



area (in addition to the proposed bund around the site) can be found using additional box culverts and additional culvert capacity if required.

The predicted increases in peak flood level to the south of Oxford Road typically include increases in peak flood level of up to 50mm and on rural sites without any existing residential developments. It is expected that the increase in flood flows in this area will be diverted to the South Brook in the Lehmans Road drain upgrades being investigated by WDC. An increase of 50mm in flood depth in rural land during a 0.5% AEP event is considered to be less than minor.

Local Flood Event

It is noted that the post-development 0.5% AEP local flood event results in the same peak flood level, maximum depth and inundation extent around the site as the existing scenario. This occurs because no floodwater is predicted to enter the site during the 0.5% AEP local flood event existing scenario because Lehmans Road acts as a barrier to this floodwater. The only floodwater that enters the site is through the existing drainage path from Lehmans Road and the site layout will be designed to accommodate this drainage path.

Proposed Building Platform

Whilst the vertical grade of internal roads within the proposed development have not yet been designed; the post-development mitigation scenario flood model predicts peak flood depths in roadways through the development typically not exceeding 150mm.

It is also expected that the proposed kerb and channel and swale to the stormwater management area will be overwhelmed by a 0.5% AEP local rainfall event over the proposed development.

Therefore it is recommended that all FFLs are raised at least 350mm above the proposed top of kerb level within the development to ensure that the required freeboard during the 0.5% AEP Ashley River breakout event can be achieved.

It is recommended that the final site grading layout be included in both flood models (local and Ashley River breakout) and the models re-run to confirm that the proposed 350mm freeboard is achieved. FFLs will be set during detailed design to ensure that the proposed freeboard requirements are achieved.



9 Limitations

Some limitations in the flood models utilised in this study are documented below.

- The Ashley River breakout flood model utilises a 10m grid size. This grid size was adopted by ECan when the original model was developed. This grid size does not represent narrow drains in the model topography and may not accurately represent the slightly raised crest level along Lehmans Road. It is expected that more floodwater may be pushed south along the western side of Lehmans Road than has been represented in the Ashley River breakout flood model. This limitation will however result in a conservative estimation of floodwater entering the Westpark site and of potential flood impacts to the south of the site as a result of proposed building platforms.
- The proposed earth bund around the Rangiora vet clinic site has not been included in the post-development mitigation model scenarios for the Ashley River breakout flood event. This results in floodwater being shown in this area on the flood maps when in practice it is expected that the site will be protected from flooding by this earth bund during future flood events.

10 References

Canterbury Regional Policy Statement – Chapter 11 Natural Hazards, ECan, 2013.

Waimakariri District Flood Hazard Management Strategy – Ashley River Floodplain Investigation, ECan, June 2008.

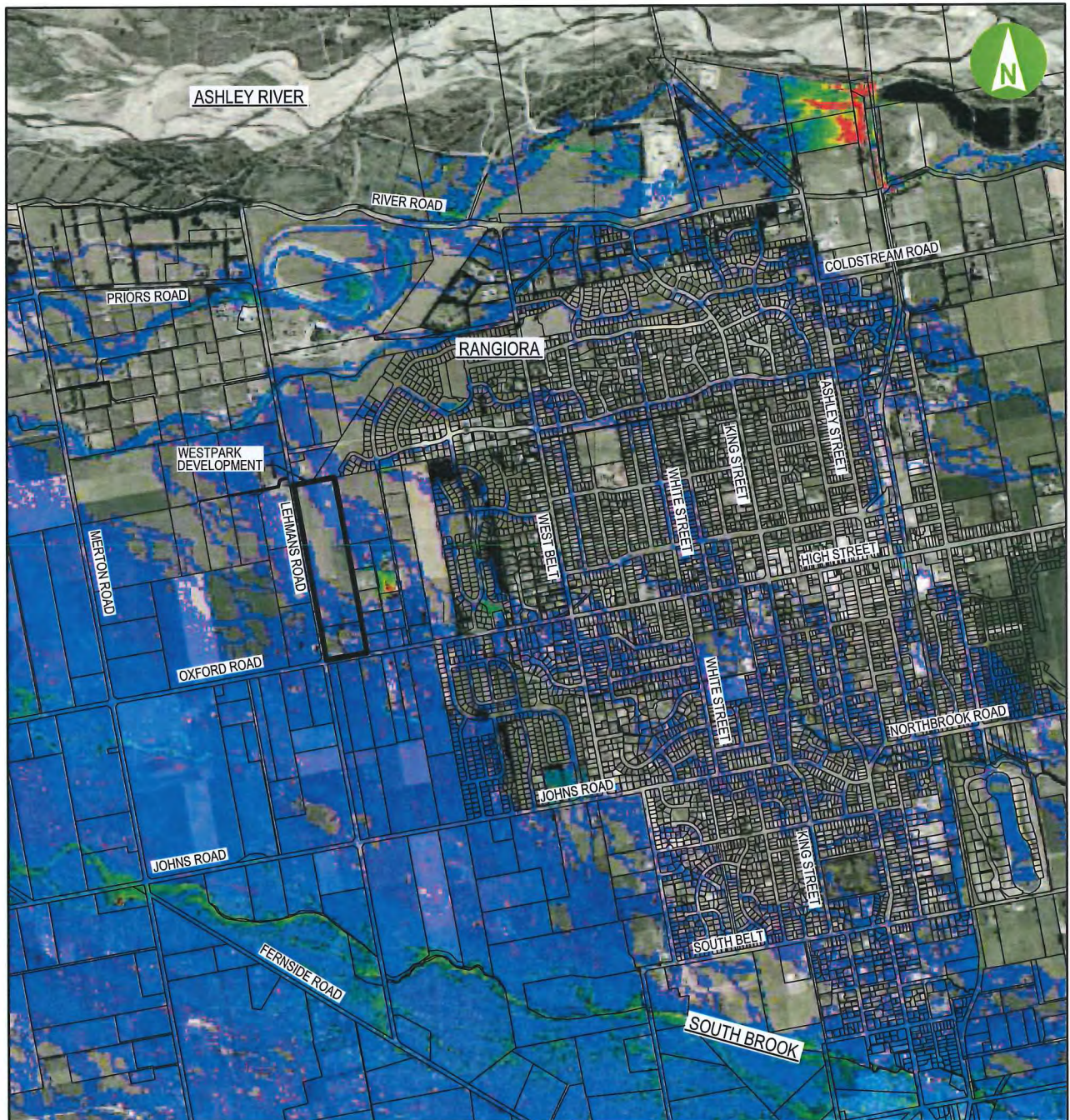
Waimakariri District Localised Flood Hazard Assessment, WDC, 2014.

Westpark – Plan Change – Lehmans Road Rangiora – Infrastructure Assessment, Aurecon, August 2014.

Appendix A

Figures





NOTES:

1. THE FLOOD INFORMATION REPRESENTED ON THIS MAP DOES NOT ALLOW FOR FREEBOARD AND AS SUCH IS NOT THE RECOMMENDED BUILDING LEVEL.
2. THE FLOOD INFORMATION REPRESENTED ON THIS MAP HAS BEEN DERIVED BASED ON THE EXISTING ASHLEY RIVER BREAKOUT 2-D HYDRAULIC MODEL AND USING EXISTING WDC GIS LIDAR (AS SUPPLIED IN NOVEMBER 2014). THE ECAN MODEL USES A 10m GRID SIZE. LOCALISED RUN-OFF CONTRIBUTIONS AND THE INFLUENCE OF THE RETICULATED STORMWATER NETWORKS HAVE BEEN EXCLUDED FROM THIS MODEL.
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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).

LEGEND:

FLOOD DEPTH (m)	
■	ABOVE 2.00
■	1.75 - 2.00
■	1.50 - 1.75
■	1.25 - 1.50
■	1.00 - 1.25
■	0.75 - 1.00
■	0.50 - 0.75
■	0.25 - 0.50
■	0.00 - 0.25

SITE BOUNDARY

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SCALE 1:25000

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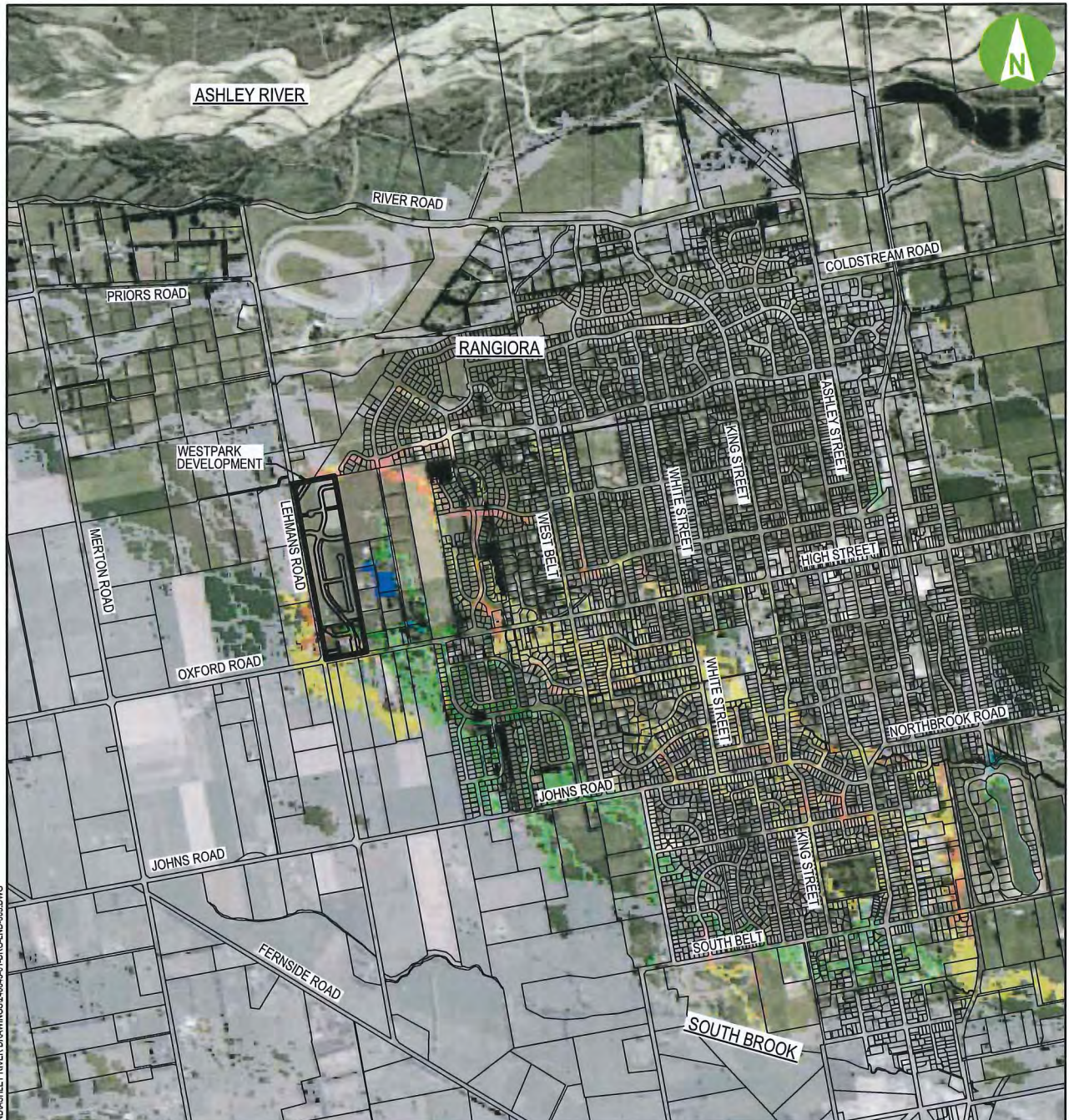
CLIENT
WESTPARK
RANGIORA LTD

REV	DATE	REVISION DETAILS
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APPROVED	SCALE	SIZE
B.TOMS	AS SHOWN	A1
	DRAWN	A.GRAY
	DESIGNED	M.STONE
	CHECKED	P.CHRISTENSEN

PRELIMINARY NOT FOR CONSTRUCTION	DATE 20/11/14
APPROVED	
B.TOMS	
B.TOMS	

PROJECT	WESTPARK DEVELOPMENT				
TITLE	ASHLEY RIVER BREAKOUT 0.5% AEP FLOOD EVENT EXISTING SCENARIO PEAK FLOOD DEPTH				
DRAWING No.	240845	WBS	01	TYPE	DRG - LND
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				REV	A

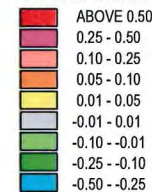


NOTES:

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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).
5. THIS DRAWING PRESENTS THE DIFFERENCE IN PEAK FLOOD LEVEL BETWEEN THE EXISTING SCENARIO AND POST DEVELOPMENT SCENARIO.

LEGEND:

FLOOD DEPTH VARIATION (m)



SITE BOUNDARY

250 0 500 1000m

SCALE 1:25000

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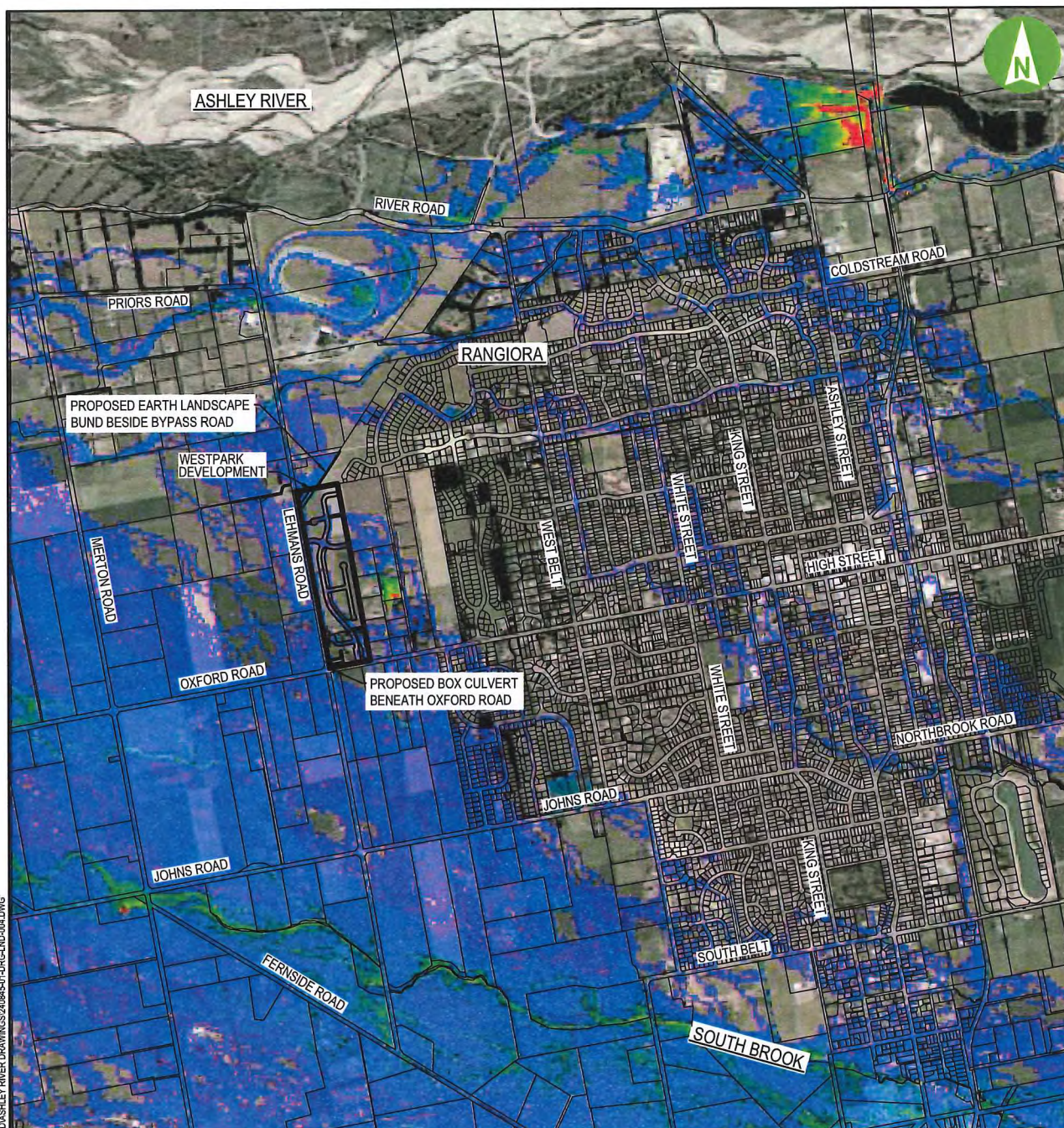
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REV	DATE	REVISION DETAILS	APPROVED
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SCALE	SIZE
AS SHOWN	A4
DRAWN	A.GRAY
DESIGNED	M.STONE
CHECKED	
P.CHRIISTENSEN	

PRELIMINARY NOT FOR CONSTRUCTION	PROJECT
APPROVED	DATE
B.TOMS	2/12/14
B.TOMS	

PROJECT	TITLE
WESTPARK DEVELOPMENT	ASHLEY RIVER BREAKOUT 0.5% AEP FLOOD EVENT POST DEVELOPMENT SCENARIO PEAK FLOOD LEVEL DIFFERENCE (NO MITIGATION)
DRAWING No.	PROJECT No.
240845 - 01 - DRG - LND - 003 - A	240845 - 01 - DRG - LND - 003 - A



NOTES:

1. THE FLOOD INFORMATION REPRESENTED ON THIS MAP DOES NOT ALLOW FOR FREEBOARD AND AS SUCH IS NOT THE RECOMMENDED BUILDING LEVEL.
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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).

LEGEND:

FLOOD DEPTH (m)
ABOVE 2.00
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
0.00 - 0.25

SITE BOUNDARY



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REV	DATE	REVISION DETAILS	APPROVED
A	2011/14	DRAFT ISSUE	B.TOMS

SCALE	SIDE
AS SHOWN	A4
DRAWN	A.GRAY
DESIGNED	M.STONE
CHECKED	P.CHRIISTENSEN

PRELIMINARY NOT FOR CONSTRUCTION	PROJECT
APPROVED	DATE
B.TOMS	21/10/14
B.TOMS	

PROJECT	WESTPARK DEVELOPMENT
TITLE	ASHLEY RIVER BREAKOUT 0.5% AEP FLOOD EVENT POST DEVELOPMENT MITIGATION SCENARIO PEAK FLOOD DEPTH
DRAWING No.	240845 - 01 - DRG - LND - 004 - A

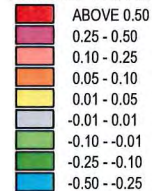


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1. THE FLOOD INFORMATION REPRESENTED ON THIS MAP DOES NOT ALLOW FOR FREEBOARD AND AS SUCH IS NOT THE RECOMMENDED BUILDING LEVEL.
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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).
5. THIS DRAWING PRESENTS THE DIFFERENCE IN PEAK FLOOD LEVEL BETWEEN THE EXISTING SCENARIO AND POST DEVELOPMENT MITIGATION SCENARIO.

LEGEND:

FLOOD DEPTH VARIATION (m)



SITE BOUNDARY



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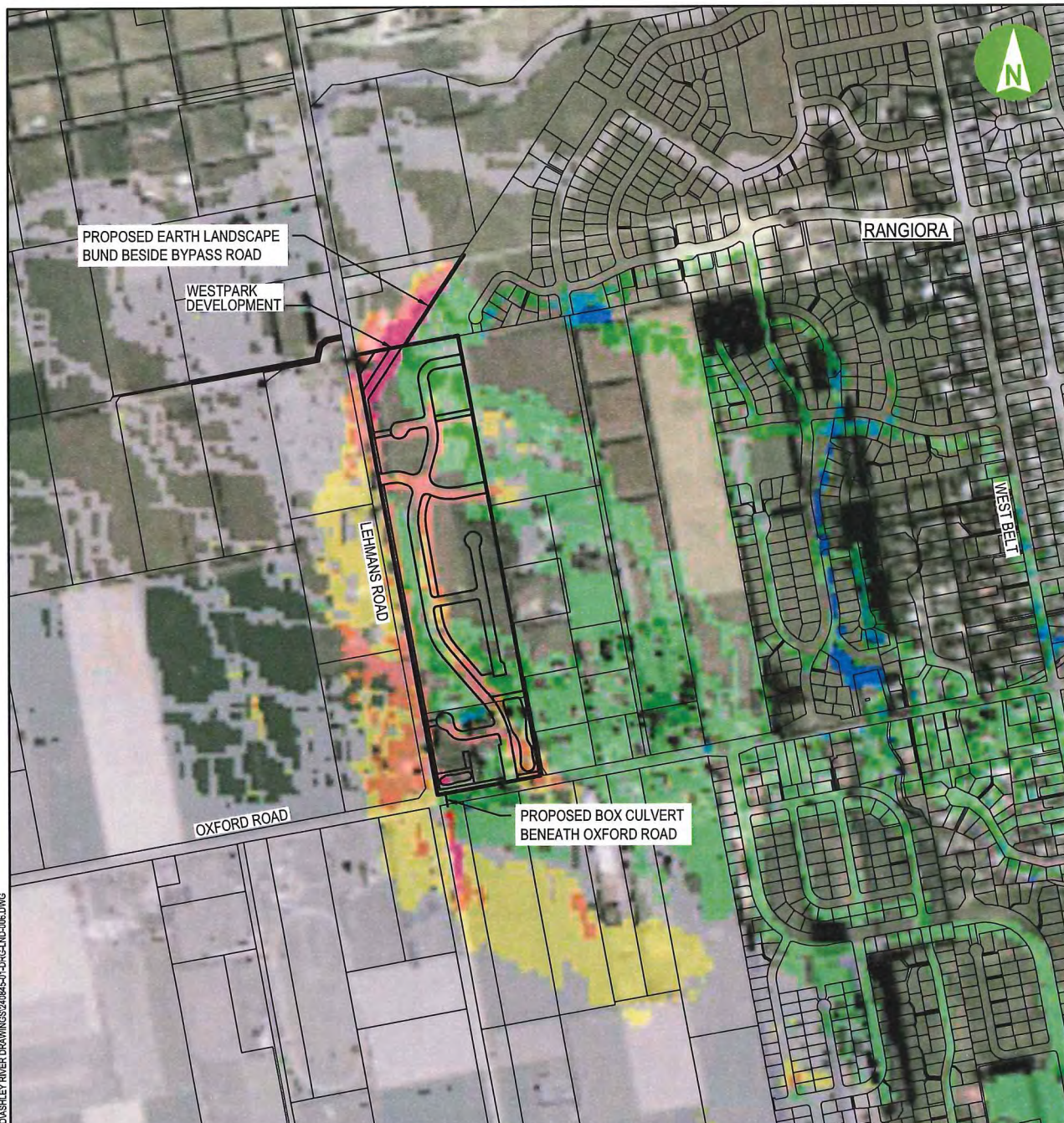
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PRELIMINARY	DATE
NOT FOR CONSTRUCTION	20/11/14

PROJECT	TITLE
WESTPARK DEVELOPMENT	ASHLEY RIVER BREAKOUT 0.5% AEP FLOOD EVENT POST DEVELOPMENT MITIGATION SCENARIO PEAK FLOOD LEVEL DIFFERENCE

DRAWING No. 240845 - 01 - DRG - LND - 005 - A



NOTES:

1. THE FLOOD INFORMATION REPRESENTED ON THIS MAP DOES NOT ALLOW FOR FREEBOARD AND AS SUCH IS NOT THE RECOMMENDED BUILDING LEVEL.
2. THE FLOOD INFORMATION REPRESENTED ON THIS MAP HAS BEEN DERIVED BASED ON THE EXISTING ASHLEY RIVER BREAKOUT 2-D HYDRAULIC MODEL AND USING EXISTING WDC GIS LIDAR (AS SUPPLIED IN NOVEMBER 2014). THE ECAN MODEL USES A 10m GRID SIZE. LOCALISED RUN-OFF CONTRIBUTIONS AND THE INFLUENCE OF THE RETICULATED STORMWATER NETWORKS HAVE BEEN EXCLUDED FROM THIS MODEL.
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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).
5. THIS DRAWING PRESENTS THE DIFFERENCE IN PEAK FLOOD LEVEL BETWEEN THE EXISTING SCENARIO AND POST DEVELOPMENT MITIGATION SCENARIO.

LEGEND:

FLOOD DEPTH VARIATION (m)	SITE BOUNDARY
ABOVE 0.50	
0.25 - 0.50	
0.10 - 0.25	
0.05 - 0.10	
0.01 - 0.05	
-0.01 - 0.01	
-0.10 - -0.01	
-0.25 - -0.10	
-0.50 - -0.25	



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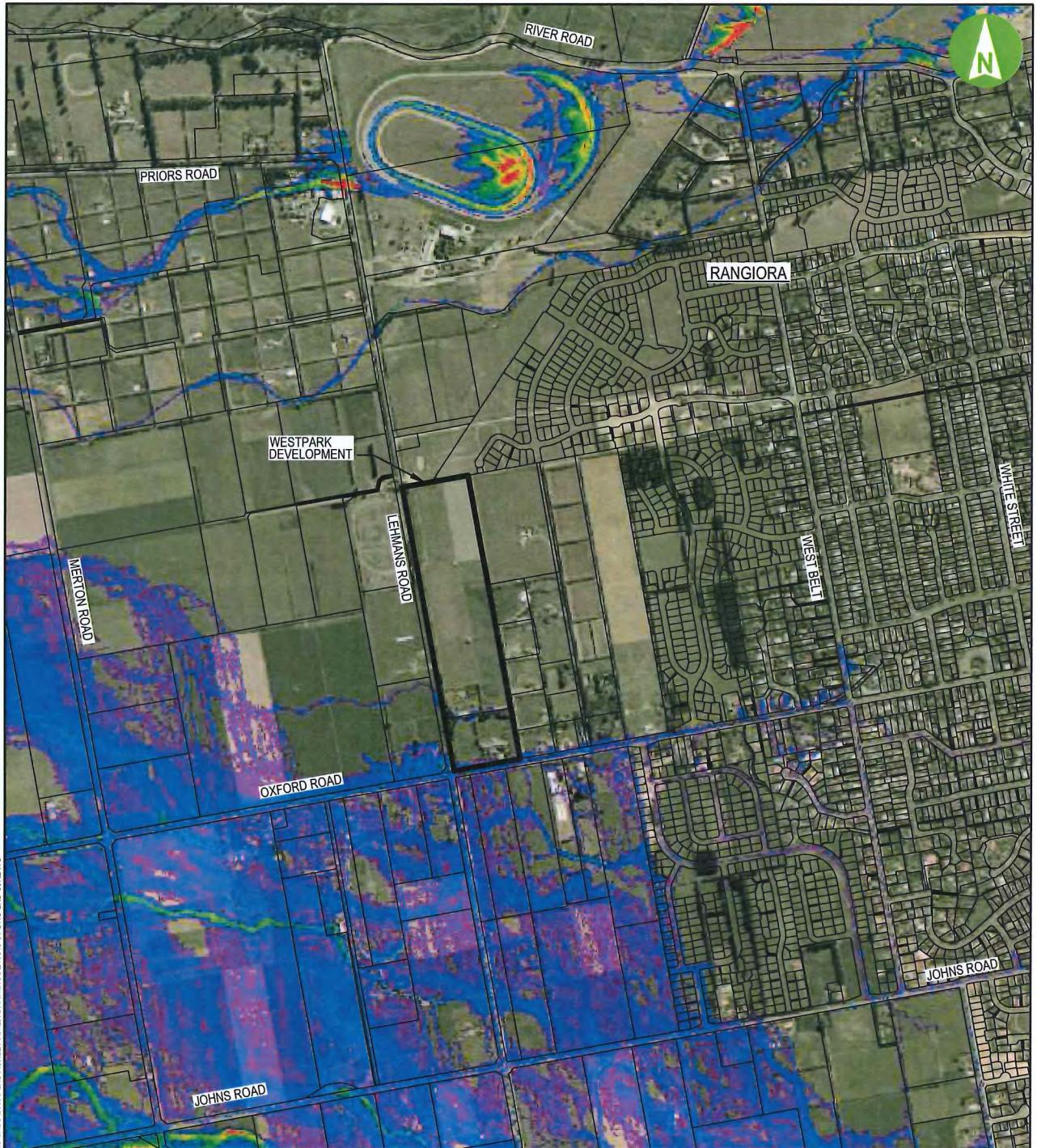
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A	20/11/14	DRAFT ISSUE	B.TOMS

SCALE	SIZE
AS SHOWN	A4
DRAWN	
A.GRAY	
DESIGNED	
M.STONE	
CHECKED	
P.CHRISTENSEN	

PRELIMINARY NOT FOR CONSTRUCTION	PROJECT
APPROVED	DATE
B.TOMS	20/11/14
B.TOMS	

PROJECT	WESTPARK DEVELOPMENT
TITLE	ASHLEY RIVER BREAKOUT 0.5% AEP FLOOD EVENT POST DEVELOPMENT MITIGATION SCENARIO PEAK FLOOD LEVEL DIFFERENCE (ZOOMED EXTENT)
DRAWING No.	240845 - 01 - DRG - LND - 006 - A

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NOTES:

1. THE FLOOD INFORMATION REPRESENTED ON THIS MAP DOES NOT ALLOW FOR FREEBOARD AND AS SUCH IS NOT THE RECOMMENDED BUILDING LEVEL.
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3. ASSUMPTIONS AND LIMITATIONS OF THE INFORMATION REPRESENTED ON THESE MAPS ARE DISCUSSED IN THE ASSOCIATED REPORT (WESTPARK DEVELOPMENT ASHLEY RIVER BREAKOUT FLOOD MODELLING, AURECON 2014).
4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).

LEGEND:

FLOOD DEPTH (m)
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0.8 - 0.9
0.7 - 0.8
0.6 - 0.7
0.5 - 0.6
0.4 - 0.5
0.3 - 0.4
0.2 - 0.3
0.1 - 0.2
0.0 - 0.1

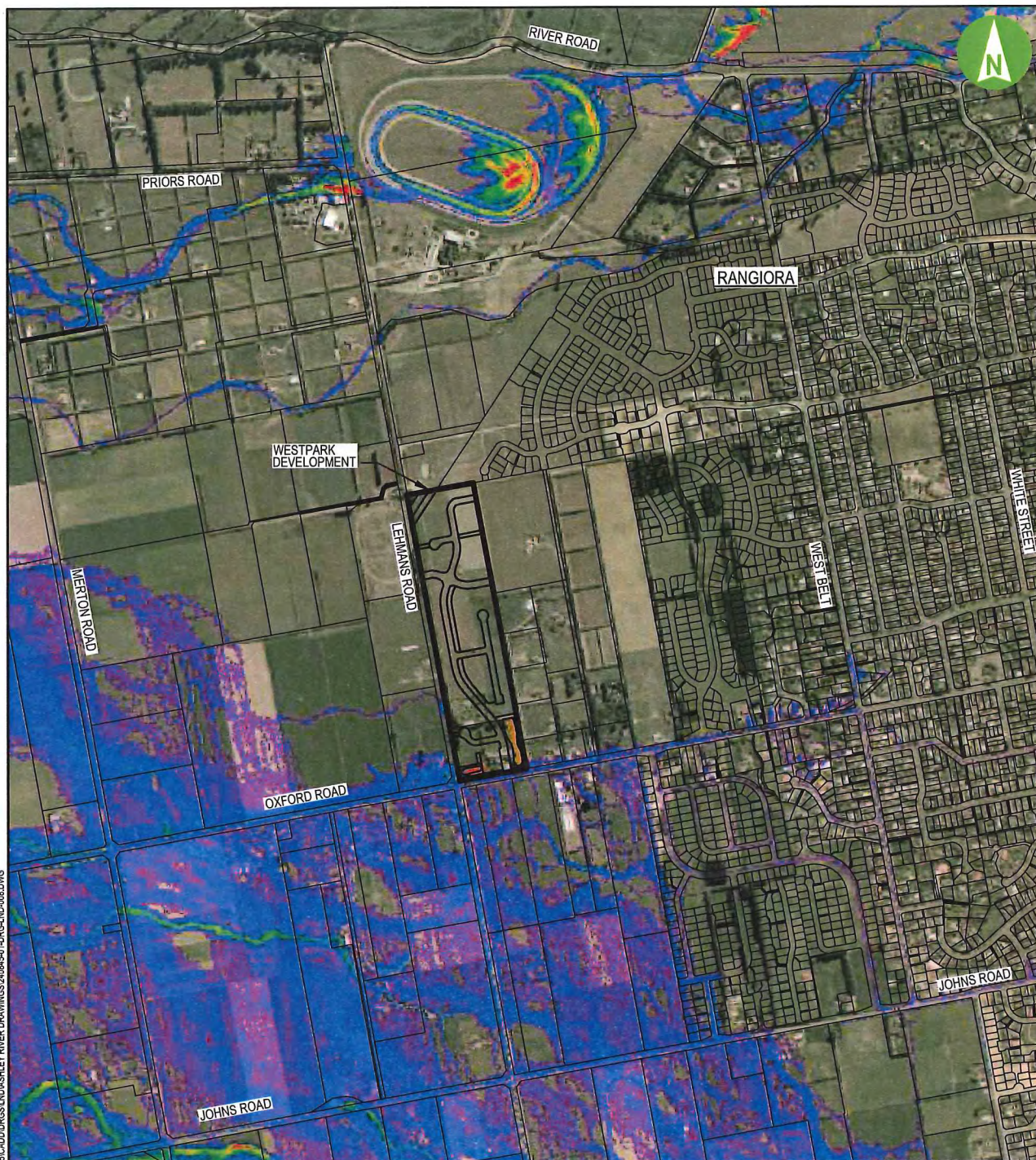
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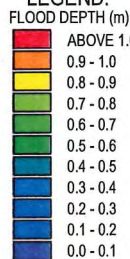
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					A.GRAY			
					DESIGNED		DRAWING No. 240845 - 01 - DRG - LND - 007 - A	
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					CHECKED			
					P.CHRIISTENSEN			



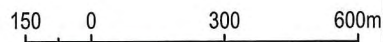
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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).

LEGEND:



□ SITE BOUNDARY



SCALE 1:15000

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REV	DATE	REVISION DETAILS	APPROVED
A	20/11/14	DRAFT ISSUE	B.TOMS

SCALE	SIZE
AS SHOWN	A4
DRAWN	
DESIGNED	
CHECKED	
P.CHRIENSEN	

PRELIMINARY NOT FOR CONSTRUCTION	DATE 20/11/14
APPROVED	
B.TOMS	
B.TOMS	

PROJECT	WESTPARK DEVELOPMENT
TITLE	LOCAL 0.5% AEP FLOOD EVENT POST DEVELOPMENT SCENARIO PEAK FLOOD DEPTH
PROJECT No.	240845
WBS	01
TYPE	DRG
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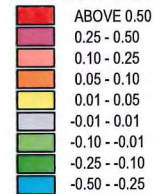


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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).

LEGEND:

FLOOD DEPTH VARIATION (m)



□ SITE BOUNDARY

150 0 300 600m

SCALE 1:15000

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REV	DATE	REVISION DETAILS
A	20/11/14	DRAFT ISSUE

APPROVED
B.TOM'S

SCALE	SIZE
AS SHOWN	A4
DRAWN	
AGRAY	
DESIGNED	
M.STONE	
CHECKED	
P.CHRISTENSEN	

PRELIMINARY NOT FOR CONSTRUCTION	DATE 20/11/14
APPROVED B.TOM'S	
B.TOM'S	

PROJECT	WESTPARK DEVELOPMENT
TITLE	LOCAL 0.5% AEP FLOOD EVENT PEAK FLOOD LEVEL DIFFERENCE
DRAWING No.	240845
PROJECT No.	01
WBS	-
TYPE	DRG
DESC	LND
NUMBER	009
REV	- A



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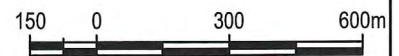
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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).

LEGEND:

MANNING'S ROUGHNESS VALUE

- ROAD (0.013)
- PARKS (0.03)
- PASTURE (0.05)
- URBAN AREAS (0.10)
- FOREST (0.125)

SITE BOUNDARY



SCALE 1:15000

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REV	DATE	REVISION DETAILS	APPROVED
A	20/11/14	DRAFT ISSUE	B.TOMS

SCALE	SIZE
AS SHOWN	A4
DRAWN	
DESIGNED	
CHECKED	
P.CHRISTENSEN	

PRELIMINARY NOT FOR CONSTRUCTION	DATE 21/11/14
APPROVED B.TOMS	
B.TOMS	

PROJECT	TITLE
WESTPARK DEVELOPMENT	EXISTING SCENARIO ROUGHNESS MAP FOR SUB MODEL
DRAWING No: 240845 - 01 - DRG - LND - 010 - A	



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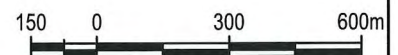
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4. AERIAL PHOTO OBTAINED FROM LAND INFORMATION NEW ZEALAND (2010).

LEGEND:

MANNING'S ROUGHNESS VALUE

- ROAD (0.013)
- PARKS (0.03)
- PASTURE (0.05)
- URBAN AREAS (0.10)
- FOREST (0.125)

SITE BOUNDARY



SCALE 1:15000

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REV	DATE	REVISION DETAILS
A	2011/14	DRAFT ISSUE

APPROVED
B.TOMS

SCALE
AS SHOWN
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DRAWN
A.GRAY
DESIGNED
M.STONE
CHECKED
P.CHRISTENSEN

PRELIMINARY
NOT FOR CONSTRUCTION
APPROVED
DATE
26/12/14
B.TOMS
B.TOMS

PROJECT
TITLE
DRAWING No.

WESTPARK DEVELOPMENT
POST-DEVELOPMENT SCENARIO ROUGHNESS MAP
FOR SUB-MODEL
PROJECT No. 240845 - 01 - DRG - LND - 011 - A



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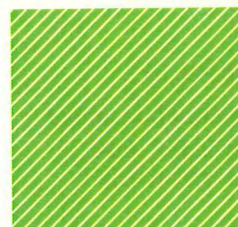
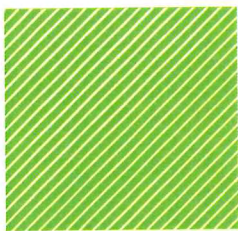
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Appendix G

Geotechnical Assessment





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**Westpark Rangiora Plan Change
Geotechnical Investigation Report**

Reference: 240845

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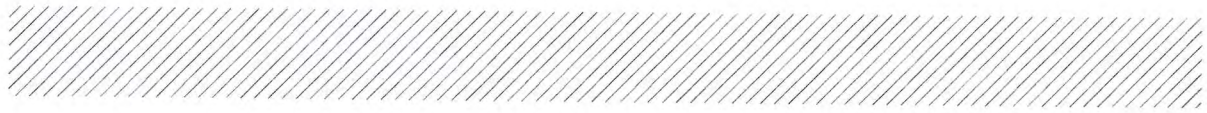
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Figure 2: Aurecon Investigation Locations

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Appendix A: ECan Borehole Logs

Appendix B: Flood modelling outputs

Appendix C: Aurecon Investigation Logs