary of Minimum, Maximum and Typical Road Grades

Road Type	Minimum Road Grade	Maximum Road Grade	Typical Road Grade Range
All roads	0.7%	3.0%	0.7% to 2.0%

5.4 Road Pavement

Preliminary flexible road pavement designs have been prepared and presented on sheet 1251 of the drawing set entitled *Jordan Springs East Stage 3C Development Application, Cardno, July 2019*. It should be noted that the preliminary road pavement designs are subject to detailed design pending additional geotechnical investigations and confirmation of sub-grade properties during construction.

Table 5-3 presents a summary of design criteria and overall pavement thicknesses nominated throughout Stage 3C of Jordan Springs East. The designs presented below have been based on the outcomes of geotechnical analysis completed as part of previous stages of the Jordan Springs East development.

Table 5-3 Pavement Design Summary

	Local Roads
Applicable road cross sections	Minor Local Street Village Centre Local Street
Assumed CBR	3%
ESA	5×10^4
Asphaltic Concrete	50 mm
Base	150 mm
Sub-base	275 mm
Total Pavement Thickness	475 mm

5.5 Intersections

The design of intersections has been set out in accordance with Penrith City Council's subdivision works guidelines and Austroads.

5.6 Footpaths

Footpaths will generally be constructed in accordance with Penrith City Council's standard drawing *Standard Footpath Details Plan No: SD1001*.

Road verges will generally be graded at 4% cross fall except in the instance where a concrete footpath is present. Concrete footpaths will contain a maximum 2% cross fall.

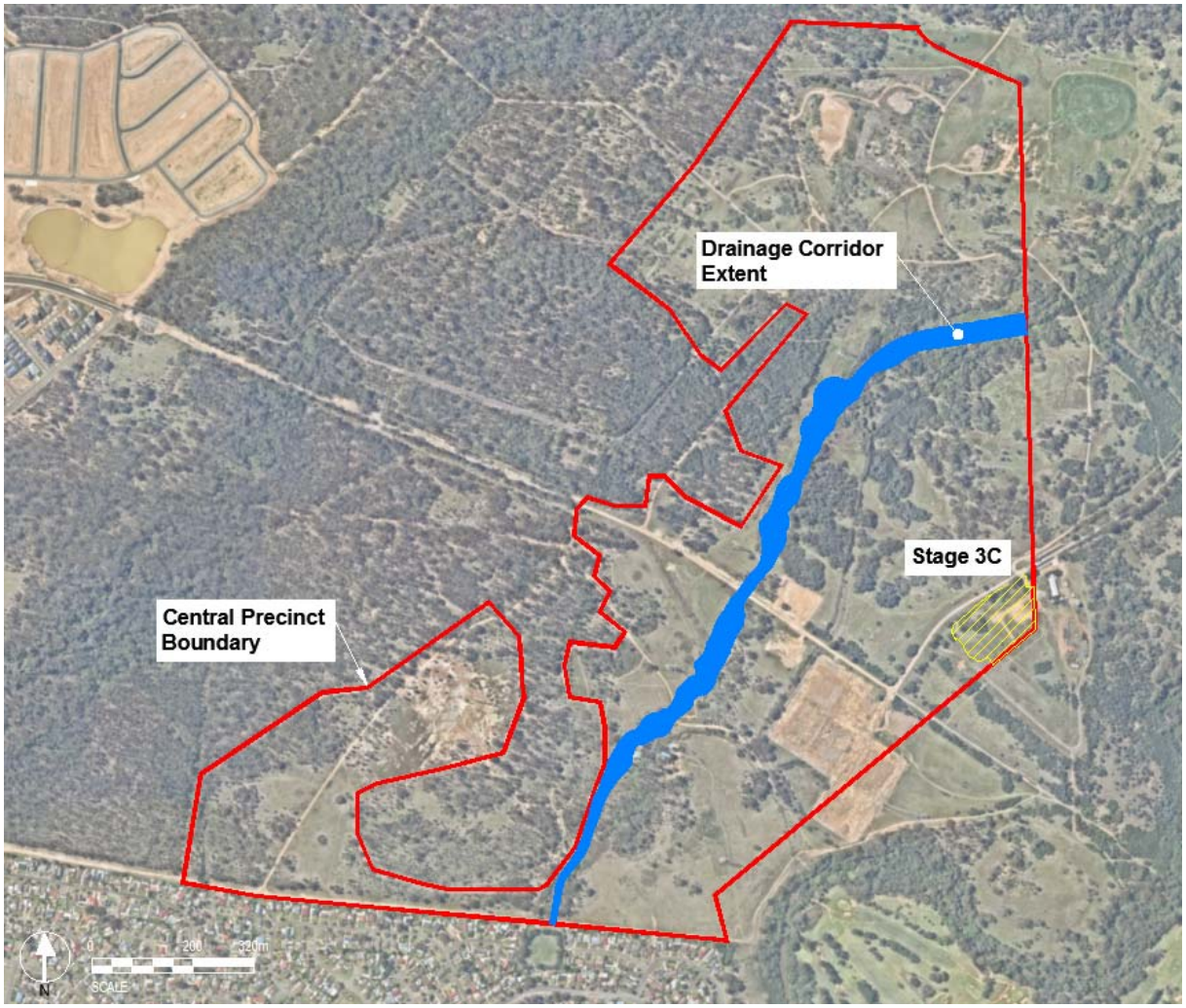
6 Drainage Corridor

As part of Jordan Springs East a drainage corridor will be constructed from the southern boundary through to South Creek. The drainage corridor will:

- Provide a trunk overland flow path through Jordan Springs East
- Assist in reducing the migration of stormwater pollutants
- Provide flood conveyance
- Form an integral aesthetic feature of the Jordan Springs East
- Be subject to future embellishment for conversion to a riparian corridor.

The location of the drainage corridor throughout the Jordan Springs East is illustrated in **Figure 6-1**. The alignment of the drainage corridor has been by approved by Council as part of the Bulk Earthworks Development Application (DA14/1228). Stage 3C is remote to the location of the corridor.

Figure 6-1 Drainage Corridor Extent



6.1 External Catchments

The trunk drainage corridor conveys runoff from external catchments through Stages 4A and 4B towards South Creek. These external catchments are summarised in **Table 6-1**.

Table 6-1 External Catchments

Type	Catchment Names on Drawing ST04-2351	Area (ha)
Existing Urban (Werrington County)	A	24.3
Jordan Springs East Urban Catchments	B, C, D, E, G, N, R	45.0
Regional Park	3.0, 4.0	49.6

7 Stormwater Drainage

7.1 Drainage Standards

The stormwater drainage network has been designed to comply with *Design Guidelines for Engineering Works for Subdivisions and Developments*, November 2013, Penrith City Council and *Australian Rainfall and Runoff, Volume 1*, 1987, Institution of Engineers.

The proposed drainage network has been designed to safely convey major and minor flows to basins or open channels before discharging from Jordan Springs East into a suitable existing downstream watercourse. Design rainfall intensities have been adopted as follows:

- Minor System 20% AEP
- Major System 1% AEP.

Stormwater pits have been positioned to suit the proposed road geometry and generally maintain a maximum flow width of 2.5 metres from the face of kerb during the design storm event. Some exception to this flow width may occur at sags which drain to the riparian corridor

Where practical, overland flow paths have been subject to preliminary design to accommodate the 1% AEP storm event by maintaining a velocity-depth product of 0.4 m^2/s or less and a maximum flow depth equal to or less than 300 millimetres. In instances where these parameters are exceeded, appropriate risk management strategies will need to be developed through the preparation of detailed design documentation.

7.2 Catchment Areas

Catchments that have been accommodated within the Stage 3C drainage network are documented on drawing ST03C-2301 within the *Jordan Springs East Stage 3C - Civil Works Development Application, Cardno, July 2019* (refer **Appendix A**).

7.3 Hydrology Calculations

Detailed catchment modelling was conducted to calculate flows generated by the site within the DRAINS software package. This software package uses the industry standard hydrology calculation ISLAX. The following parameters were used in the model:

- Bureau of Meteorology IFD coefficients (refer **Table 7-1**) based on the geographical location of Jordan Springs East
- Depression storage:
    - 1 mm for paved (i.e., impervious) areas
    - 5 mm for grassed (i.e., pervious) areas
- Antecedent moisture condition 3
- Catchments, including roads have been assumed to be 80% impervious in accordance with Council's design guidelines.
- Times of Concentration have been calculated based on catchment size, catchment slope and roughness. Minimum Times of Concentration of 2 minute and 10 minutes for impervious and pervious areas have been adopted respectively.

Table 7-1 Adopted IFD Coefficients

	2 Year (mm/h)	50 Year (mm/h)
1 hour rainfall intensity	29.4	59.8
12 hour rainfall intensity	6.6	12.8
72 hour rainfall intensity	1.9	4.3
Geographical Coefficients	Adopted Value	
G	0.02	
F2	4.3	
F50	15.8	

7.4 Hydraulic Calculations

The hydraulic calculation was conducted using the dynamic drainage component within the 12D software package.

The model represents all catchments collected via a pit and pipe network designed to cater for the minor flows with consideration of major design storms. All areas are gravity drainage with overland flows in excess of pipe capacity safely directed to bio-filtration basins, open spaces, the drainage corridor or existing watercourses.

Hydraulic calculations are preliminary only and have been used principally to assess the ability to drain the site given the relatively minor road grades proposed throughout the site and to identify overland flow paths within which flow will need to be managed.

7.5 Results

Preliminary pipe sizes are nominated within the *Jordan Springs East Stage 3C - Civil Works Development Application, Cardno, July 2019 drawing* set.

8 Detention

8.1 Detention Strategy for Jordan Springs East

The Detention Strategy for Jordan Springs East is outlined in the *Central Precinct Stormwater Detention Strategy Report* Cardno, January 2017. The objective of the Detention Strategy is that "stormwater flows for all events up to and including the 1% ARI from the development site will have no adverse impact upon the downstream properties and existing waterbodies".

This Strategy considers the hydrologic impact of all parts of Jordan Springs East including the following:

> The majority of Jordan Springs East that drains directly to South Creek;

> Those parts of Jordan Springs East that drain to the western tributary such as Stage 2 and the northern section of Jordan Springs East; and

> Increasing the waterway area of the culverts under the Wianamatta Parkway.

Under the Strategy agreed with Council, the potential downstream impacts of Jordan Springs East development are to be off-set by the provision of a suitable stormwater detention volume within one of the regional water quality basins known as 'Basin I' located within the Regional Park to west of Jordan Springs East and south of Jordan Springs. Until Basin I is constructed, an interim detention basin is to be provided in the central drainage corridor.

8.2 Temporary Detention Basin

Jordan Springs East *Stormwater Detention Strategy Report* proposed that the interim detention basin would be constructed as part of the Stage 4 development. As Stage 4A has been constructed prior to Stage 3C, the interim detention basin was approved as part of the stage 4A/4B development.

9 Stormwater Quality

9.1 St Marys ADI Objectives

The stormwater management strategy for Jordan Springs East cannot be considered in isolation. Rather, the strategy needs to take into account the regional objectives outlined within SREP30 for the Central and Western Precincts. The regional objectives seek to preserve the condition of the receiving waters by matching existing stormwater pollutant concentrations at key locations along South Creek.

The regional stormwater management strategy has been prepared by SKM (Jacobs) and incorporates a number of strategically located basins within the Regional Park.

9.2 Jordan Springs East Stormwater Quality Management Strategy

Council has advised that in addition to the requirements of SREP30, the stormwater quality performance objectives of the Penrith Development Control Plan are to required to be achieved. In order to meet Council's objectives Cardno has developed a water quality strategy for the entire precinct. This strategy is documented in the *Jordan Springs East Precinct Stormwater Quality Management Report* (Cardno January 2017).

Jordan Springs East Stormwater quality management strategy includes the follow stormwater quality improvement devices:

- Rainwater tanks on residential lots
- 7 bio-retention basins
- Gross Pollutant Traps within each urban catchment
- Riparian corridor.

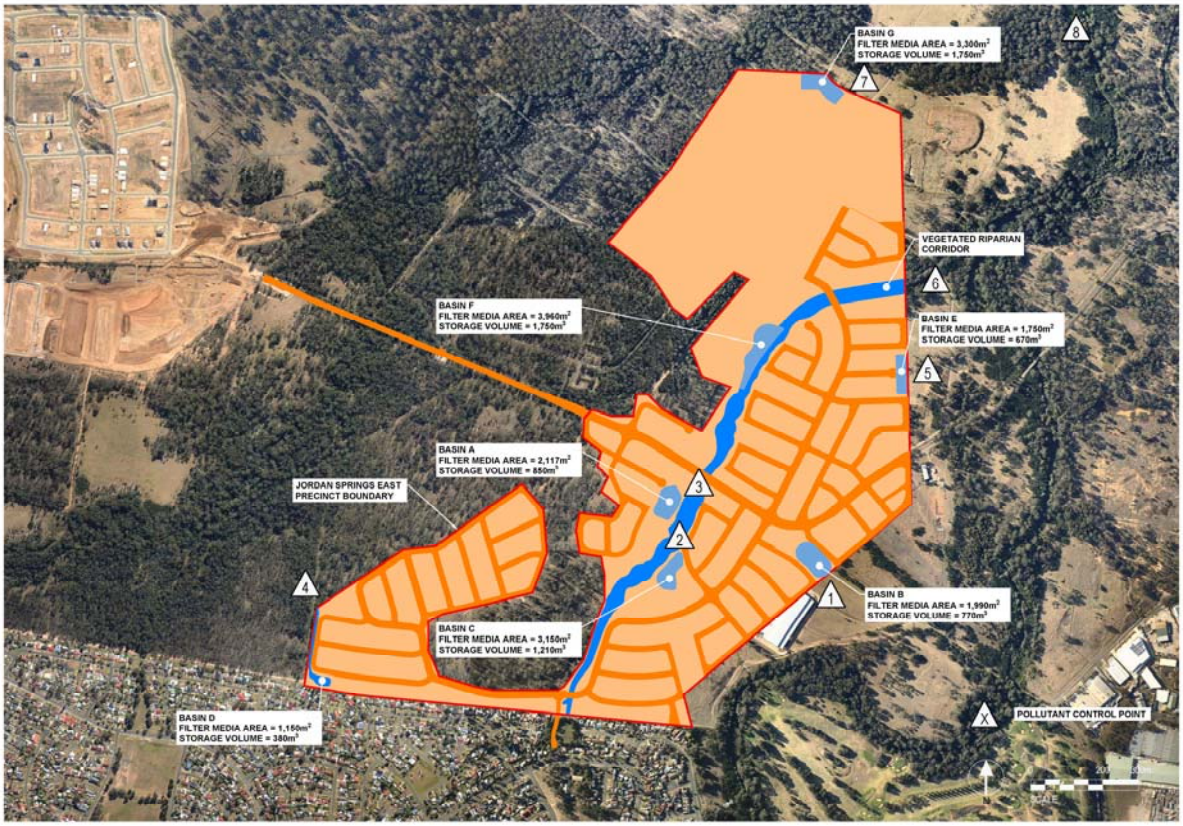
An overview of Jordan Springs East stormwater quality management strategy is provided in **Figure 9-1**.

The *Jordan Springs East Precinct Stormwater Quality Management Report* included MUSIC modelling of the stormwater quality management masterplan. The modelled treatment efficiencies are given in **Table 9-1** (excludes credits for treating existing upstream catchments).

Table 9-1 Jordan Springs East Stormwater Quality Treatment Train Effectiveness

Pollutant	Sources	Residual Load	Percentage Reduction	Council DCP Reduction Target
Gross Pollutants (kg/year)	19,200	308	**98%**	90%
Total Suspended Solids (kg/year)	119,000	15,600	**87%**	85%
Total Phosphorus (kg/year)	223	81.7	**63%**	60%
Total Nitrogen (kg/year)	1,460	755	**48%**	45%

Figure 9-1 Jordan Springs East Stormwater Quality Management Strategy



9.3 Stage 3C Stormwater Quality Management Strategy

The stormwater quality management infrastructure proposed for Stage 3C is consistent with the strategy in the *Jordan Springs East Precinct Stormwater Quality Management Report.* Stage 3C includes the following measures:

- Rainwater tanks on all residential lots;
- Connection to a proposed Gross Pollutant Trap;
- The future vegetated Riparian corridor (not part of the DA for Stage 3C); and,
- Construction of a future basin as part of future stages.

The majority of treatment of stormwater runoff from Stage 3C (Proposed Zoning) will be offset vie the overall precinct scheme. The stage is proposed to drain to a GPT which treats gross pollutants prior to discharge into the regional open space.

Treatment for this stage has been offset and accounted for within the precinct water quality plan. The results of modelling, as documented in the precinct water quality report, demonstrate the adequacy of the treatment capacity of the proposed scheme to cater for this bypass.

10 Sediment & Erosion Control

Erosion and sediment control will be installed and maintained in accordance with Council's requirements and Landcom's Managing Urban Stormwater, Soils and Construction (i.e., the Blue Book).

As part of the bulk earthworks phase, sediment and erosion control was managed via a temporary sediment basin positioned within the central corridor. This arrangement is proposed to be maintained as part of the subdivision civil works. Additional temporary basins may be incorporated within the stages where required.

Construction stockpile areas will be located near areas of minimal cut and fill. Stockpiles will be protected above by local diversion drains and below by sediment fences.

The full sedimentation and erosion control strategy is presented within the Cardno drawing set *Jordan Springs East Stage 3C - Civil Works Development Application, Cardno, July 2019* (refer **Appendix A**).

11 Utility Servicing Strategy

11.1 Potable Water

Sydney Water will be the primary potable water supplier for Jordan Springs East. As part of the Stage 1 works two water main extensions, from Lake Side Parade, Jordan Springs and Henry Lawson Avenue Werrington County, have been constructed.

The potable water reticulation network within Jordan Springs East will be situated below ground within the verge of the public road reserve. The network will be installed in accordance with the Shared Trenching Agreement or the *Guide to Codes and Practises for Streets Opening*, July 2009, NSW Street Opening Conference Guideline.

Discussions are currently in progress with Sydney Water through an accredited Water Services Coordinator in accordance with Sydney Water's Section 73 process. A detailed potable water plan for Stage 3C of Jordan Springs East will be prepared as part of the Construction Certificate design process.

11.2 Wastewater

Sydney Water will be the supplier of wastewater infrastructure for Jordan Springs East via a connection to the existing Werrington Carrier which traverses the Jordan Springs East site in an east-west orientation.

The Central Precinct will require the construction of a sewer pumping station and rising main to service a proportion of the site that is unable to drain via gravity to existing wastewater infrastructure. It is important to note that Stage 4C (Proposed Zoning) will drain via gravity to the Werrington Carrier.

All wastewater works will be designed and constructed in accordance with Sydney Water standards. Discussions are currently in progress with Sydney Water through an accredited Water Services Coordinator in accordance with Sydney Water's Section 73 process.

A detailed sewer plan for Stage 3C of Jordan Springs East will be prepared as part of the Construction Certificate design process.

11.3 Electricity

The primary electricity supplier to the Jordan Springs East will be Endeavour Energy.

Jordan Springs East is serviced via the extension of two 11 kV feeders from Werrington County. Lead-in works have been constructed as part of the Stage 1 development. Current advice from Endeavour Energy suggests that the existing HV feeder from Jordan Springs has adequate capacity to meet the demand of Stage 3C.

A Level 3 Endeavour Energy Accredited Service Provider will undertake the design and documentation of the electrical reticulation network. Street lighting will be installed in accordance with Endeavour Energy and Council standards.

11.4 Telecommunications

Communication infrastructure has been provided to Jordan Springs East by extending the existing network from Jordan Springs along the road corridor that links Jordan Springs East to Jordan Springs.

Telecommunications pits and pipes will be designed by OptiComm personnel and will be installed by certified contractors. The design of the network will be undertaken as part of the detailed design process.

All telecommunications infrastructure will be aligned within the road verges in the alignment allocated for telecommunications under the Road Clear Ways Act (1991).

11.5 Gas

The primary natural gas supplier to the Jordan Springs East will be Jemena. Jemena has extended the existing gas main reticulation from Lakeside Parade along the road corridor that links Central Precinct to Jordan Springs.

Internal gas reticulation will be installed throughout Stage 3C of Jordan Springs East in accordance with the Shared Trenching Agreement or the *Guide to Codes and Practises for Streets Opening*, July 2009, NSW Street Opening Conference Guideline.

12 Conclusion

A preliminary civil design for Stage 3C of the Jordan Springs East Precinct has been undertaken. The civil design has been developed in accordance with the relevant Council and authority guidelines as well as the requirements of SREP30.

The key outcomes documented within this report include:

- Stage 3C requires approximately 1,660 m^3 of cut, which will be placed within future stages of the Jordan Springs East development
- Suitable site grading and drainage infrastructure has been provided to accommodate stormwater flows generated within the Stage 3C extent of works
- Stage 3C will be located at least 500mm above the 1% AEP peak water surface level estimated for South Creek
- The proposed road network and grading within Stage 3C will provide suitable flood evacuation routes
- Overland flow paths within Stage 3C have been subject to preliminary assessment for events up to the 1% AEP to assess flow characteristics and flood hazard
- Roads have been designed generally in accordance with:
    - *Guide to Road Design*, Austroads, 2006
    - *Central Precinct Plan*, JBA, 2009
    - *Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments*, Penrith City Council, November 2013
- The design vehicle used to assess the proposed road network was a 12.5 m SU Truck
- The minimum longitudinal road grades within Stage 3C is 0.7%
- A drainage corridor has been sized suitably to accommodate both internal and external overland flows
- The drainage corridor will be subject to future embellishment under a subsequent Development Application for landscape works for conversion into a riparian corridor
- Preliminary designs for the riparian corridor are detailed within the *Central Precinct Landscape Master Plan*, JMD Design, February 2015
- A preliminary drainage network has been designed in accordance with *Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments*, Penrith City Council, November 2013
- A merit based assessment has been presented to Council representatives for the removal of the requirement to provide on-site detention within Jordan Springs East. Concurrence for the approach was provided in January 2017. A temporary basin has been provided as an interim measure until permanent basins are constructed.
- A stormwater quality management strategy has been prepared for Stage 3C which demonstrates the capacity to align with the region stormwater management strategy prepared previously for both the Jordan Springs East (Central) and Jordan Springs (Western) Precincts
- Sediment and erosion control measures have been included as required to protect downstream receiving waters from sediment laden runoff during construction activities
- Liaison with utility providers has confirmed that there is suitable capacity within existing networks to service Stage 3C of Jordan Springs East

- Lead-in Utility infrastructure for potable water, electricity, gas and telecommunications has been provided as part of the previous stage works.
- A sewer pumping station and rising main that will service Stage 3C as well as future Stages of the Central Precinct is presently being constructed by Sydney Water and is anticipated to be complete prior to the completion of Stage 3C.

13 References

- *St Marys Central Precinct Water Soils and Infrastructure Report*, SKM, May 2009
- *Central Precinct Bulk Earthworks Development Application*, Cardno, July 2014
- *Central Precinct of St Mary's Project Development Flood Assessment Report Final,* Jacobs, February 2015
- *Central Precinct Stormwater Detention Strategy,* Cardno January 2017
- *Jordan Springs East Precinct Stormwater Quality Management Report*, Cardno January 2017
- *Floodplain Development Manual,* NSW Department of Infrastructure, Planning & Natural Resources, April 2005
- *Central Precinct Plan*, JBA 2009
- *Guide to Road Design*, Austroads, 2006
- *Penrith City Council Design Guidelines for Engineering Works for Subdivision and Developments*, Penrith City Council, November 2013
- *Central Precinct Stage 1 Traffic Impact Assessment*, Cardno, December 2014
- *Central Precinct Landscape Master Plan*, JMD Design, February 2015
- *Guidelines for Riparian Corridors on Waterfront Land*, NSW Department of Primary Industries Office of Water, July 2012
- *Bushfire Emergency Evacuation Plan, Central Precinct, St Marys ADI Development*, Molino Stewart, September 2014
- *Australian Rainfall and Runoff, Volume 1*, Institution of Engineers, 1987
- *Hydrologic Assessment of St Mary's Central Precinct*, Jacobs, 12 November 2014
- *Water Sensitive Urban Design (WSUD) Policy*, Penrith City Council, December 2013
- *Managing Urban Stormwater – Soils and Construction*, NSW Department of Housing, March 2004
- *Guide to Codes and Practices for Streets Opening,* NSW Streets Opening Conference, 2009

Stage 3C: Jordan Springs East

APPENDIX

A

JORDAN SPRINGS EAST STAGE 3C
DA DRAWING SET

Cardno
Shaping the Future

Cardno
Shaping the Future