7th June 2013

The General Manager
Penrith City Council
601 High Street
PENRITH NSW 2760

Attention: Gavin Cherry

Dear Gavin,

DEVELOPMENT APPLICATION (DA)
PROPOSED SUBDIVISION OF LOT 11 IN DP1176163 INTO 6 LOTS FOR THE PURPOSE OF 3 LOTS FOR FUTURE MIXED USE DEVELOPMENT, 1 FUTURE PUBLIC RESERVE LOT, 1 LOT FOR DRAINAGE PURPOSES AND 1 RESIDUE LOT, JORDAN SPRINGS, WESTERN PRECINCT, ST MARYS

1.0 INTRODUCTION

This Statement of Environmental Effects (SEE) is submitted to Penrith City Council (PCC) in support of a Development Application (DA) for the proposed subdivision of lot 11 into 6 lots consisting 3 future Mixed Use Development sites, 1 future public reserve lot, 1 lot for future drainage purposes and 1 residue lot within Jordan Springs, Western Precinct, St. Marys.

This report has been prepared by the Applicant, Lend Lease (LL) as agent for Maryland Development Company.

This report should be read in conjunction with the following:

- DA form and application fees;
- Location Plan, prepared by Lend Lease (**Appendix A**);
- Existing Conditions Plan, prepared by Lend Lease (**Appendix B**);
- Neighbour Notification Plan, prepared by Lend Lease (**Appendix C**);
- Plan of Subdivision, prepared by Whelans Insites (**Appendix D**);
- Bushfire Protection Assessment, prepared by Bushfire and Environmental Services (**Appendix E**); and
- Upstream Extended East / West Open Channel Report, prepared by SKM (**Appendix F**).

This report describes the site and its environs, the proposed development and includes an assessment of the proposal in terms of the matters for consideration as listed under Section 79C(1) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Within this report, references to the 'subject site' mean the land to which this DA relates.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Background

The St Marys site was endorsed by the NSW Government for inclusion on the Urban Development Program (UDP) in 1993. The St Marys site is located approximately 45km west of the Sydney CBD, 5km north-east of the Penrith City Centre and 12km west of the Blacktown City Centre.

The St Marys site has an area of approximately 1,545ha and is approximately 7km east to west and 2km north to south. The site is bounded by Forrester Road and Palmyra Avenue in the east, The Northern Road in the west, Ninth Avenue and Palmyra Avenue in the north and the Dunheved Industrial Area, Dunheved Golf Club and Cambridge Gardens, Werrington Gardens and Werrington County residential estates in the south.

The St Marys site, which has been rezoned for a variety of uses, comprises 6 development precincts – Western, Central, North and South Dunheved, Ropes Creek and Eastern Precincts. Developable areas within these Precincts are shown on **Figure 1**.

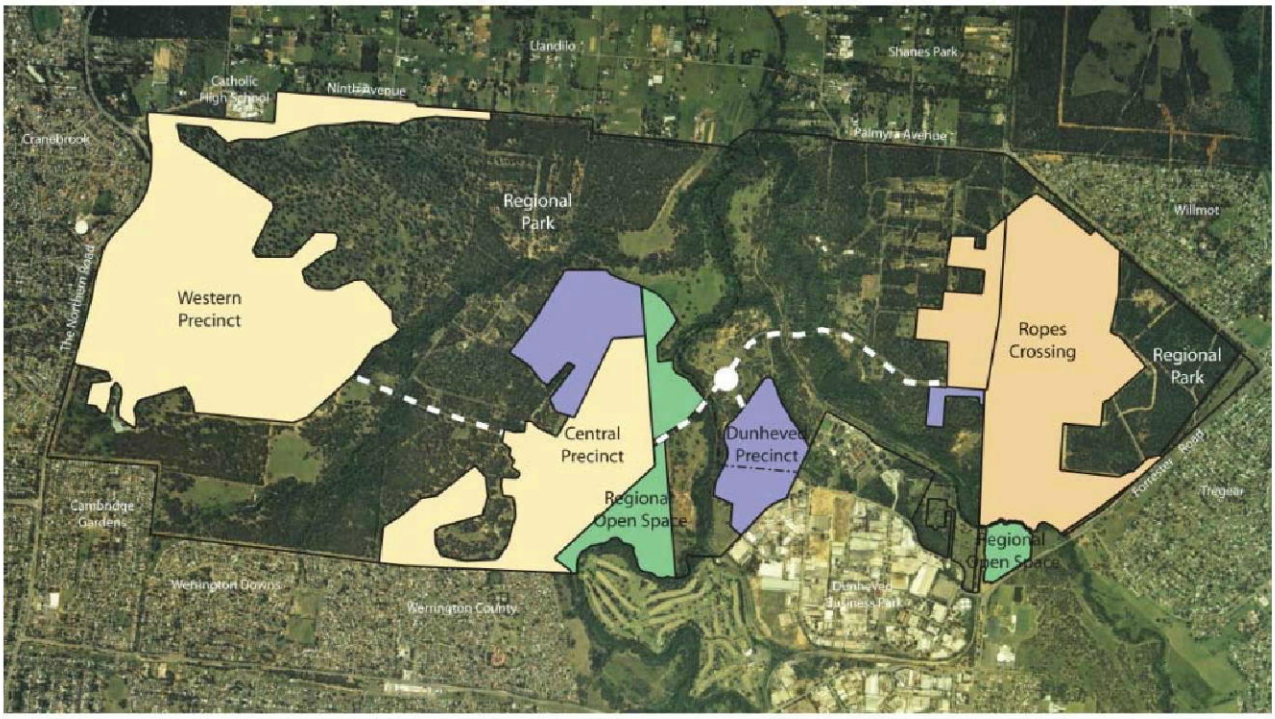

Figure 1 – St Marys Development Precincts

On 16 June 2003 the Minister for Infrastructure, Planning and Natural Resources announced the "release" of the Eastern, North and South Dunheved Precincts. Subsequently, on 29 September 2006, the Minister released the remaining precincts, allowing "Precinct Plans" to be released for each area.

A Precinct Plan for the Western Precinct (the WPP) and accompanying Development Control Strategy (DCS) were adopted by Penrith City Council on 23rd March 2009. Construction of roads, services, landscaping and housing has been undertaken. The WPP required the preparation and adoption by Council of a Concept Plan prior to the approval of any subdivision proposal within the Western Precinct. The Concept Plan provides the next level of specificity of detail in relation to the matters addressed in the WPP and is intended for use by Council as an assessment tool for the consideration of future DAs.

2.2 Site Description and Ownership

The land to which this DA refers is the suburb of Jordan Springs which comprises the Western Precinct of the St Mary's development. The site is owned by St Marys Land Limited and is being developed by Lend Lease under the name of Maryland Development Company.

The subject land of this subdivision DA is located on the existing balance lot 11 in DP1176163, registered on 3rd June 2011.

For site context, refer to **Appendix A** for the Site Location Plan, and the Plan of Subdivision at **Appendix D**.

2.3 Relevant Western Precinct Subdivision DAs

This DA will require consideration within the context of previous DAs lodged adjacent to the subject site (refer **Table 1**). The scope of each DA and its status is provided.

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Table 1- Associated Western Precinct subdivision DAs

Development Application	Proposal	Status
Stage 3A subdivision application (DA11/0511)	• 139 Residential lots, 7 residue lots and public roads	Approved 15th August 2011
Stage 3B subdivision application (DA11/0512)	• 138 Residential lots, 1 public reserve, 3 residue lots and public roads	Approved 15th August 2011
Retail Site subdivision application (DA11/1047)	• 3 residue lots	Approved 19th December 2011
Childcare Centre and CRH subdivision application (DA11/1360)	• 1 Childcare Centre site, 1 Community Resource Hub site and 1 residue allotment	Approved 2nd March 2012
Stage 1H subdivision application (DA11/1333)	• 29 residential lots	Approved 3rd April 2012
Mixed Use site 4-lot subdivision application (DA12/0101)	• 1 Mixed Use Development site, 1 future road reserve and 2 residue allotments	Approved 15th May 2012
Temporary Builders Display Village Car Park (DA12/0291)	• 1 temporary car park for the Builders Display Village	Approved 26th June 2012
Living Street subdivision application (DA11/1094)	• 22 residential lots and public roads	Approved 10th October 2012
Riparian Corridor subdivision application (DA11/1088)	• 5 residue lots	Approved 13th November 2012
Trunk Sewer EIS (DA12/0910)	• Construction of permanent sewer main	Approved 10th December 2012
Village 4 subdivision application (DA12/0897)	• 291 residential lots and public road	Approved 1st March 2013
Northern Road Oval landscape application (DA12/1363)	• Landscape embellishment works	Approved 30th May 2013
Riparian Corridor Construction (DA13/0065)	• Construction of Riparian Channel	Lodged 25th January 2013
Riparian Corridor Landscape Embellishment (DA13/0066)	• Landscape embellishment works for the Riparian Corridor	Lodged 25th January 2013
Builders Display Village Operations (DA13/0114)	• Operation of a Builders Display Village in Stage 2A and car park construction	Lodged 8th February 2013

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3.0 DESCRIPTION OF PROPOSAL

This section of the report provides a detailed description of the proposed development.

The DA seeks development consent for subdivision of proposed residue lot 11 into 6 allotments. The allotments created as part of the proposed paper subdivision are as follows:

- Lot 3989 (5026m²) – Future Mixed Use site proposed for possible higher density housing and retail / commercial uses (Village Centre Site 3);
- Lot 3990 (2.345ha) – Future Mixed Use site proposed for possible higher density housing and retail / commercial uses (Village Centre Site 10);
- Lot 3991 (3.633ha) - Mixed Use site proposed for possible higher density housing and retail / commercial uses (Village Centre Site 2);
- Lot 3992 (1.084ha) - Future Drainage Corridor;
- Lot 3993 (1.183ha) - Future Public Open Space; and
- Lot 3994 (61.56ha) - Residue allotment for future development.

This DA is for a paper subdivision only, and does not propose any other development, including landscape embellishment works, civil works such as earthwork, road construction, footpaths or service connections, or dwelling construction.

Any development on lots 3989, 3990 and 3991 (Village Centre Sites 2, 3 and 10) will be proposed and undertaken by a separate developer, including roads and associated civil works, dwellings and associated landscape embellishment works. The assessment of any potential future development will be subject to future DAs, which will include specific details on built form to ensure compliance with the Western Precinct Plan and Village Centre Concept Plan.

An assessment of planning issues is included in Section 4, and an assessment of the proposal against the relevant Environmental Planning Instruments is included in Section 5.

3.1 Location of subject site

The subject site is located on the Southern side of the Jordan Springs Village Centre. The site is bound by Jordan Springs Boulevard and Lakeside Parade to the North, the proposed Village 4 to the East, and the proposed Regional Park to the South and West.

3.2 Existing site conditions

The Existing Conditions Plan (refer **Appendix B**) illustrates that the subject site generally grades from West to East. There is a wedge of Regional Park which separates lot 3990 (VC10) and the other lots. Within this area of Regional Park is a remnant farm dam, which has regenerated into a

more natural state. As a result, there are some existing trees located around the dam, mainly on the eastern side.

No modifications to the existing site conditions are proposed in this DA.

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4.0 ASSESSMENT OF PLANNING ISSUES

Section 79C(1) of the Environmental Planning and Assessment Act 1979 declares that the Consent Authority, in assessing a DA, must take into account a range of issues relevant to the proposal, including the suitability of the site, and the impacts of the site and surrounds imposed by the proposal.

The following matters are reviewed in accordance with the proposed subdivision.

4.1 Flooding and Stormwater Drainage

The Water, Soils and Infrastructure Report that forms part of the WPP and prepared by SKM contains an analysis of the existing water, drainage and soil characteristics of the Western Precinct. The report establishes that the site is not affected by the Probably Maximum Flood level from the Hawkesbury Nepean River system, or the 100 year ARI level in South Creek, located to the west of the subject site.

This DA is for a paper subdivision of allotments only. No stormwater drainage works are proposed as part of the subject DA. However, a stormwater report has been prepared by SKM and is included at **Appendix F** to demonstrate that lot 3992 (proposed future drainage corridor) is of sufficient width to ensure that it can cater for the 1% AEP flood with a minimum of 500mm freeboard, subject to some future modifications of the land.

4.2 Earthworks and Ground Contouring

This DA does not propose any earthworks or ground contouring on the site. These items will be contained in future DAs for development on these allotments.

4.3 Erosion and Sediment Control

As part of this DA, there are no activities proposed on the subject site to cause erosion and result in the need for sediment control. Details of erosion control during construction will be submitted with future DAs for proposed development on the subdivided allotments.

4.4 Soil Salinity

The Soil and Water Management Plan contained within the Western Precinct Plan includes possible measures to address potential soil salinity issues, should they occur. The proposed subdivision will not have an impact on the current levels of salinity on the subject site.

4.5 Bushfire Management

The subject site is identified as bushfire prone land. The subject DA is proposing the subdivision of allotments for future residential purposes, therefore the proposal is defined as “integrated development” under Section 91 of the Environmental Planning and Assessment Act 1979.

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Accordingly, a Bushfire Protection Assessment has been undertaken for the proposal, as prepared by EcoLogical Australia Pty Ltd and included at **Appendix E**. The bushfire report identifies that the site is subject to an Asset Protection Zone (APZ) of either 10 or 15 metres as shown in the report.

4.6 Explosive Ordnance Material

Processes are in place for when potential ordnance material is uncovered, however this is not applicable under this subdivision DA.

4.7 Access and Traffic

Road frontage is provided to all allotments, with the exception of lot 3993 (future Public Open Space), to which legal access is granted by a Right of Carriageway. The easement will be created with a minimum width of 11.8m, which is a sufficient width to incorporate a standard verge on one side, footpath and carriageway under the DCS standards for a local street. The details of any road construction or associated works on any of the proposed allotments will be subject to a future DA.

4.8 Safety

This is not applicable under this subdivision DA.

4.9 Landscaping and Maintenance

No landscaping is proposed under this subdivision DA.

4.10 Tree Retention

The subject DA does not propose the modification of the existing conditions on site, and so tree retention or removal is not applicable under this DA.

4.11 Ecology

The existing flora and fauna on site will not be disturbed through this paper subdivision DA, as no site works are being undertaken as part of the proposal.

4.12 Utility Services

Consultation with service providers was undertaken in preparation of the WPP. The subdivided allotments will be serviceable with water, sewer, electricity and telecommunications, subject to extensions or augmentation of utilities infrastructure to be determined in future DAs.

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4.13 Heritage

There are no SREP30 identified European Heritage sites or Aboriginal Archaeological Salvage sites located in the subject site area. In any event, a Section 90 permit exists for all Urban zoned land in the Western Precinct.

4.14 Contamination

The St Marys Precinct has been subject to extensive investigation and remediation to ensure that the land is suitable for development. The Environmental Protection Agency (EPA), now DECCW, has been involved in the process of preparing the Site Audit Statements (SAS) for the Precinct. The specific SASs which encompasses the subject site is CHK001/1. A copy of this SAS has been submitted to Penrith City Council as part of previous DAs.

4.15 Social and Economic Impacts

The proposed development of urban land for residential purposes provides further housing choice within the region that is well connected to education and community services, public transport, parks and open spaces. The development framework established under SREP 30 is delivering economic development employment opportunities. The proposed subdivision will create developable allotments which will promote these positive social and economic impacts.

Further, the proposed development will continue the utilisation of construction jobs as well as longer term economic benefits associated with flow on effects from establishing a new residential community.

4.16 The public interest

The proposed development and subdivision is adherent with the Development Control Strategy and Western Precinct Plan. These documents have been subject to public exhibition and assessment by Penrith City Council, leading to its subsequent adoption. The proposal represents Council's planning objectives for the Western Precinct.

5.0 DEVELOPMENT ASSESSMENT UNDER RELEVANT PLANNING INSTRUMENTS AND CONTROLS

Section 79C(1) of the Environmental Planning and Assessment Act states that the consent authority must take into account a range of matters relevant to the development in determining an application, and specifically the provisions of environmental planning instruments.

The following planning instruments and documents are relevant to the proposed development:

- Environmental Planning and Assessment Act 1979 (EP&A Act)
- St. Marys Development Agreement (Deed) and St Marys Penrith Planning Agreement;
- Sydney Regional Environmental Plan No. 30 – St Marys (SREP 30);
- St Marys Environmental Planning Strategy (St Marys EPS);
- Western Precinct Plan; and
- Development Control Strategy.

The following assessment of these instruments only includes those matters under Section 79C(1) that are relevant to the proposal. These planning instruments have been used to determine the social, economic and natural and built environmental impacts.

5.1 Environmental Planning and Assessment Act 1979

In accordance with the EP&A Act, the proposal will require a bushfire safety authority to allow the subdivision of the land for future residential purposes, as the land is identified as bush fire prone. Therefore, the proposal is defined as Integrated Development in accordance with the Rural Fires Act 1997.

A cheque accompanies this application to facilitate the assessment of the proposal by the NSW Rural Fire Service. A Bushfire Protection Assessment prepared by EcoLogical Australia Pty Ltd also accompanies this application at **Appendix E**.

5.2 St. Marys Development Agreement and St. Marys Penrith Planning Agreement

The St. Marys Penrith Planning Agreement specifies the obligations in relation to the Remnant Farm Dam Park (the future public open space on lot 3993). The park is required to be a minimum size of 1ha, which is achieved on lot 3993. The area of 1.183ha is considered appropriate to include the provisions of the park, being a kick-around area, play space, picnic facilities, associated landscaping and interpretive signage.

5.3 Sydney Regional Environmental Plan No. 30 – St Marys (SREP 30)

SREP 30 contains planning objectives, principles and provisions to control development within the Precincts shown in figure 1. The proposed subdivision is not inconsistent with the achievement of the performance or zone objectives, and reflects the aims of the development control strategies of SREP 30.

Part 5 specifies the performance objectives for the Western Precinct. The proposed subdivision supports the future achievement of these objectives. Specifically, lot 3993 supports the objectives of Clause 27 (Open Space and Recreation) to enable the construction of a future public reserve which can:

- provide an area for passive and active recreation;
- ensure utilisation by maximising accessibility; and
- provide a design which maximises the natural environmental values of the location.

Lot 3992 supports the objectives of Clause 28 (Watercycle) and will enable the future construction of a drainage corridor which can:

- minimise impacts on water quality during construction;
- minimise impact upon flood levels downstream; and
- minimise flood risk to both people and property.

Lots 3989, 3990 and 3991 support the objectives in Part 5, as they will enable the future construction of housing and built form which can:

- provide a range of housing types and sizes in close proximity to services and facilities within the Village Centre;
- provide an attractive and safe built environment; and
- maximise the potential for alternative forms of transport.

Clause 40 states the objectives and permissible uses within the Urban Zone. The proposed subdivision is development for the purpose of drains, housing and parks, which are all the proposed future uses of the proposed allotments created in this DA.

Similarly, Clause 40 (1) states that:

The objectives of the Urban Zone are...to ensure that buildings and works within the zone are primarily used for residential purposes and associated facilities.

This proposal is consistent with these objectives, as this DA seeks consent for the subdivision of the subject lot within the Urban Zone for the future purpose of residential use and associated facilities.

In addition to the above, Part 4, Clause 20 (subsection 3) states that “consent may be granted...on or with respect to any land development that, in the opinion of the consent authority, is of a minor nature”. As the proposal is purely a paper subdivision of land, with no modifications or improvements being undertaken on the land as part of the proposal, this subdivision would be considered as minor. Consequently, the proposal is permissible under SREP 30.

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5.4 St Marys Environmental Planning Strategy (St Marys EPS)

The St Marys EPS establishes guidelines and strategies for the future development of land under SREP 30, specifically in relation to matters of conservation, cultural heritage, water cycle and soils, transport, urban form, energy and waste, human services, employment and contamination.

The proposal is generally consistent will the performance objectives contained in the EPS, and will not prevent the achievement of the objectives for future development on the allotments created.

5.5 St Marys Western Precinct Plan (WPP)

The Western Precinct Plan (WPP) identifies the distribution of major land uses including the location and function of open space and public facilities within the Western Precinct.

The proposed subdivision is not inconsistent with the vision for the City of Penrith and Western Precinct detailed in sections 1.5 and 1.6, and it does not hinder the achievement of these principles with future development on the proposed allotments.

The proposal creates lot 3993 which is the site of a future public reserve. This is consistent with the Framework Plan and Open Space Master Plan. Similarly, the location of the proposed future drainage corridor on lot 3992 is compliant with the location indicated in the Precinct Plan.

The proposed subdivision also supports the objectives of the Village Centre Character Area specified in the Jordan Springs Village Centre Concept Plan. The subdivision will not prevent future development from achieving these objectives.

5.6 Western Precinct Development Control Strategy (DCS)

The subdivision proposal will promote compliance of the residential development controls included in Section 5B of the Precinct Plan, and will allow for a range of dwelling types, potentially including integrated housing and apartments.

Objectives specifically relating to built form are not relevant to this subdivision DA, and will be addressed as part of a future DA for dwellings on the subdivided allotments.

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6.0 Conclusion

The proposed subdivision is consistent with the objectives and controls within the planning instruments relevant to this site.

The proposed subdivision is considered minor in nature, as no physical site works will be undertaken. The subdivision lot configuration is generally in accordance with the Development Control Strategy and Western Precinct Plan, and represents Council's planning objectives for the Western Precinct. Under SREP 30 objectives, the subdivision proposal is permissible with consent according to clause 45, and is consistent with the Urban Zone objectives specified in clause 40 (2).

In light of the merits of the proposal, and in absence of any significant adverse environmental, social or economic impacts, we request that the application be approved, subject to appropriate conditions of consent.

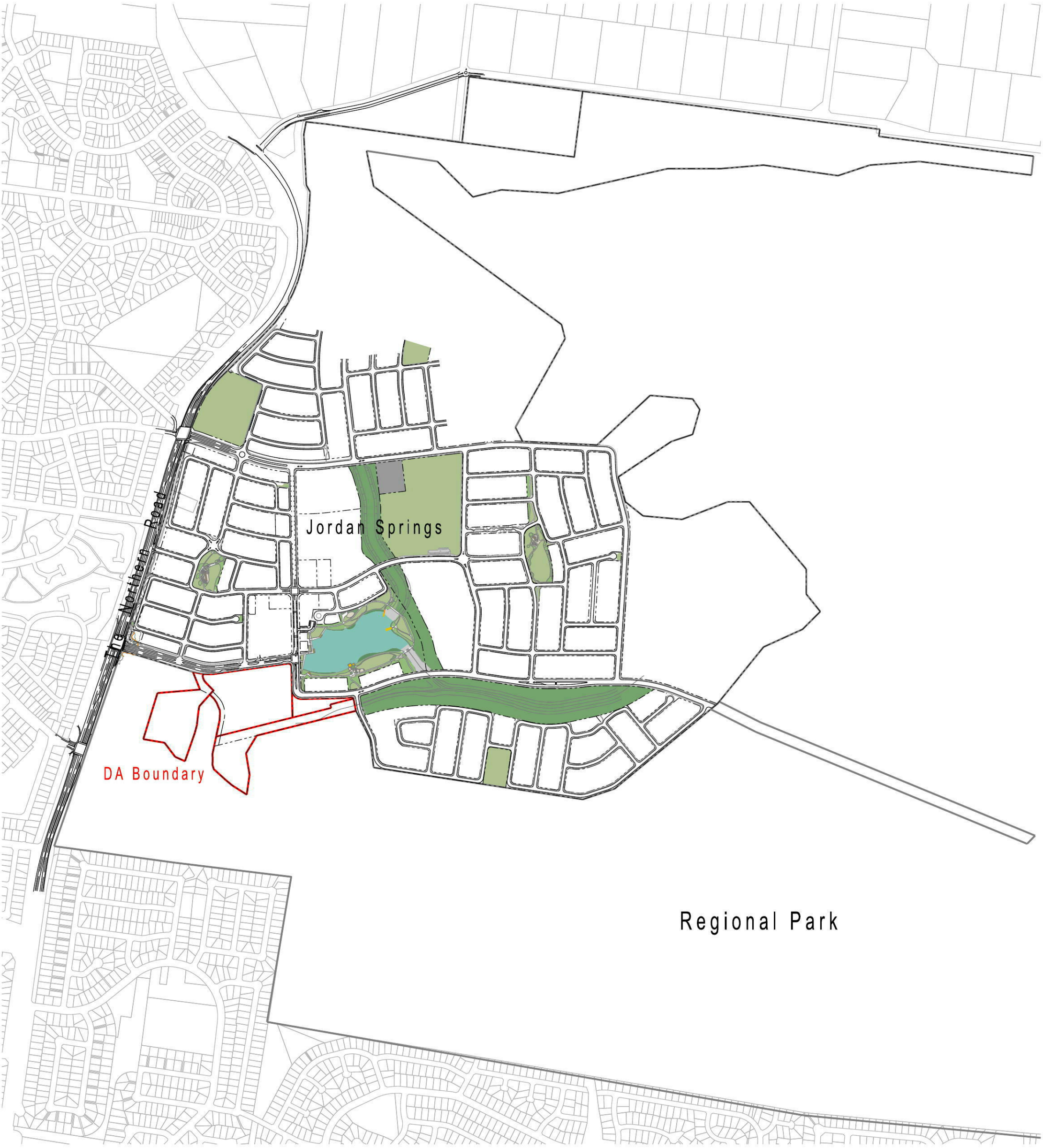
Should you require further clarification on any of the above items or require additional plans or documentation, please do not hesitate to contact me on 0439 094 730.

Yours faithfully,

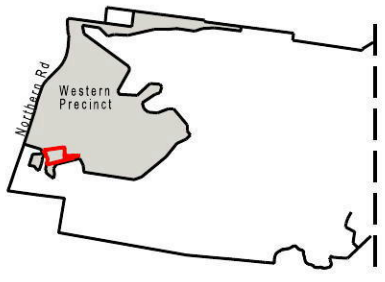
Angus Fulton
Statutory Planner
COMMUNITIES

Lend Lease

Appendix A
Location Plan, prepared by Lend Lease



KEY PLAN



NOTES

Issue	Amendment	Date
A	Council Lodgement Issue	06.06.13

LEGEND

Developer

Lend Lease

Cnr Jordan Springs Blvd and Lakeside Pde
Jordan Springs NSW 2747
PO Box 1870, Penrith NSW 2751
p.02 8016 6500

ABN 19 087 876 864

Development Manager: Lend Lease Development Pty Ltd

Project

JORDANSPRINGS

Drawing Title

Village Centre VC 2 ,3 & 10 DA Location Plan

Scale AT A3	1:10000
Drawn by	RS/LM
Drawing No.	JS VC2&3 Loc

Issue A

Lend Lease

Appendix B
Existing Conditions Plan, prepared by Lend Lease

VC2 DA Boundary

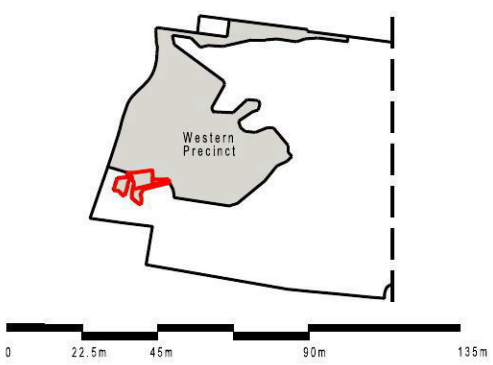
VC3 DA Boundary

VC10 DA Boundary

Future Drainage Reserve

Future Public Reserve

KEY PLAN



NOTES

Issue	Amendment	Date
A	Council Lodgement Issue	05.06.13

LEGEND

DA Boundary

Existing tree

35.0 Existing contour

Top of bank

Bottom of bank

Existing road

Developer

Lend Lease

Ropes Crossing Boulevard,
Ropes Crossing NSW 2760
p.02 9673 8800 f.02 9673 8888

ABN 88 000 966 085 ©

Development Manager: Lend Lease Development Pty Ltd

Project

JORDANSPRINGS

Drawing Title

Village Centre VC 2 ,3 & 10 DA

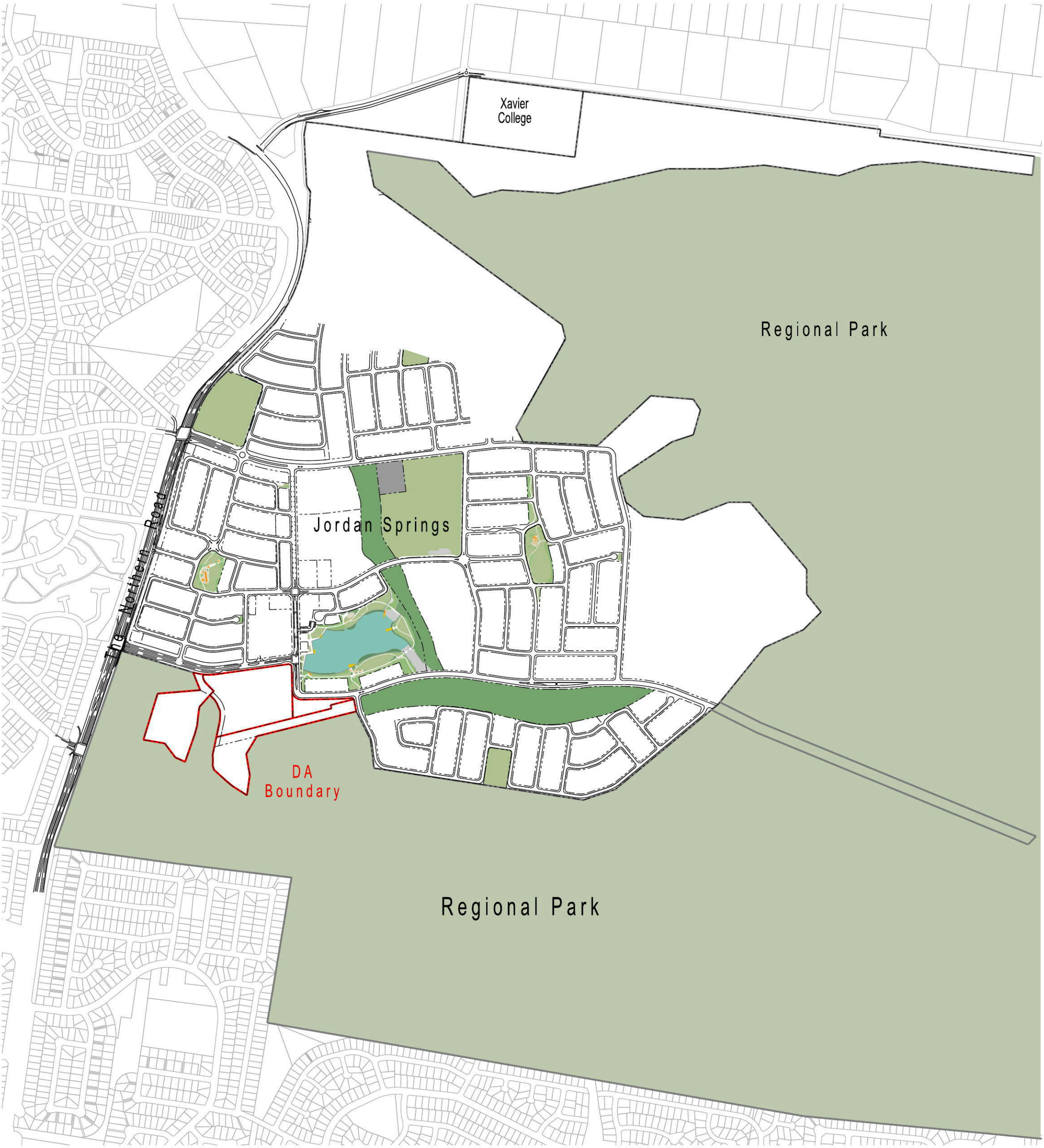
Existing Conditions Plan

Scale AT A3	1:2250
Drawn by	RAS
Drawing Number	WP VC2&3 EC

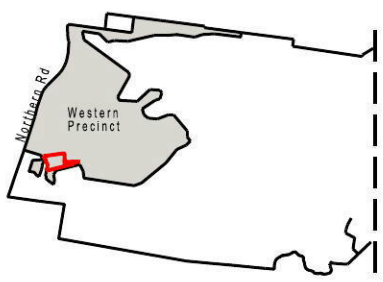
Issue A

Lend Lease

Appendix C
Neighbour Notification Plan, prepared by Lend Lease



KEY PLAN



0 100m 200m 400m 600m

NOTES

Issue	Amendment	Date
A	Council Lodgement Issue	06.06.13

LEGEND

DA Boundary

Developer

Lend Lease

Cnr Jordan Springs Blvd and Lakeside Pde
Jordan Springs NSW 2747
PO Box 1870, Penrith NSW 2751
p.02 8016 6500
ABN 19 087 876 864

Development Manager: Lend Lease Development Pty Ltd

Project

JORDANSPRINGS

Drawing Title

Village Centre

VC 2 ,3 & 10 DA
Neighbour Notification Plan

Scale AT A3	1:10000
Drawn by	RS/LM
Drawing No.	WP VC2&3 Notification

Issue A

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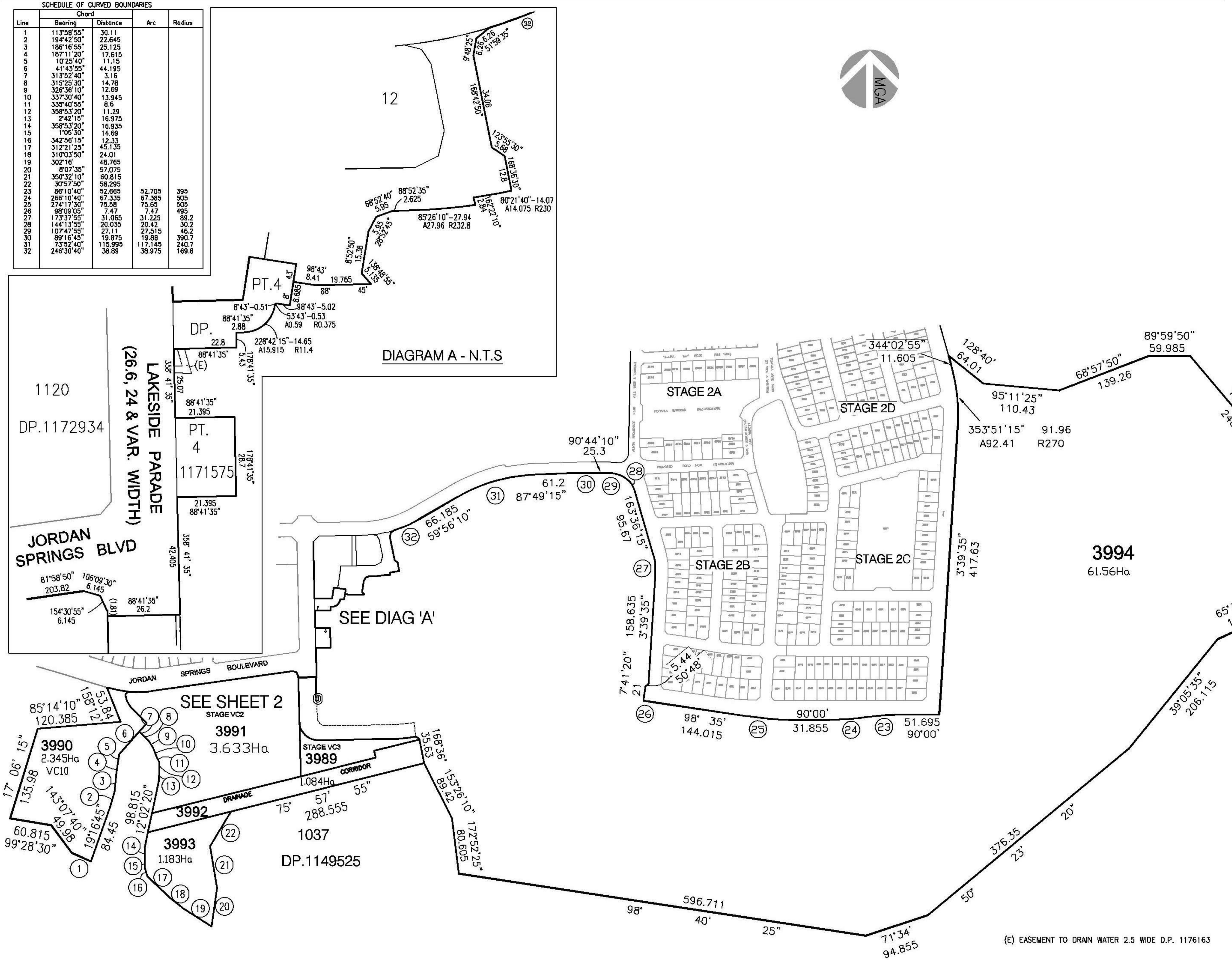
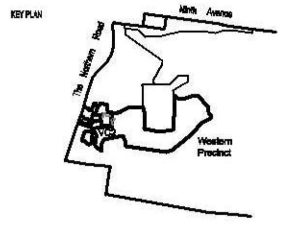
Appendix D
Plan of Subdivision, prepared by Whelans Insites

SCHEDULE OF CURVED BOUNDARIES

Line	Chord Bearing	Chord Distance	Arc	Radius
1	113°58'55"	30.11		
2	194°42'50"	22.645		
3	186°16'55"	25.125		
4	187°11'20"	17.615		
5	10°25'40"	11.15		
6	41°43'55"	44.195		
7	313°52'40"	3.16		
8	315°25'30"	14.78		
9	326°36'10"	12.69		
10	337°30'40"	13.945		
11	335°40'55"	8.6		
12	358°53'20"	11.29		
13	2°42'15"	16.975		
14	358°53'20"	16.935		
15	1°05'30"	14.69		
16	342°56'15"	12.33		
17	312°21'25"	45.135		
18	310°03'50"	24.01		
19	302°16'	48.765		
20	8°07'35"	57.075		
21	350°32'10"	60.815		
22	30°57'50"	58.295		
23	86°10'40"	52.665	52.705	395
24	266°10'40"	67.335	67.385	505
25	274°17'30"	75.58	75.65	505
26	98°09'05"	7.47	7.47	495
27	173°37'55"	31.065	31.225	89.2
28	144°13'55"	20.035	20.42	30.2
29	107°47'55"	27.11	27.515	46.2
30	89°16'45"	19.875	19.88	390.7
31	73°52'40"	115.995	117.145	240.7
32	246°30'40"	38.89	38.975	169.8



(E) EASEMENT TO DRAIN WATER 2.5 WIDE D.P. 1176163



Issue	Amendment	Date
A	ADD LOT 3989 AND RIGHT OF ACCESS	26-4-13
B	AMEND LOTS 3989&3991 & NOC	31-5-13

NOTES

NO BOUNDARY SURVEY HAS BEEN UNDERTAKEN. DIMENSIONS AND AREA(S) SHOWN ARE APPROXIMATE ONLY AND ARE SUBJECT TO CONFIRMATION BY BOUNDARY SURVEY

LOT NUMBERING IS SUBJECT TO CHANGE ON PREPARATION OF FINAL DEPOSITED PLAN.

ORIGIN OF MGA BASED SITE CO-ORDINATES FROM PM 147113 AND PLANE DISTANCES HAVE BEEN USED.

CO-ORDINATES FOR PM 147113 WERE DEDUCED BY WHELANS FROM SURROUNDING SSM & PM'S ON PUBLIC RECORD. CO-ORDINATES FOR PM 147113 HAVE BEEN ADOPTED AS 292202.160E 6256005.620N

Developer

Lend Lease

Prepared by

WHELANS INSITES

D646-V4-009b.dwg

Project

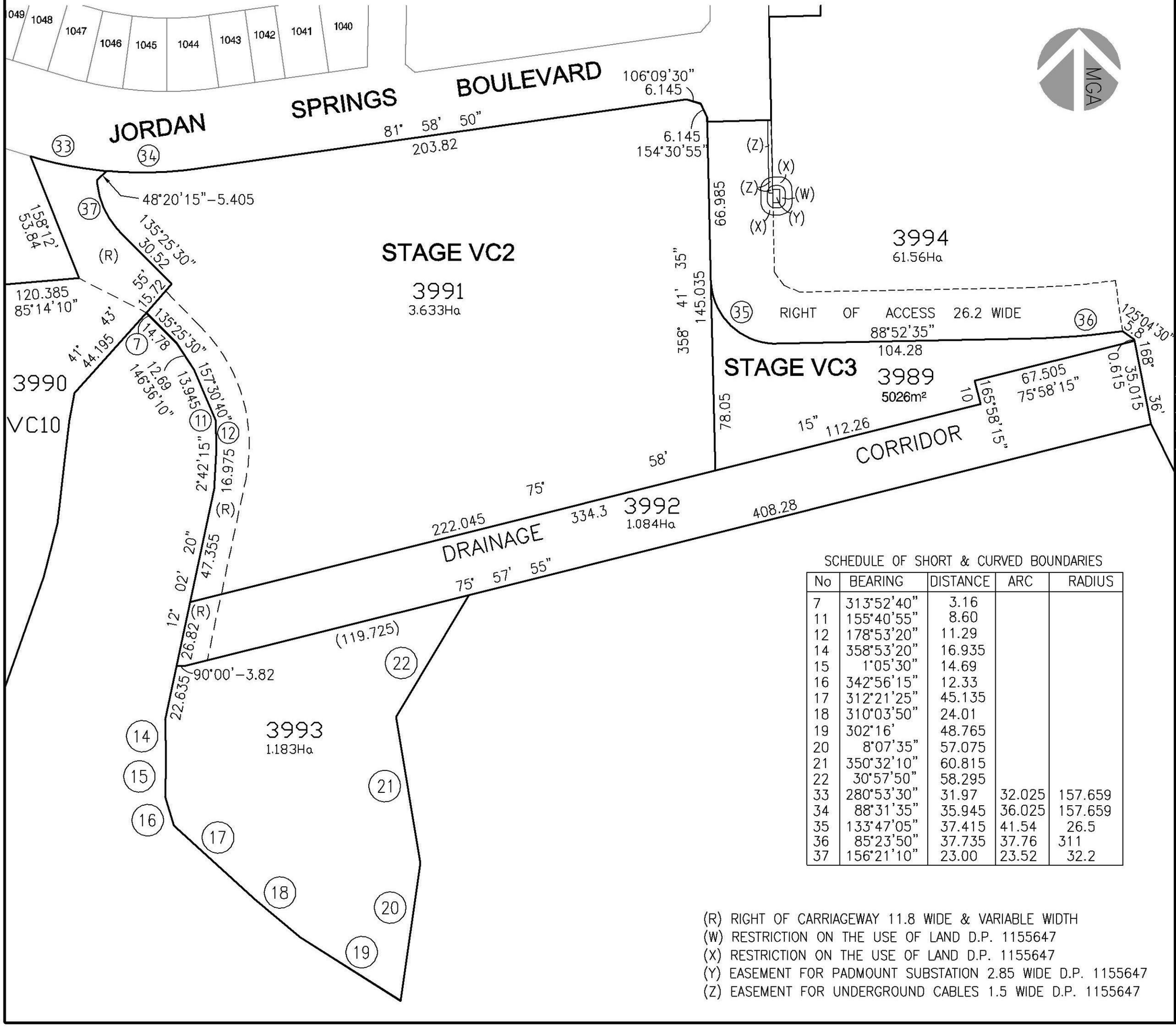
St Marys Development
Western Precinct - VC2, 3 & 10

Drawing Title

PLAN OF SUBDIVISION OF LOT 11 IN DP. 1176163

0 10m 20m 50m 100m

CCAD REF: D646-V4	SHEET 1 OF 2
Scale 1:2500 @ A1	DATE 26-4-13
Drawn	LAS
Checked	JMcW
Job No	D646
Drawing Number	D646-V4-009b
Project Web DCR No. W	Issue B

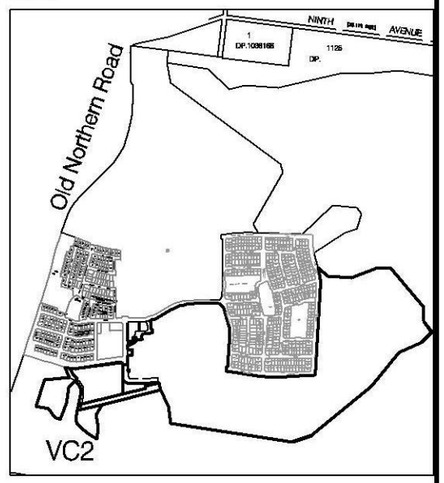


SCHEDULE OF SHORT & CURVED BOUNDARIES

No	BEARING	DISTANCE	ARC	RADIUS
7	313°52'40"	3.16		
11	155°40'55"	8.60		
12	178°53'20"	11.29		
14	358°53'20"	16.935		
15	1°05'30"	14.69		
16	342°56'15"	12.33		
17	312°21'25"	45.135		
18	310°03'50"	24.01		
19	302°16'	48.765		
20	8°07'35"	57.075		
21	350°32'10"	60.815		
22	30°57'50"	58.295		
33	280°53'30"	31.97	32.025	157.659
34	88°31'35"	35.945	36.025	157.659
35	133°47'05"	37.415	41.54	26.5
36	85°23'50"	37.735	37.76	311
37	156°21'10"	23.00	23.52	32.2

(R) RIGHT OF CARRIAGEWAY 11.8 WIDE & VARIABLE WIDTH
(W) RESTRICTION ON THE USE OF LAND D.P. 1155647
(X) RESTRICTION ON THE USE OF LAND D.P. 1155647
(Y) EASEMENT FOR PADMOUNT SUBSTATION 2.85 WIDE D.P. 1155647
(Z) EASEMENT FOR UNDERGROUND CABLES 1.5 WIDE D.P. 1155647

Notes:



No.	DATE	REVISION DETAILS
B	31-5-13	AMEND LOTS 3390&3391 & ROC
A	26-4-13	ADD LOT 3989 & ROA

PREPARED BY:
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PREPARED FOR:
Lend Lease

PLAN OF SUBDIVISION OF LOT 11 IN DP. 1176163 Stage VC2, 3 & 10 Jordan Springs

ORIGINAL SIZE: A3

SCALE	HOR: 1:1500	VERT:	
CO-ORDS:	MGA	DATUM:	-
DATE OF SURVEY	APR 2013	DATE OF PLAN:	APR 2013
SURVEY	JMCW	DRAWN	LAS
CHECKED:	JMcW	DATE	31-5-13
APPROVED:		DATE	
CIVILCAD REF: D646VC23			
JOB REF:	D646-V4	LAYOUT:	SH2
CAD REF:	D646-V4-009b.dwg	SHEET 1 OF 1 SHEETS	

Lend Lease

Appendix E
Bushfire Protection Assessment, prepared by Bushfire and Environmental Services

Bushfire Protection Assessment

Proposed Subdivision: Jordan Springs – Stage VC2 and VC3 Super-lots

Prepared for
Lend Lease

24 May 2013

DOCUMENT TRACKING

ITEM	DETAIL
Project Name	Bushfire Protection Assessment, Proposed Subdivision, Jordan Springs Stage VC2 and VC3 Super-lots
Project Number	09SUTBUS-0001
Prepared by	Daniel Copland
Approved by	David Peterson
Status	DRAFT
Version Number	1
Last saved on	24 May 2013

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd.

Contents

List of Figures

List of Tables

1 Property and proposal

Name:	Lend Lease		
Street or property Name:	Jordan Springs – Stage VC2 and VC3		
Suburb, town or locality:	Jordan Springs	**Postcode:**	2747
Lot/DP no:	Lot 11 DP 1176163		
Local Government Area:	Penrith City Council		
Type of development:	Subdivision (creation of super-lots)		

1.1 INTRODUCTION

Lend Lease commissioned Eco Logical Australia Pty Ltd (ELA) to prepare a bushfire protection assessment (BPA) for the proposed subdivision to create two super-lots, known as Stage VC2 and VC3, for future residential development and two residual lots for managed open space use. The proposed super-lot subdivision will occur within Lot 11 DP 1176163 of Jordan Springs (hereafter referred to as the subject land).

This assessment has been prepared by the ELA Senior Bushfire Consultant Daniel Copland (FPAA BPAD-A Certified Practitioner No. BPD-PA-28853). Daniel is recognised by the NSW Rural Fire Service as qualified bushfire consultant in bushfire risk assessment.

1.2 LOCATION AND DESCRIPTION OF SUBJECT LAND

The subject land is located approximately 3.4 km's east of the Nepean River and 2.9 km's north east of the Penrith CBD. The site is bounded to the north and east by land that is in varying stages of development for the Jordan Springs residential community. It is bounded in all other directions by Wianamatta Regional Park frontages. The subject land is located in the Local Government Area of Penrith City Council and has a Fire Danger Index (FDI) of 100.

The location is shown in Figure 1.

1.3 DESCRIPTION OF PROPOSAL

The development proposal will establish two super-lots for future residential development and two residual lots for future managed open space uses. Proposed Lot 3991 (also known as Stage VC2) is the largest of the four lots, and proposed Lot 3989 (also known as Stage VC3) will incorporate further residential development (including higher density development). Proposed lots 3992 and 3993 are proposed to have a managed open space function providing for the needs of the surrounding community as well as providing a buffer from the vegetated areas within Wianamatta Regional Park to the south and west, and to the riparian corridor areas of Village 4 to the east.

In terms of context, the Jordan Springs development precinct has been subject to various previous planning processes, including the development of an Indicative Land Use Plan (ILP) and a masterplan. Various 'village' developments are underway throughout and this subdivision will allow further development to occur.

Figure 1: Location Plan for Jordan Springs - Stage VC2 and VC3 super-lots

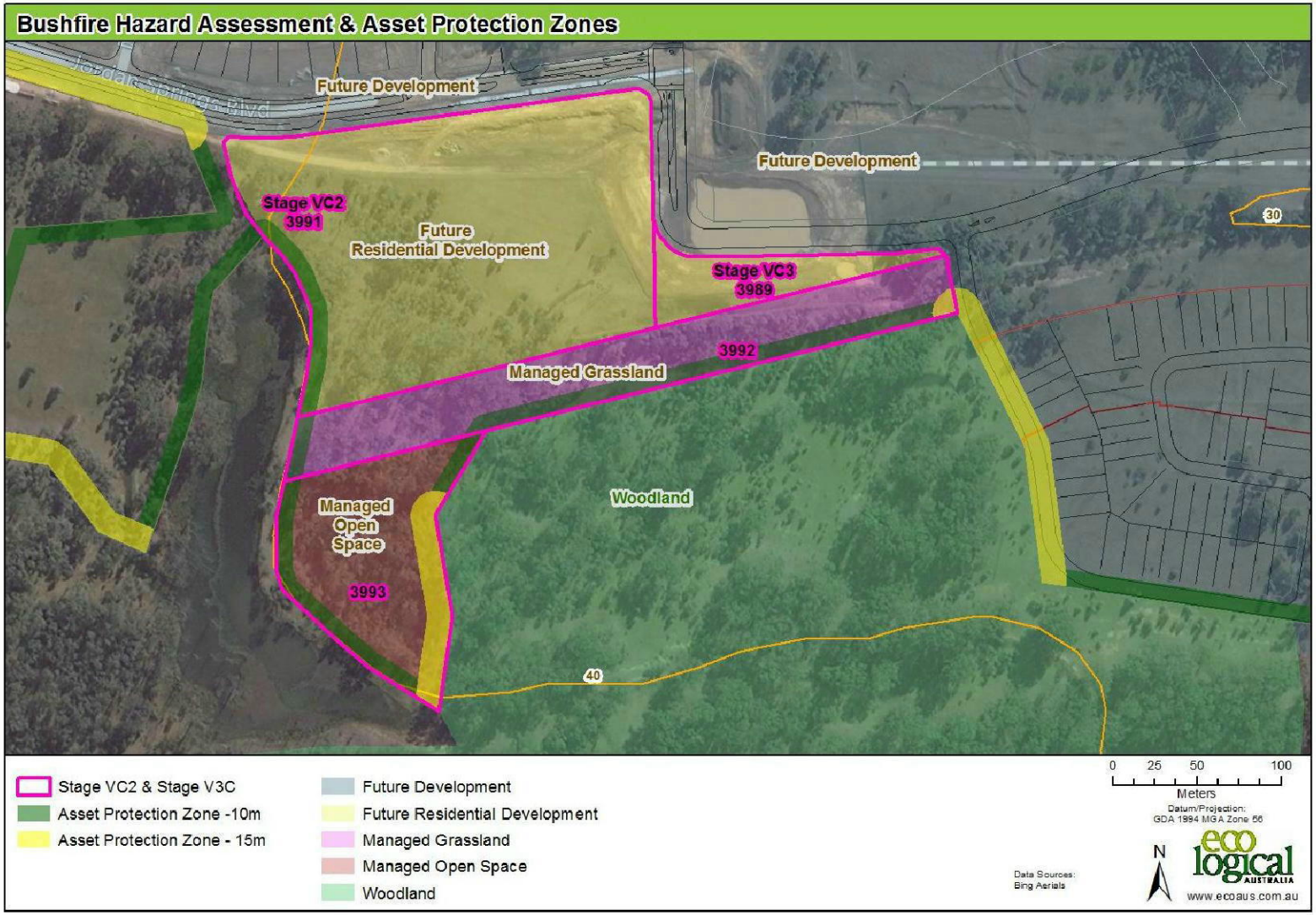

Figure 2: Bushfire Hazard Assessment and proposed Asset Protection Zones for Stage VC2 and VC3 super-lots

2 Bushfire threat assessment

2.1 ASSESSMENT REQUIREMENTS

The subject land is identified as Bush Fire Prone Land by Penrith City Council. The following assessment is prepared in accordance with Section 100B of the *Rural Fires Act 1997*, Clause 44 of the *Rural Fires Regulation 2008*, and '*Planning for Bush Fire Protection* 2006' (RFS 2006) herein referred to as PBP.

2.2 VEGETATION TYPES AND SLOPES

The vegetation and slope have been assessed in all directions for the proposed four-lot super-lot subdivision. In accord with PBP the predominant vegetation class has been calculated for a distance of at least 140 m out from the boundary of the subject land and the slope class *"most significantly affecting fire behaviour having regard for vegetation found [on it]"* determined for a distance of at least 100 m in all directions. The predominant vegetation and effective slope assessments are shown in Table 1.

Due to the staged nature of the development proposal across the Jordan Springs precinct, the majority of land surrounding the proposed super-lots, particularly to the north and east, will become either managed land or future development as the various stages are completed. Equally, there are areas that are currently either not vegetated or have highly disturbed vegetation that will be restored through revegetation process for conservation purposes – this is particularly true of the riparian corridor areas, which are situated along the western and eastern boundaries of the super-lots, the former within Wianamatta Regional Park, and the latter as part of the Village 4 development. The highly dynamic nature of the vegetation within the site means that little of the current vegetation will remain in situ in its current form, the main exception being areas to the south situated within Wianamatta Regional Park.

The primary bushfire hazard is the extensive areas of Woodland vegetation situated to the south and south west of the proposed subdivision, and a sparse riparian corridor of vegetation to the west of the super-lots. The areas shown within Lots 3992 and 3993 in Figure 3 represent areas of Open Space (managed lands) that have been designated for community use in perpetuity. These areas are suitable for use as Asset Protection Zones (APZs) to provide separation from the adjoining hazard areas

The Woodland within Wianamatta Regional Park is the most significant hazard area in that it is managed for conservation and public use purposes and does not form part of the proposed Jordan Springs precinct. The quality of the vegetation is variable, ranging from areas of Grassland through more mature and establish Woodland Community structures. Despite the variation in quality and density, this vegetation is reasonably extensive and well connected with other hazard areas further to the east. The areas are shown in green within Figure 2 and generally have an effective upslope away from the development of 0-5 degrees.

The riparian corridor area is significant in that it represents an area of potentially significant revegetation, likely to be with Woodland or Forested Wetland-type structure. The corridor is narrow and when vegetated will be less than 50 metres in width. The corridor will consist of various 'zones' of differing vegetation and landscaping depending on the proximity to the actual drainage line. Due to the narrow width of the corridor, even when completely revegetated these areas can be considered as 'Low-hazard' and as such will only require implementation of a minimal APZ. These areas are shown to the immediate west of the subdivision within Figure 2 and generally have an effective downslope away from the development of 0-5 degrees.

3 Bushfire protection measures

Due to the large size of the super-lots, asset protection zones (APZ) can be accommodated within the lots between future development and the hazards identified. An indication of the likely APZ dimensions for future residential development is listed within Table 1 below.

As the proposal does not involve approval or construction for development, the APZs listed in Table 1 are not required to be established at this stage. A subsequent subdivision application for residential lots will demonstrate how the APZs will be applied based on a subdivision design.

Similarly, water supply, access, utilities and landscaping are not proposed and are therefore not required to be assessed for compliance. A future subdivision design should be able to comply with all the necessary requirements and specifications of PBP. A bushfire assessment of which will inform future subdivision design and demonstrate compliance.

Table 1: Threat assessment, APZ and category of bushfire attack

Direction from Development Interface (refer to Figure 5)	Slope[1]	Vegetation[2]	APZ[3]	Proposed APZ	Comment
South and south west (adjacent to Wianamatta Regional Park)	upslope/flat	Woodland	10-15 m (APZ varies depending on effective slope towards lots)	>15 m	APZ will generally consist of two or more of the following: managed open space; road reserve; pedestrian/cycle paths. Front setbacks within lots are unlikely to be required.
West and east (adjacent to Riparian Corridor areas)	>0-5º downslope	Low-hazard (narrow corridor)	10 m	>10 m	APZ will generally consist of two or more of the following: managed open space; road reserve; pedestrian/cycle paths. Front setbacks within lots are unlikely to be required.

[1] Slope most significantly influencing the fire behaviour of the site having regard to vegetation found. Slope classes are according to PBP.

[2] Predominant vegetation is identified, according to PBP and *"Where a mix of vegetation types exist the type providing the greater hazard is said to be predominate".*

[3] Assessment according to PBP.

4 Conclusion

As the proposal is for the subdivision of four large super-lots, it does not involve the creation of residential lots, roads or other infrastructure. Therefore this assessment focuses on the ability of the proposed lot to accommodate the future requirements.

It is concluded that the subdivision proposal complies with the aims and objectives of PBP. It is recommended that a Bush Fire Safety Authority be issued with the condition that future subdivision and development design comply with PBP.

Daniel Copland
Senior Bushfire Consultant
FPAA BPAD Certified Practitioner No. BPD-PA-28853

FPA AUSTRALIA
Certified Business
Bushfire Planning & Design

References

NSW Rural Fire Service (RFS). 2006. *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners*. Australian Government Publishing Service, Canberra.

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Lend Lease

Appendix F
Upstream Extended East / West Open Channel Report, prepared by SKM

Jordan Springs Western Precinct Development – Lend Lease

Upstream Extended East/West Open Channel Report

- 23 April 2013

Jordan Springs Western Precinct Development

Upstream Extended East/West Open Channel Report

- 23 April 2013

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Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
0	22/4/13	J Constandopoulos	J Constandopoulos	22/4/13	Draft
1	23/4/13	J Constandopoulos	J Wall	23/4/13	Final

Distribution of copies

Revision	Copy no	Quantity	Issued to
1	1	1	Lend Lease

Printed:	23 April 2013
Last saved:	23 April 2013 02:17 PM
File name:	\\skmconsulting.com\SYDProjects\ENVR\Projects\EN02754\Technical\Water_Quantity\HecRas\Upstream channel\Report\Upstream Channel report.docx
Author:	Mahala McLindin
Project manager:	John Constandopoulos
Name of organisation:	Lend Lease
Name of project:	Jordan Springs Precinct Development
Name of document:	Upstream Extended East / West Open Channel Report
Document version:	Final
Project number:	EN02754

Executive summary

This report provides an understanding of flood events in the region of development lots VC2 and VC3 of the Lend Lease's Jordan Springs residential development, Sydney. The investigated study area is a drainage corridor located between the southern perimeter of the Jordan Springs development and a regional park.

Hydraulic modelling using the HEC-RAS model assesses the 1% Annual Exceedance Probability Event (AEP) (commonly known as the 1 in 100 year flood) and its behaviour in the existing situation. The results show that without mitigation flooding would extend into lots VC2 and VC3.

The hydraulic modelling assesses two mitigation options: filling to raise the level of lots VC2 and VC3, and a proposed channel that would be an upstream extension to the previously designed East – West open channel.

The results demonstrate that filling and raising VC2 and VC3 would prevent inundation of lots VC2 and VC3. However, the drainage corridor would be mostly inundated and the flood waters would extend slightly further into the regional park than the existing situation

Hydraulic modelling results of the upstream extension to the East – West open show that it would provide protection against inundation with adequate freeboard to VC2 and VC3. Some out of bank flow would still occur in the regional park to the south of the channel, but this is not deemed to be an issue. The proposed channel would also meet the key objective of minimising land take in the drainage corridor in order to maximise available land for lots VC2 and VC3.

This would allow the current southern development boundary for lots VC2 and VC3 to be extended by 10m south towards the proposed channel.

1. Introduction

1.1. Background

As part of the Jordan Springs residential development at Jordan Springs, Sydney, Lend Lease has recently developed the trunk drainage design. The trunk drainage network comprises two open channels: the North –South channel that carries flows into the constructed Jordan Springs Lake, and the East – West channel that follows a west-east course to drain to the proposed East Lake. The layout of the trunk drainage network is shown in **Figure 1**.

1.2. Purpose

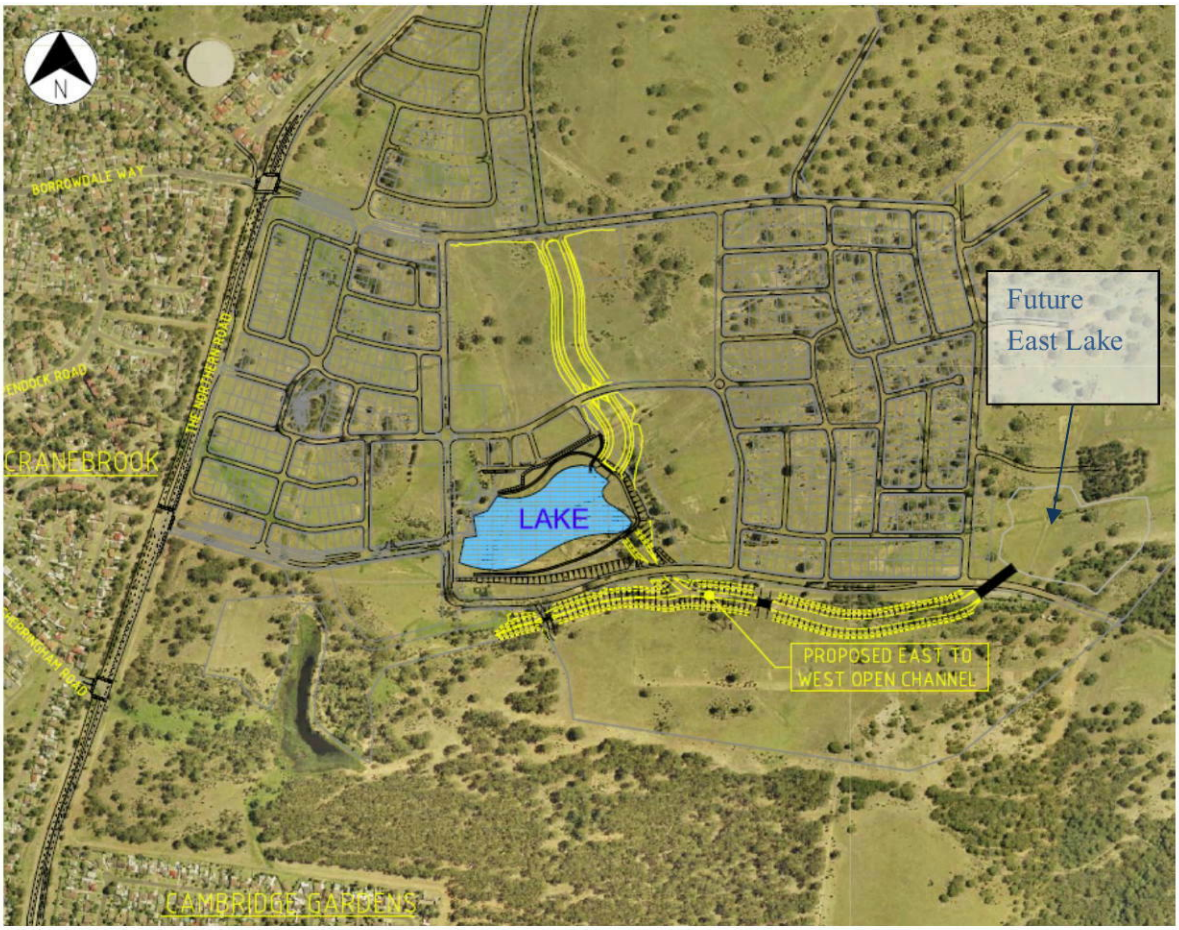
The purpose of this report is to investigate flood behaviour *upstream* of the proposed East – West channel, in order to provide an understanding of flooding impacts on Lend Lease's development lots VC2 and VC3.

This report has been prepared to summarise the work undertaken for a hydraulic assessment of the existing flowpath in the Western Precinct, Jordan Springs. It provides an understanding of the existing flood extents and an explanation of two options investigated to alleviate flood risk to the VC2 and VC3 lots, including raising lots VC2 and VC3 by filling, and an upstream extension to the proposed East – West open channel. Details of the hydraulic modelling method, adopted modelling parameters and results are provided.

1.3. Study area

The investigated study area is a drainage corridor located between the southern perimeter of the Jordan Springs development and a regional park. Runoff from the urban Cranebrook catchment is collected in an existing pond upstream of the study area. Spill from the existing pond currently flows into a natural channel that would then be formalised within the proposed downstream East – West channel before flowing to the East Lake.

- **Figure 1 - Trunk Drainage Layout for the proposed North - South and East –West open channels**



2. Hydraulic modelling

2.1. Objective

The objective of the hydraulic assessment was to:

1) Investigate the extent of the 1% AEP flood (commonly referred to as the 1 in 100 year flood) on the Lend Lease lots VC2 and VC3
2) Review the extent of the 1% AEP flood with the proposed filling and raising of lots VC2 and VC3
3) Size an upstream extension to the East – West open channel to adequately accommodate the 1% AEP flood, with adequate freeboard, whilst maximising available land spaces for lots VC2 and VC3.

A number of design criteria are to be met to satisfy Council requirements. These are presented below.

2.2. Design criteria

Design criteria have been agreed with Penrith City Council and are stated below.

1) Open channels must contain the 1% AEP peak water level with a minimum freeboard of 0.5m on the northern side.
2) Water depth in the channel should not exceed 1.5m the 1% AEP flood.

2.3. HEC-RAS set up

2.3.1. Overview

Hydraulic models of the trunk drainage system have been developed in HEC-RAS (V 4.1.0). Cross sections at 10m intervals were extracted from the 12D CAD model and inputted into HEC-RAS.

The models are steady state, meaning they model peak flows for the 100 year ARI event, rather than a full event flow hydrograph which is considered to be acceptable. The models are run in a mixed flow regime to allow adequate representation of subcritical and supercritical flows in the model.

2.3.2. Model parameters

Manning's n values were previously selected in consultation with the landscape architects for the East – West channel design. A Manning's n value of 0.07 was selected based on the final open channels being heavily vegetated and landscaped. To ensure consistency with previous work, the same value has been adopted.

2.3.3. Flow distribution

Peak flows were extracted from the work undertaken for the downstream East – West open channel design, which developed an XP-RAFTS hydrology model for the site. The XP-RAFTS model was used to determine the required sizing of the East – West channel. Details of the hydrology model can be found in previous reports *(St Marys Stage 1 Western Precinct Detention requirements – March 2010 and St Marys Stage 3 Western Precinct Detention Requirements – November 2011)*.

Peak flows of 13.2 m^3/s and a downstream surface water level of 1.5m were inputted to the HEC-RAS model.

2.3.4. Channel sizing

Channels were sized by modifying the bottom width and slope of the channel, with the following design requirements:

- 1:4 channel side slopes for safety and to maximise vegetation growth
- 1m width between the channel and the southern boundary for maintenance access
- No supercritical flow
- Flow velocities less than 1.5m/s by selecting appropriate long slopes
- Minimising land take within the drainage corridor

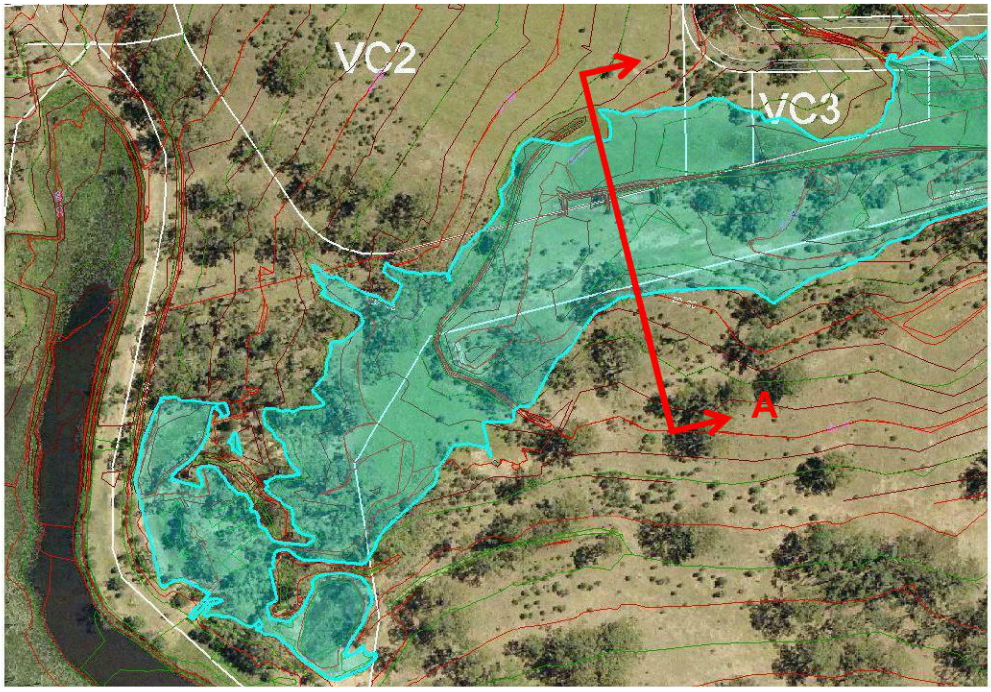
The key constraint for sizing the channel was the available width of the drainage corridor. The design objective was to size the channel adequately whilst maximizing available space for lots VC2 and VC3.

3. Results

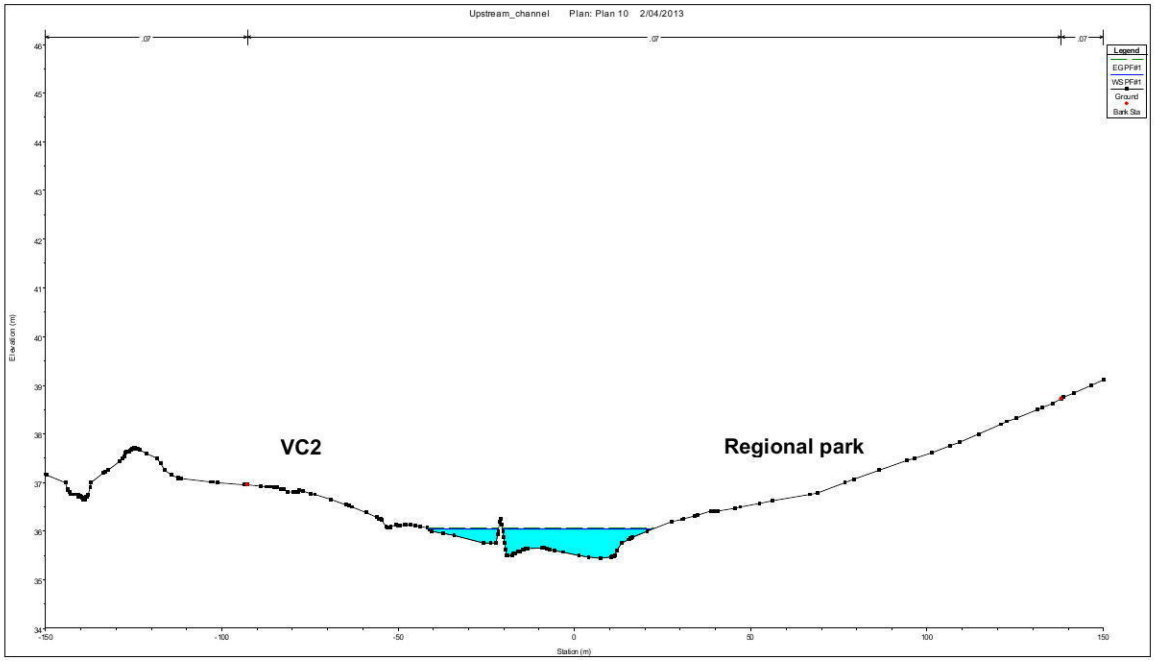
3.1. Existing flood extents

HEC-RAS was used to determine the extent of flooding during a 1%AEP flood. The results are shown in **Figure 2**, indicating that without any mitigation, inundation would affect both lots VC2 and VC3, as well as the majority of the drainage corridor. Inundation would also extend into the regional park.

- **Figure 2 - 1% AEP flood extent without any mitigation**



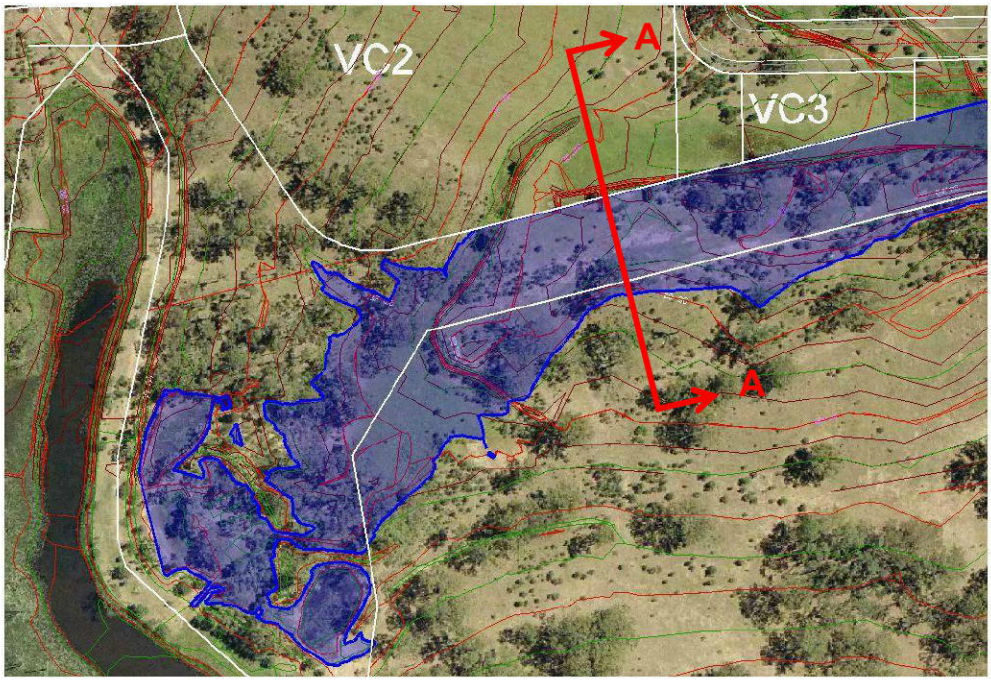
- **Figure 3 – HEC-RAS cross section through A-A showing ground profile and exsting flood extent (not to scale)**



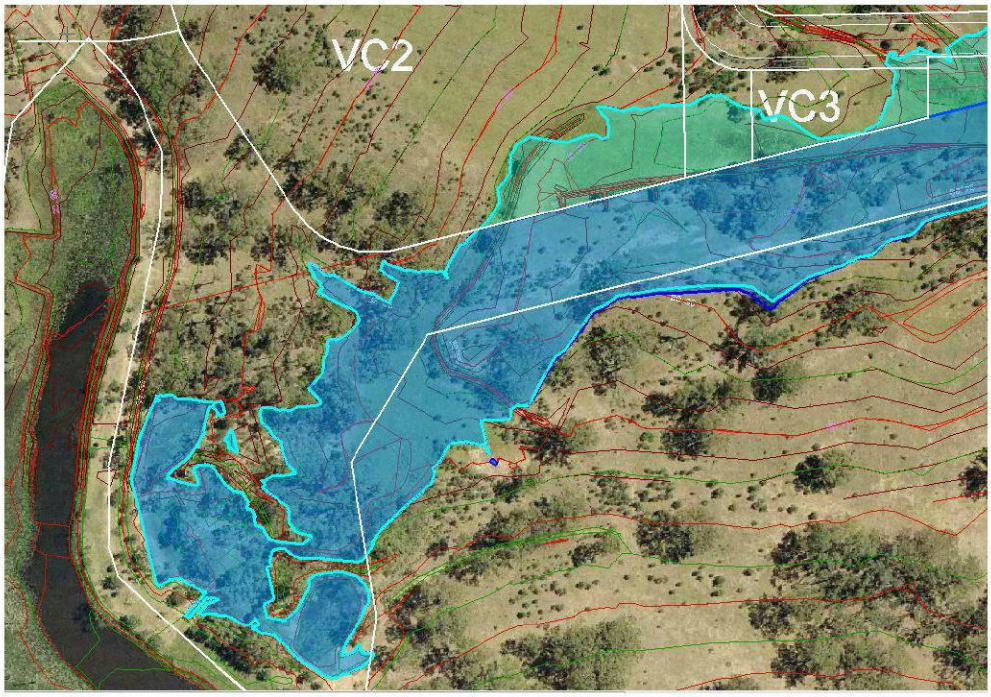
3.2. Filling VC2 and VC3

The extent of the 1% AEP flood after backfilling and raising lots VC2 and VC3 is shown in **Figure 4**. The designed fill would protect lots VC2 and VC3. However, the drainage corridor would be mostly inundated and the flood waters would extend slightly further into the regional park than the existing situation. **Figure 5** demonstrates the difference between the two flood extents.

- **Figure 4 - 1%AEP flood extent with levee**

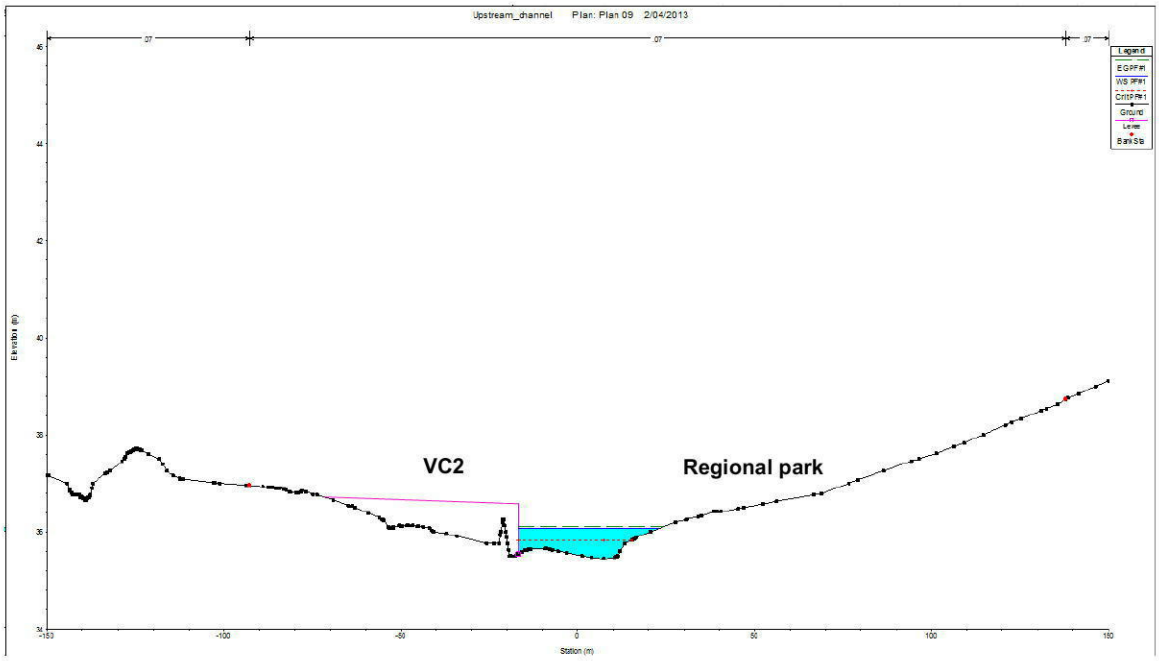


- **Figure 5 – Comparison of 1%AEP flood extent s in existing situation (light blue) and with levee (dark blue)**



An example cross section through A-A is given in **Figure 6** showing the proposed levee and the revised flood extent. In this location flood waters would rise slightly and extend further into the regional park in comparison to the existing situation.

- **Figure 6 – HEC-RAS cross section through A-A showing levee and revised flood extent at VC2 (not to scale)**



3.3. Constructed channel

In order to investigate further containment of the 1% AEP flood, a 318 m upstream extension to the proposed East-West channel was designed in 12D and modelled in HEC-RAS. Some minor design amendments were made to the proposed East – West open channel to effectively tie in the extended upstream reach.

As per the design requirements, the channel was sized to contain the 1% AEP flood with 0.5 m freeboard to lots VC2 and VC3, with channel batters of 1:4 and with maximum water depth of 1.5m. The long gradient and lateral location of the channel were investigated with the purpose of maximising the land area available for VC2 and VC3. The best result has been achieved by:

- Locating the new channel on the southern edge of the drainage corridor providing a distance of 10m between the top of the channel and the current boundary of lots VC2 and VC3. **This means that the current VC2 and VC3 boundaries can be shifted to the south by 10m.**
- Changing the long gradient at one location from 0.5% to 1% to suit the local topography

- Changing the channel base width at one location to account of the change in channel gradient.

The physical channel details are given in **Table 1**.

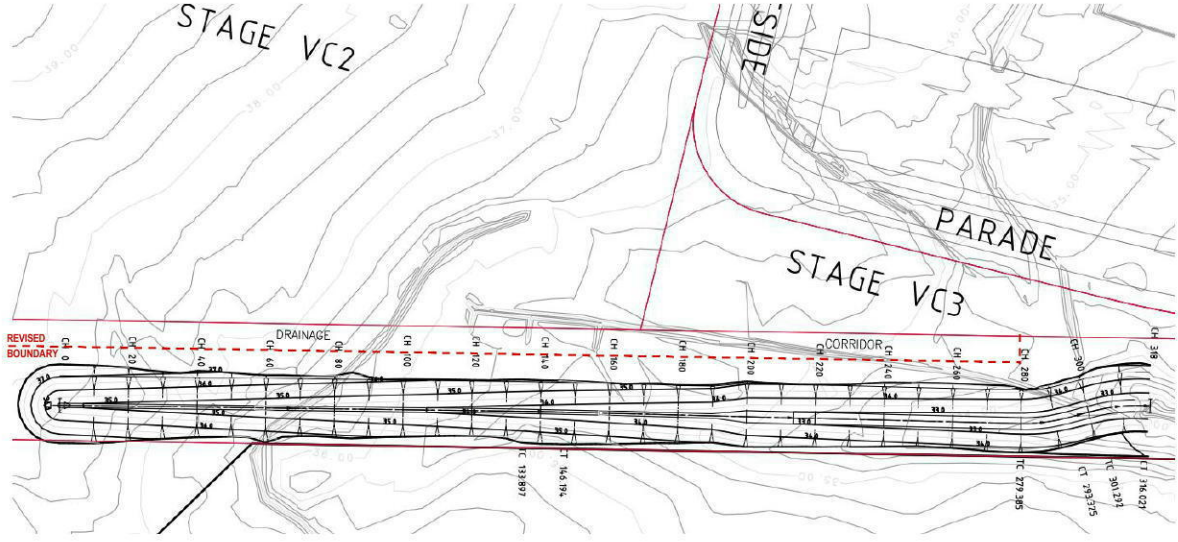
- **Table 1 - Upstream channel details**

Chainage (m)	Distance from current VC2 and VC3 boundary	Distance from regional park boundary*	Base width (m)	Long gradient
0 - 190	10m (minimum)	1m	1.25	1.0%
190 - 200	10m (minimum)	1m	Transition	1.0%
200 - 318	10m (minimum)	1m	3.45	0.5%

*There is a minor encroachment on the regional park boundary at the far western end of the channel that would be resolved during detailed design through localised steepening of the channel batter slope.

An overview of the design is shown in **Figure 7**. The dashed line shows the potential revised boundary for VC2 and VC3. This provides an additional 10m of width to the lots. A larger plan of the designed upstream channel is included in Appendix A.

- **Figure 7 – Overview plan of designed upstream channel (not to scale)**



HEC-RAS modelling was undertaken to check the 1% AEP flood extent for the proposed upstream design. It demonstrated that the flood water would be fully contained within the designed channel on the development side of the channel, thus protecting lots VC2 and VC3 from inundation. On the southern side of the channel, some flood water would flow to the regional park, which is not considered to be an issue. The proposed grading and bund downstream of the area provides a safe

passage for the flood waters to return to the channel. The results are shown in **Table 2** with key outputs of water depth, freeboard and flow velocities. It shows that the channel design meets the design criteria identified in Section 2.3.4. A long section plot of maximum water levels is provided in Figure 8 and a representative cross section through A-A is provided in **Figure 9**.

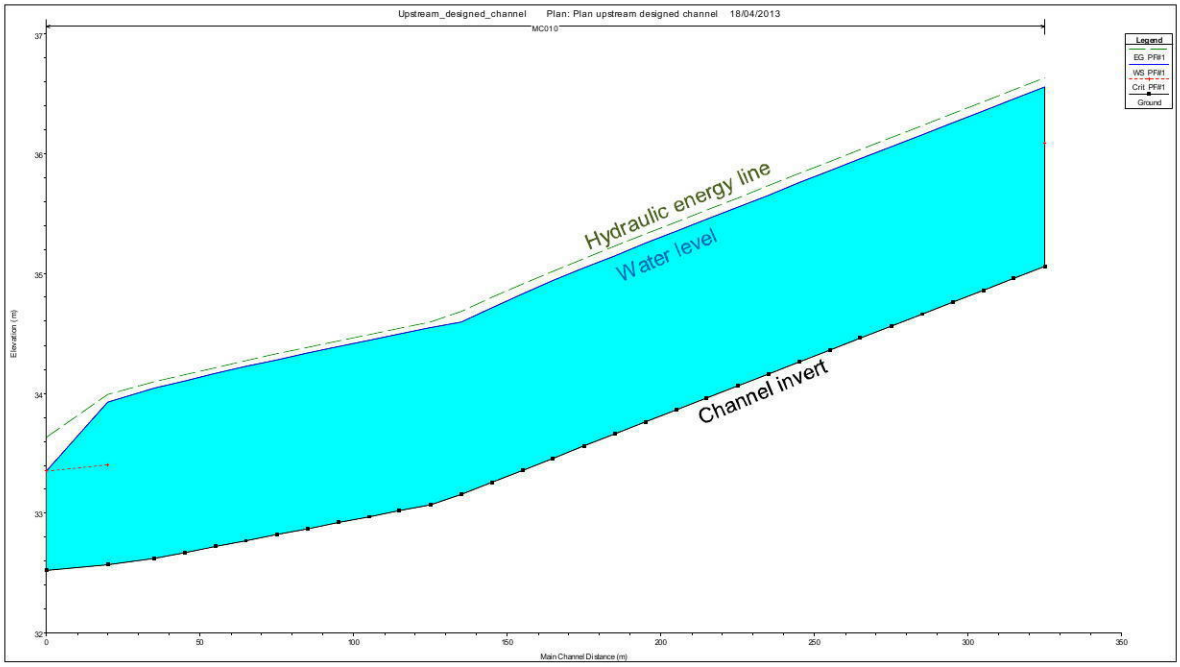
Table 2 – Representative HEC-RAS modelling results

Channel cross section	HEC-RAS cross section label*	Channel slope	1% AEP water depth (m)	Flow velocity (m/s)	Freeboard to lots VC2 / VC3 (m)	Freeboard to regional park (m)
0	1197.59	1%	1.50	1.23	0.50	1.09
20	1177.59	1%	1.50	1.23	0.50	0.87
40	1157.59	1%	1.50	1.23	0.50	0.54
60	1137.59	1%	1.50	1.23	0.50	0.80
80	1117.59	1%	1.50	1.23	0.50	0.43
100	1097.59	1%	1.50	1.23	0.50	0.31
120	1077.59	1%	1.49	1.23	0.51	0.19
140[#]	1057.59	1%	1.49	1.24	0.51	0.71
160	1037.59	1%	1.48	1.25	0.52	0.60
180	1017.59	1%	1.45	1.30	0.55	0.45
200	997.59	0.5%	1.48	0.95	0.52	0.28
220	977.59	0.5%	1.48	0.96	0.52	0.14
240	957.59	0.5%	1.47	0.97	0.53	0.15
260	937.59	0.5%	1.46	0.98	0.54	0.00
280	917.59	0.5%	1.44	1.00	0.56	0.23
300	897.60	0.5%	1.36	1.10	0.64	0.22

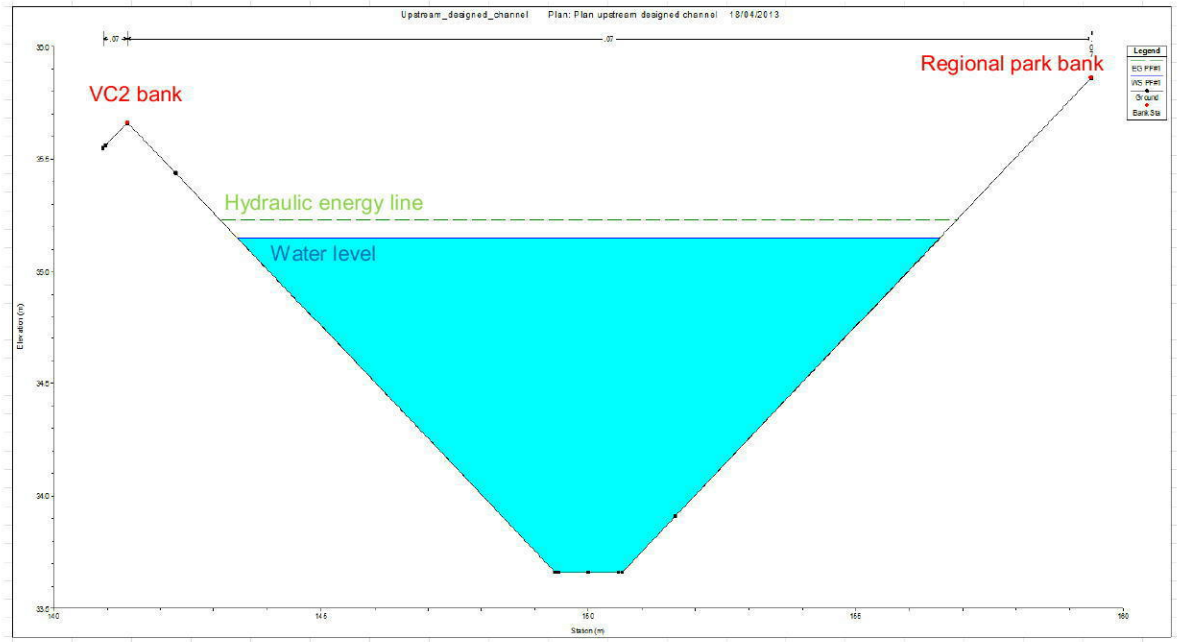
*For model reference only

[#] This cross section is represented by A-A in the previous figures

- **Figure 8 – Long section of upstream channel showing 1% AEP water level (not to scale)**



- **Figure 9 – Cross section at A-A of upstream channel showing 1% AEP water level (not to scale)**



4. Further work

There is a minor encroachment on the regional park boundary at the far western end of the channel. This would be resolved during detailed design through localised steepening of the channel batter slope in this area.

Following review of this report, there may be scope to further increase the distance of the proposed VC2/VC3 boundary from 10m away from the current development boundary (as proposed in this report) to somewhere in the order of 12m to a maximum of 15m.

It is currently not known whether a fence will be erected along the boundary of the regional park. It should be noted that a fence in this location could exacerbate flooding of the development (to the south of the previously designed East – West channel). Therefore, from a flooding perspective, it is not recommended that fence is erected on the boundary of the regional park.

A preliminary safety-in-design assessment has been undertaken for this work and is included in Appendix D. This would also be reviewed and updated during detailed design.

5. Conclusion

This report provides an understanding of the current extent of flooding in the region of lots VC2 and VC3 of the Jordan Springs residential development at St Marys, Sydney.

The hydraulic modelling presented assesses the 1% AEP flood and its behaviour in the existing situation, and assesses two options: the cases of a proposed fill and proposed channel. The results demonstrate that the designed channel would provide protection against inundation with adequate freeboard to VC2 and VC3. Some out of bank flow would still occur in the regional park to the south of the channel, but this is not deemed to be an issue.

The proposed channel would allow the current boundary for lots VC2 and VC3 to be extended by 10m south towards the proposed upstream channel.

Appendix A Upstream channel plan

STAGE VC2

LAKESIDE

PARADE

STAGE VC3

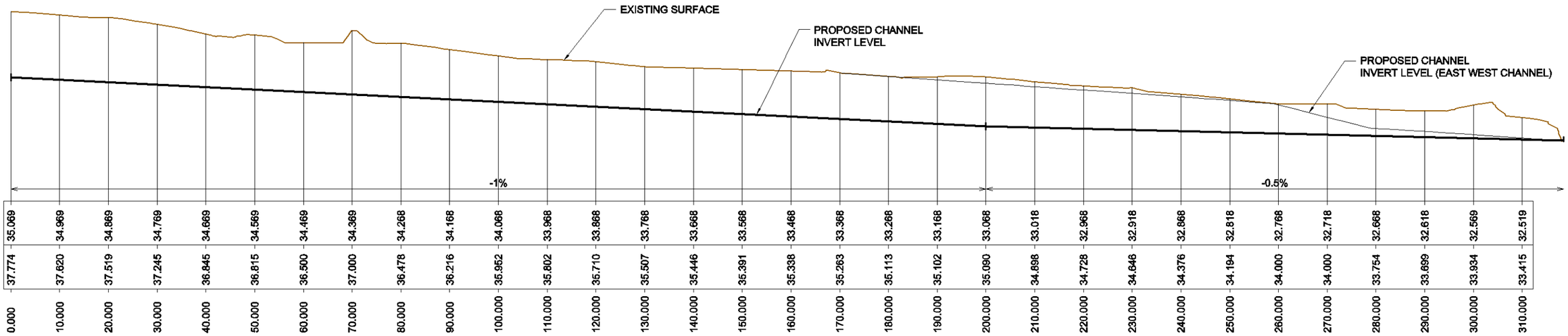
LAKESIDE

DRAINAGE CORRIDOR

CH 0
CH 20
CH 40
CH 60
CH 80
CH 100
CH 120
CH 140
CH 160
CH 180
CH 200
CH 220
CH 240
CH 260
CH 280
CH 300
CH 318

TC 133.897
CT 146.194
TC 279.385
CT 293.325
TC 301.292
CT 316.021

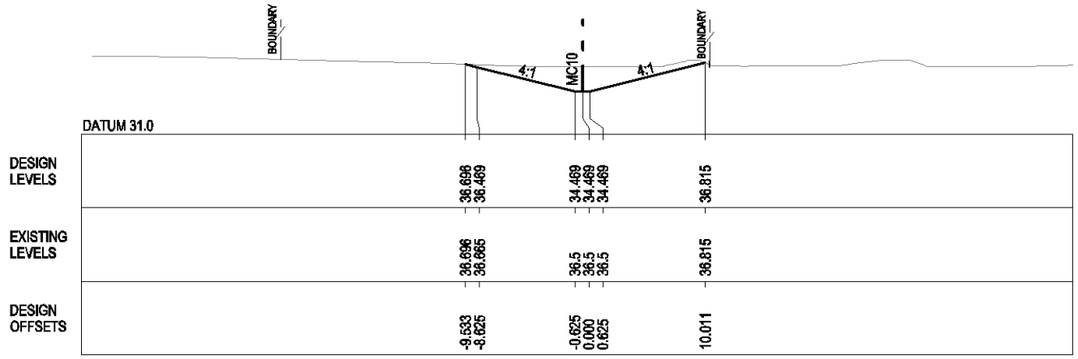
Appendix B Upstream channel profile



DATUM R.L. 30.0																														
DESIGN SURFACE LEVELS	35.069	34.969	34.869	34.769	34.669	34.569	34.469	34.369	34.268	34.168	34.068	33.968	33.868	33.768	33.668	33.568	33.468	33.368	33.268	33.168	33.068	33.018	32.968	32.918	32.868	32.818	32.768	32.718	32.668	32.618	32.569	32.519
EXISTING SURFACE LEVELS	37.774	37.620	37.519	37.245	36.845	36.815	36.500	37.000	36.478	36.216	35.952	35.802	35.710	35.507	35.446	35.391	35.338	35.263	35.113	35.102	35.090	34.898	34.728	34.646	34.376	34.194	34.000	34.000	33.754	33.699	33.934	33.415
STATION	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000

CONTROL MC10 - EAST WEST CHANNEL EXTENSION

Appendix C Upstream channel cross sections



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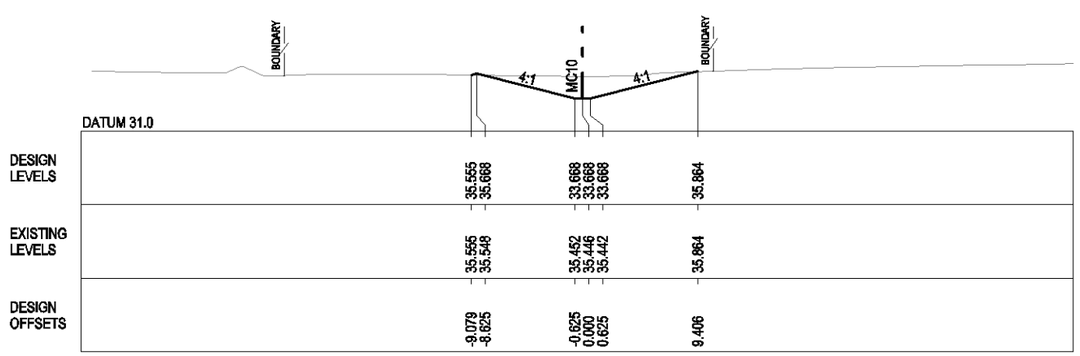

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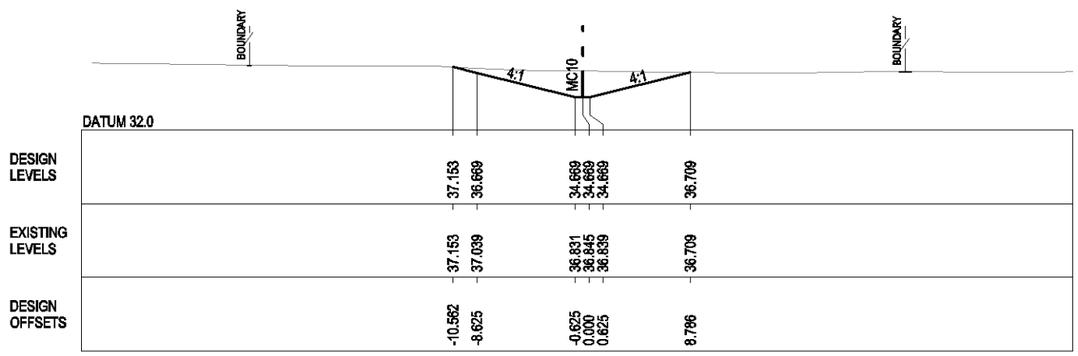

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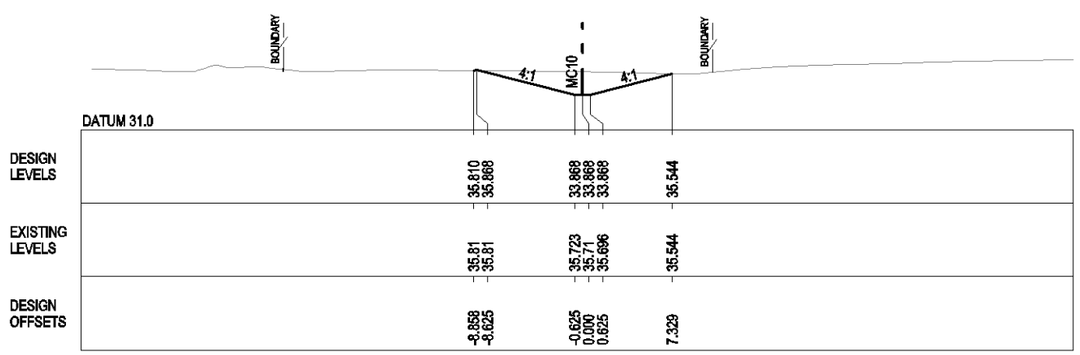

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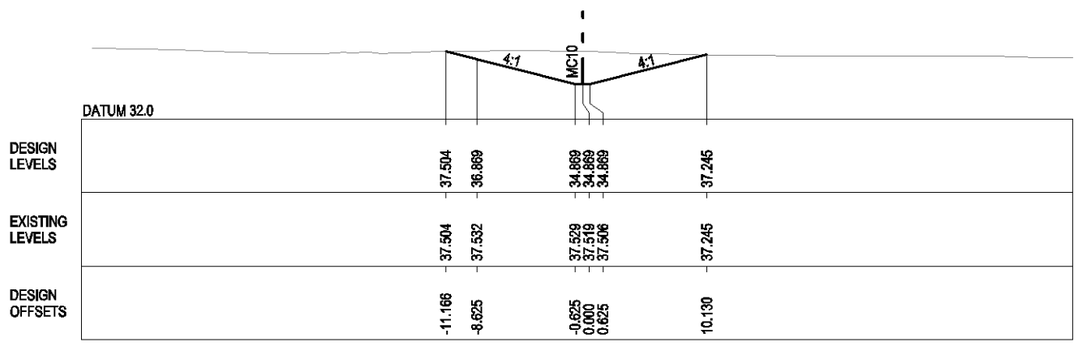

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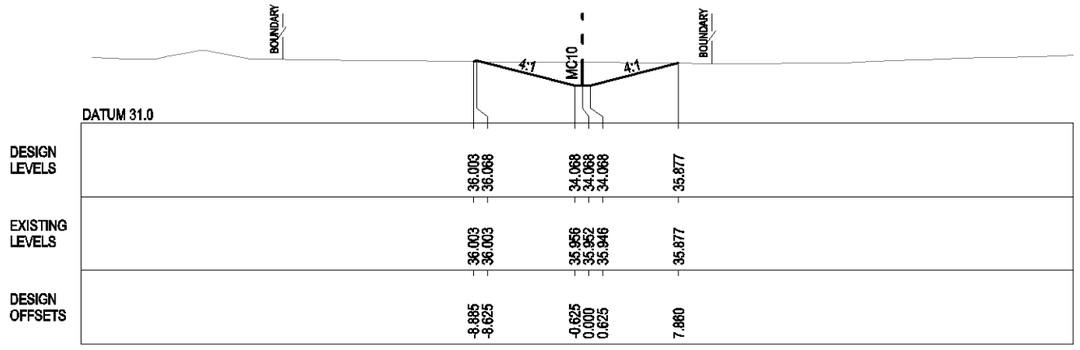

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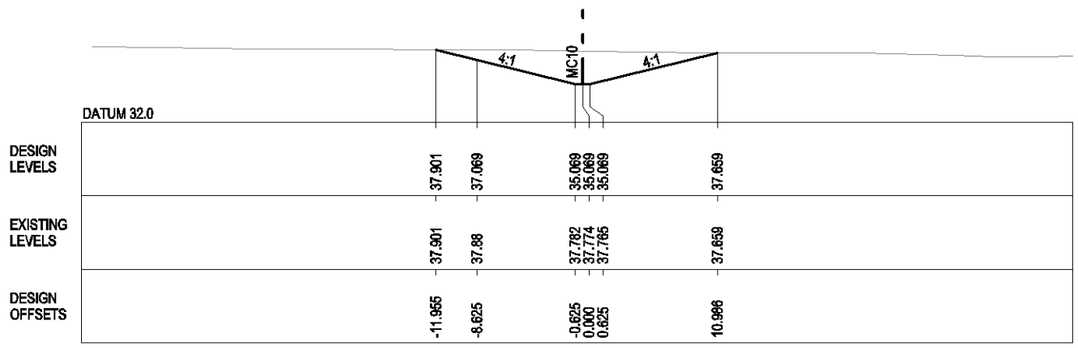

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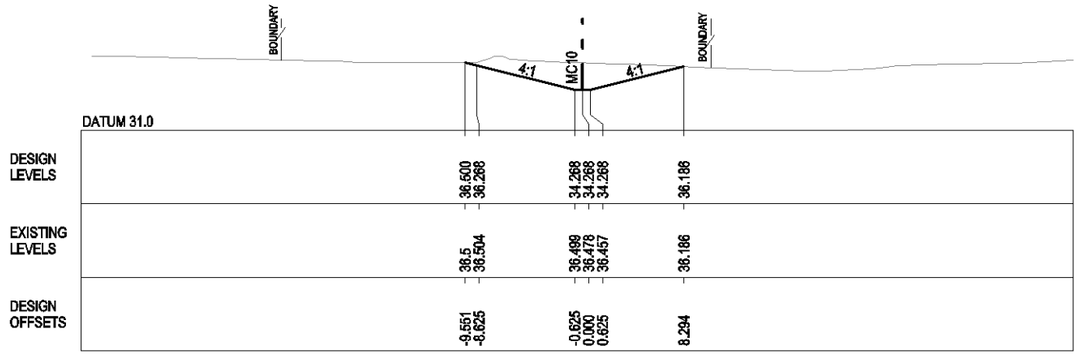

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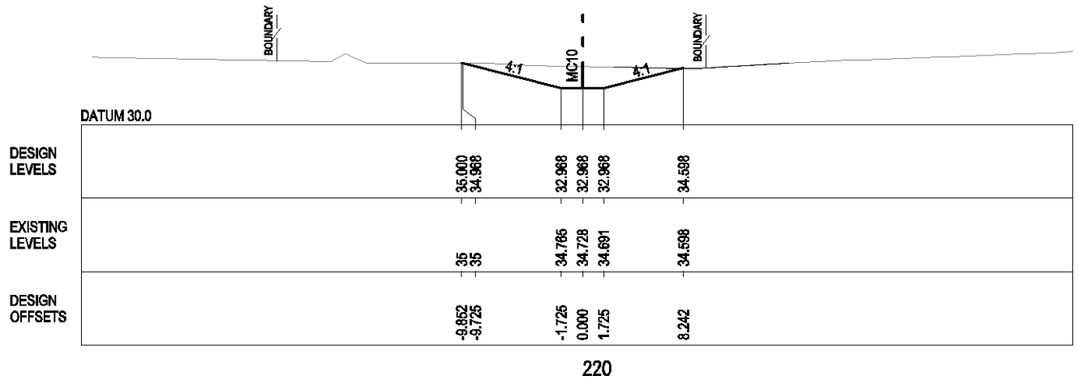

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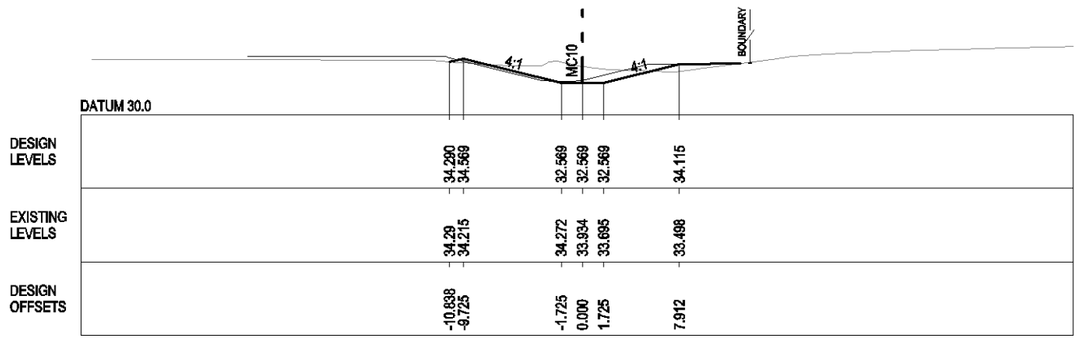

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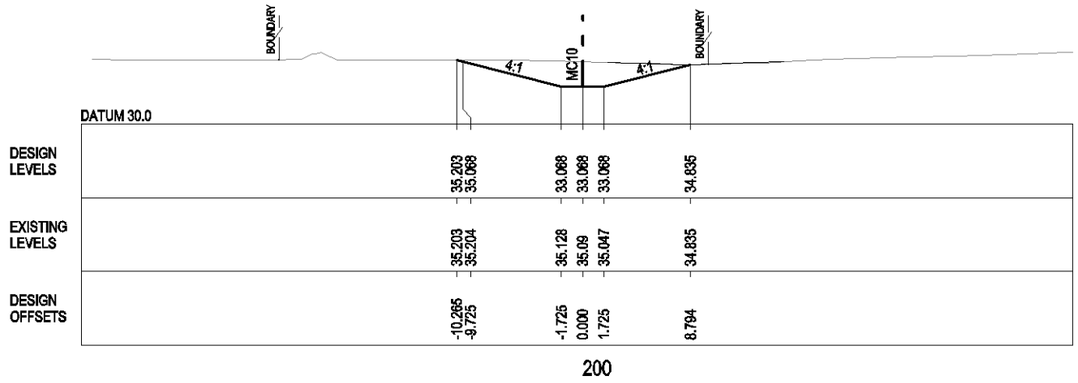

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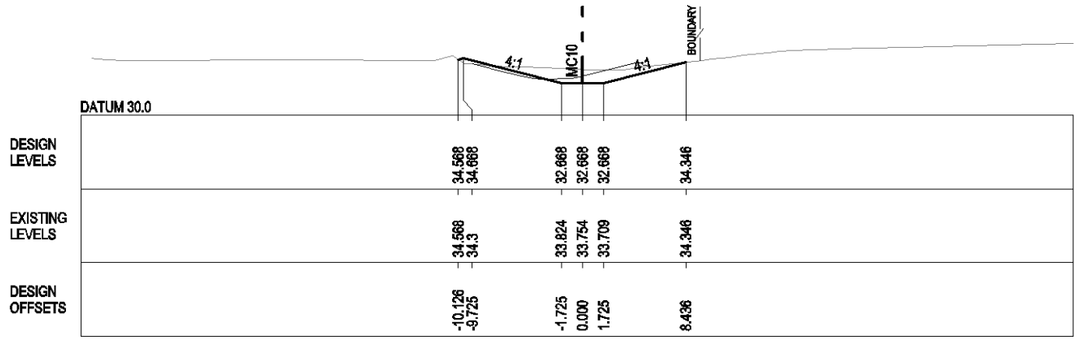

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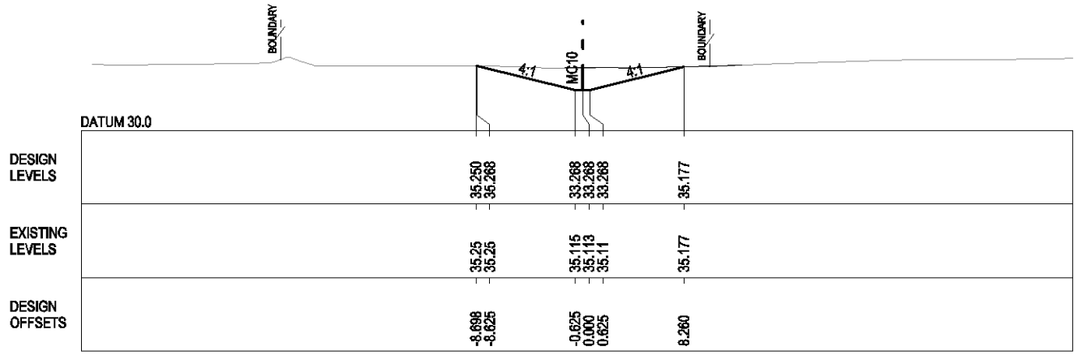

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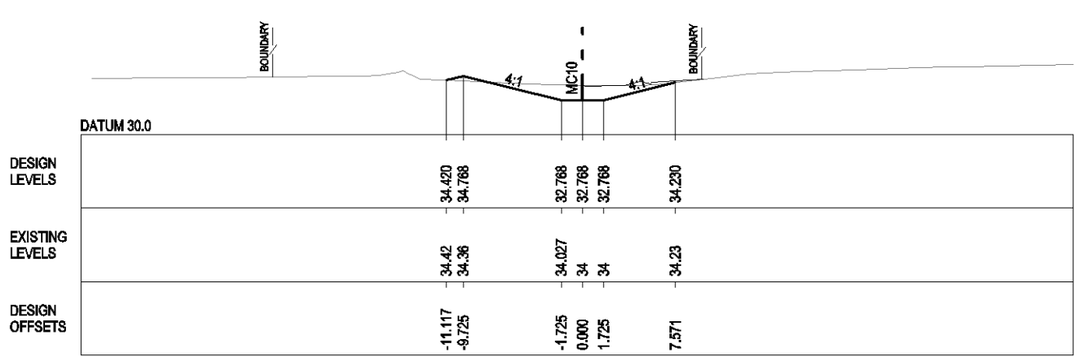

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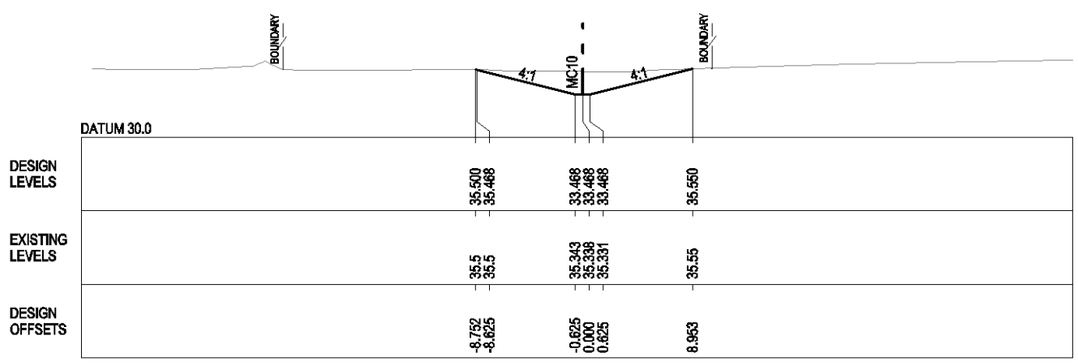

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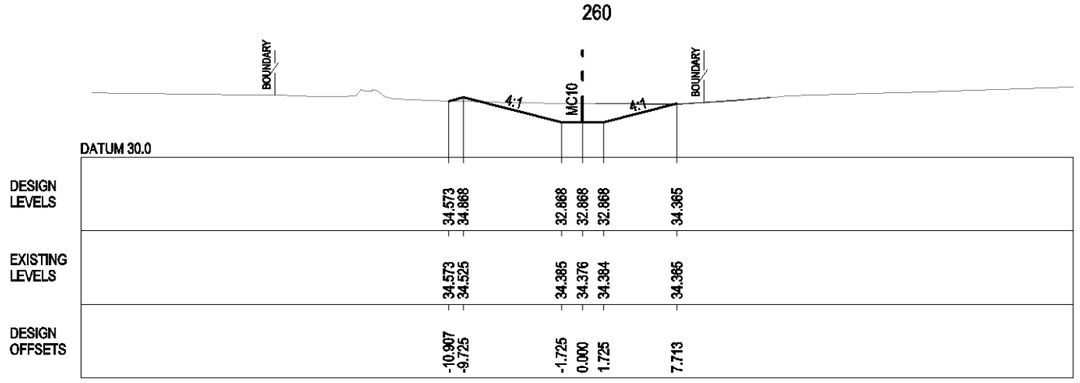

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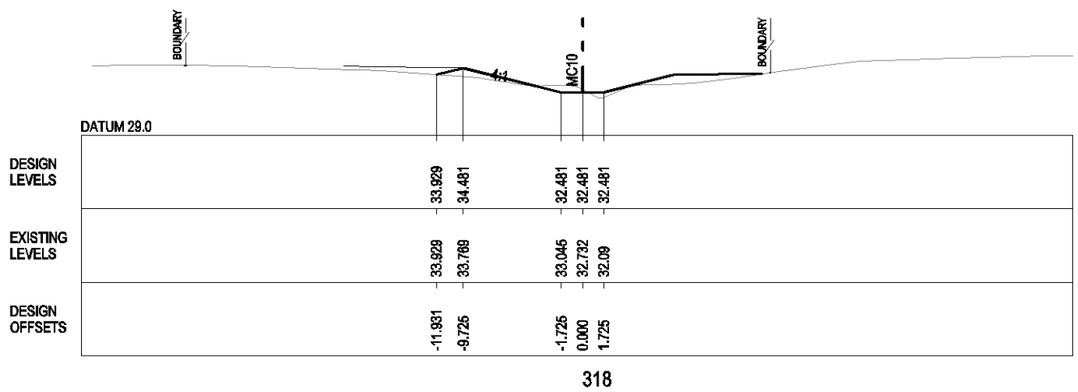
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MC10
BOUNDARY
DATUM 29.0
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32.481
32.481
32.481
EXISTING LEVELS
33.929
33.769
33.045
32.732
32.09
DESIGN OFFSETS
-11.931
-9.725
-1.725
0.000
1.725

Appendix D Safety in design assessment

A preliminary assessment has been undertaken to review the key hazards associated with the maintenance and operation of the upstream channel and to provide design solutions to mitigate these. A summary is given in **Table D - 1**.

Table D - 1 Safety hazards and mitigation measures that have been incorporated into the design

Hazard	Design management
Restricted access between top of bank and boundary fence potentially leading to someone falling into the channel	1m distance between top of channel and boundary fence has been included in the design
Inability for someone to exit the channel if they enter or fall in	1:4 side slopes on have been designed to improve ability for people to exit the channel
Slippery side slopes causing people to fall into the channel or making it difficult for someone to exit the channel	Channel side slopes would be vegetated
Deep water during high rainfall events	Channel has been designed so that the water depth would not exceed 1.5m in a 1% AEP event. During detailed design, safety signage would be incorporated the design to indicate flood danger.