

MATERIAL LEGEND

BAL1	1.1m High Glass Balustrade	CLDF	Feature Metal Sheet Cladding
BAL2	1.1m High Steel Balustrade	SUNV	Timber Sunshading
BAL3	1.8m High Glass Balustrade	FR	Feature Render Finish
BAL4	Solid Precast Concrete Balustrade	VESC	Vegetated Screening with Stainless Steel Vertical Wires
BLST	Black Steel - Matt Finish	WD1	Glazing with Clear Anodised Aluminium Mullions
BRIK	Grey Brick Finish	WD2	Glazing with Clear Anodised Aluminium Mullions, Green Tinted Glass
CAWN	Cantilivered Concrete Awning	WD3	Glazing with Clear Anodised Aluminium Mullions, Dark Green Tinted Glass
CCLM	Concrete Column	WD4	Glazing with Glass Mullions, Transparent Glass
CONC	Off-form Concrete	WD5	Retail Glazing with Black Anodised Aluminium Mullions
SCRN1	Aluminium Screening for Privacy		

LODGED
23/12/2019
BCC DS



Revision	REV	DESCRIPTION	DATE	INT.
A	Draft DA Issue		08.05.19	
B	Draft DA Set		31.10.19	
C	Draft DA Set		25.11.19	NA
D	Draft DA Set		03.12.19	NA
E	DA Issue		18.12.19	NA

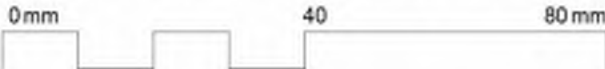
Client
**MARKETPLACE
DEVELOPMENTS**

Project
**Lamington Markets,
Lutwyche**

Drawing
South Elevation

A1 Scale As indicated
Project 14037
Issue E
Drawn AS
Drawing DA 53

Details
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Do not scale this drawing and verify all dimensions and levels on site.
Nominated Architect : Lawrence Toaldo NSW Reg. 10255.



DEVELOPMENT APPROVAL

1 South Elevation
1 : 200

BAL1	1.1m High Glass Balustrade
BAL2	1.1m High Steel Balustrade
BAL3	1.8m High Glass Balustrade
BAL4	Solid Precast Concrete Balustrade
BLST	Black Steel - Matt Finish
BR1K	Grey Brick Finish
CAWN	Cantilevered Concrete Awning
CCLM	Concrete Column
CONC	Off-form Concrete
SCRN1	Aluminium Screening for Privacy

CLDF	Feature Metal Sheet Cladding
SUNV	Timber Sunshading
FR	Feature Render Finish
VESC	Vegetated Screening with Stainless Steel Vertical Wires
WD1	Glazing with Clear Anodised Aluminium Mullions
WD2	Glazing with Clear Anodised Aluminium Mullions, Green Tinted Glass
WD3	Glazing with Clear Anodised Aluminium Mullions, Dark Green Tinted Glass
WD4	Glazing with Glass Mullions, Transparent Glass
WD5	Retail Glazing with Black Anodised Aluminium Mullions

Conrad Gargett



Revision			
REV	DESCRIPTION	DATE	INT.
A	Draft DA Issue	08.05.19	
B	Draft DA Set	31.10.19	
C	Draft DA Set	25.11.19	NA
D	Draft DA Set	03.12.19	NA
E	DA Issue	18.12.19	NA

Client

MARKETPLACE DEVELOPMENTS

Project
**Lamington Markets,
Lutwyche**

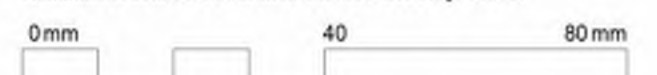
Drawing

West Elevation

A1 Scale As indicated
Project 14037
Issue E
Drawn AS
Drawing DA 54

Details

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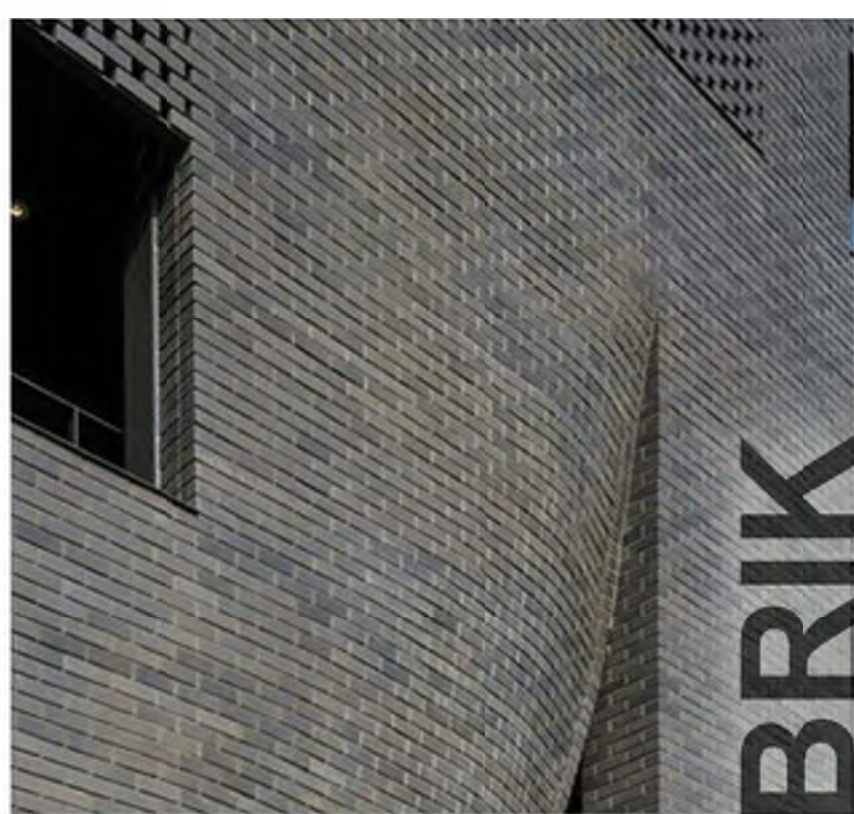


1 West Elevation
1 : 200

DEVELOPMENT APPROVAL

MATERIAL LEGEND

BAL1	1.1m High Glass Balustrade	CLDF	Feature Metal Sheet Cladding
BAL2	1.1m High Steel Balustrade	SUNV	Timber Sunshading
BAL3	1.8m High Glass Balustrade	FR	Feature Render Finish
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CCLM	Concrete Column	WD4	Glazing with Glass Mullions, Transparent Glass
CONC	Off-form Concrete	WD5	Retail Glazing with Black Anodised Aluminium Mullions
SCRN1	Aluminium Screening for Privacy		



Revision			
REV	DESCRIPTION	DATE	INT.
A	Draft DA Issue	08.05.19	
B	Draft DA Set	25.11.19	NA
C	Draft DA Set	03.12.19	NA
D	DA Issue	18.12.19	NA

Client
**MARKETPLACE
DEVELOPMENTS**

Project
**Lamington Markets,
Lutwyche**

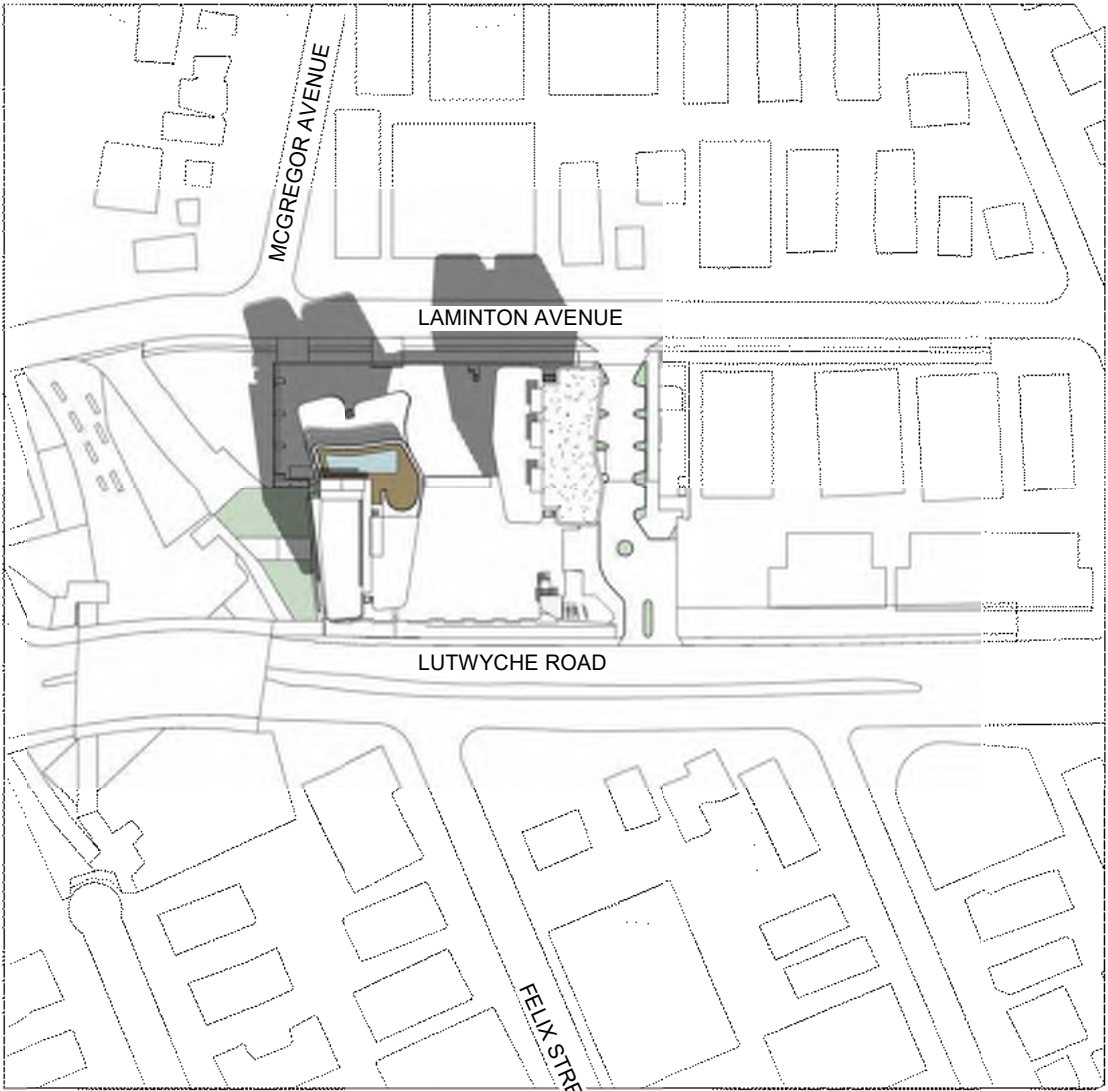
Drawing
Material Board

A1 Scale 1 : 100
Project 14037
Issue D
Drawn AS
Drawing DA 55

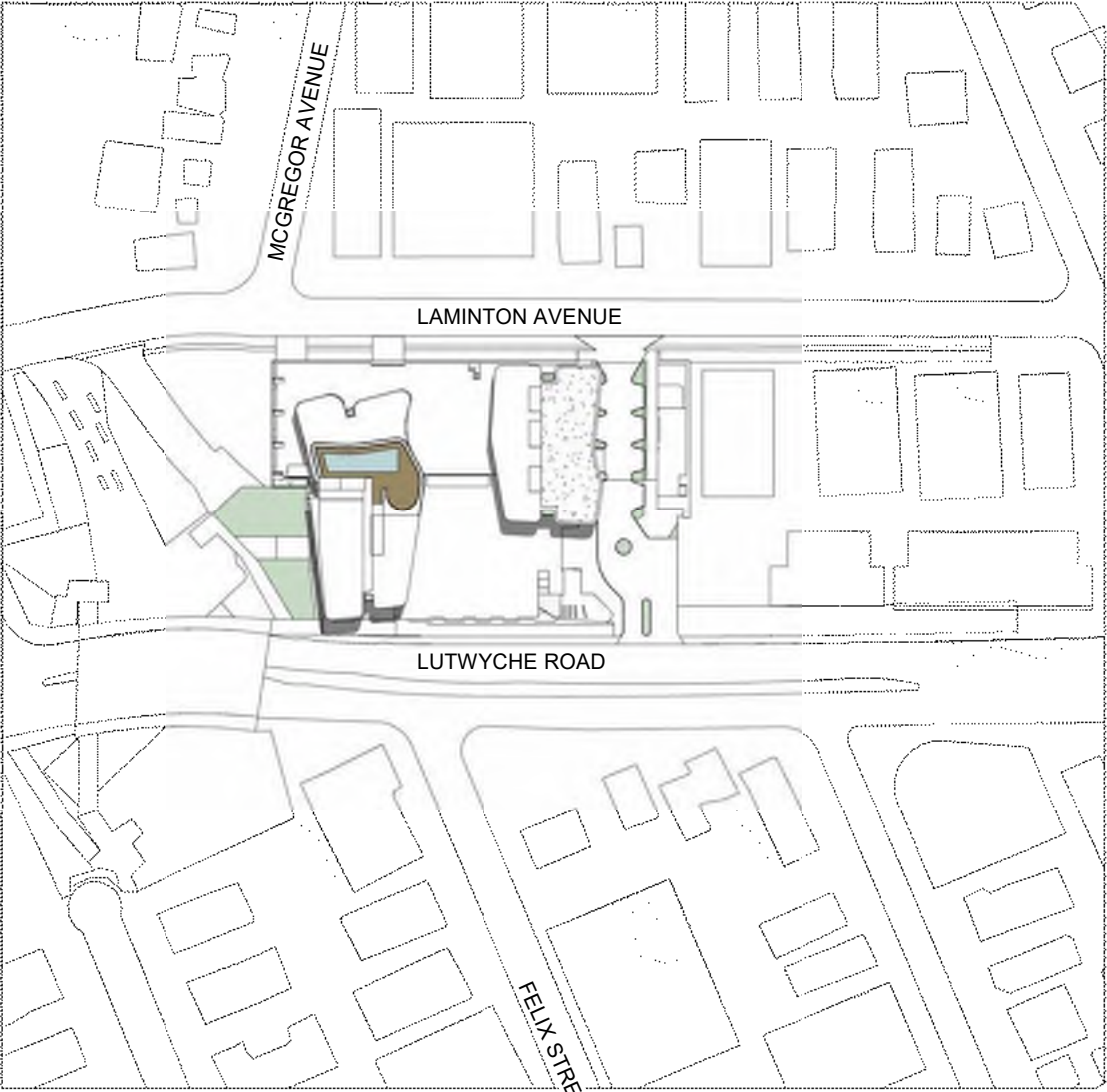
Details
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Nominated Architect : Lawrence Toaldo NSW Reg. 10255.

10 0 10 20 30 40 50 60 70
SCALE 1:1 mm

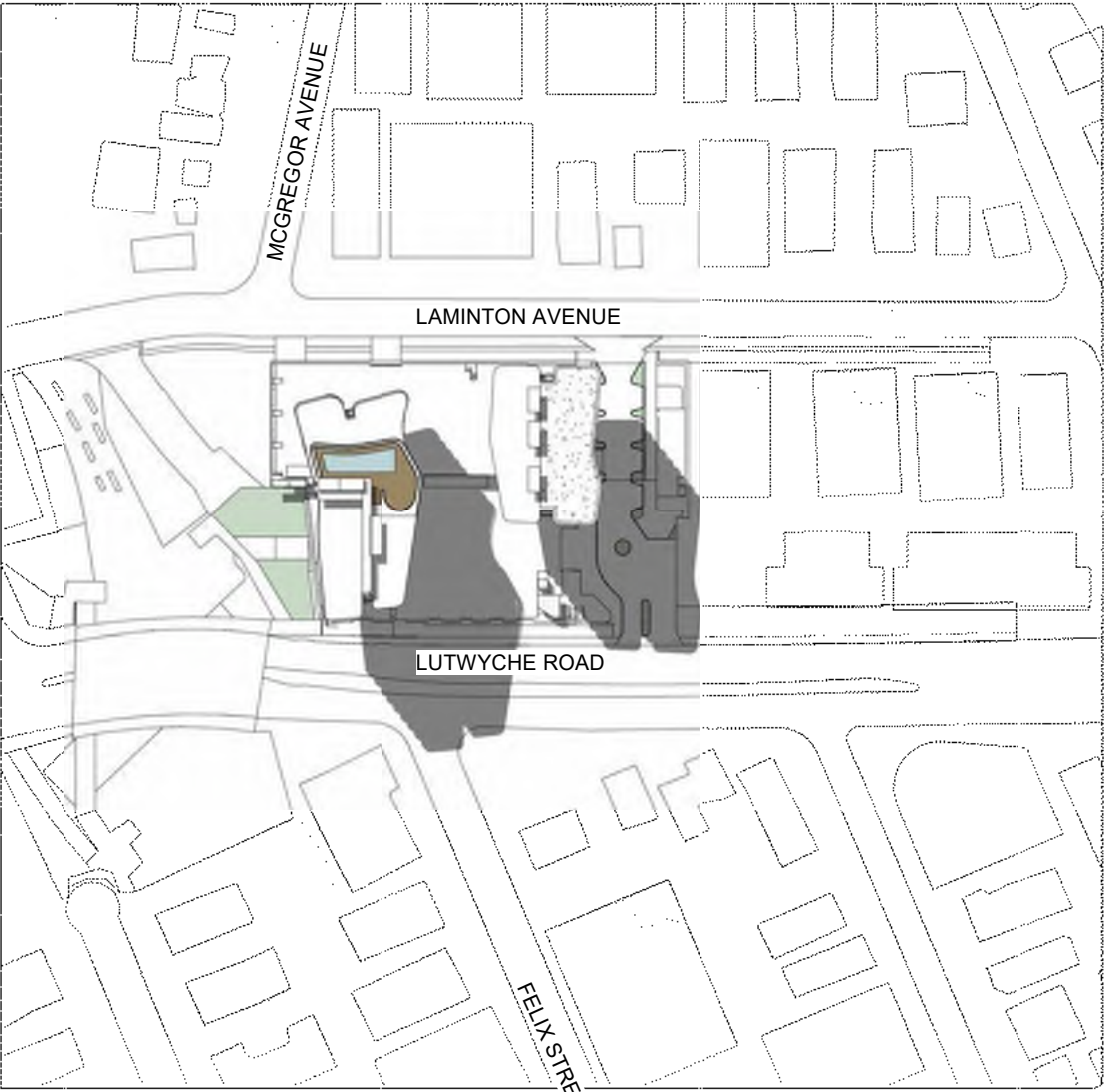
DEVELOPMENT APPROVAL



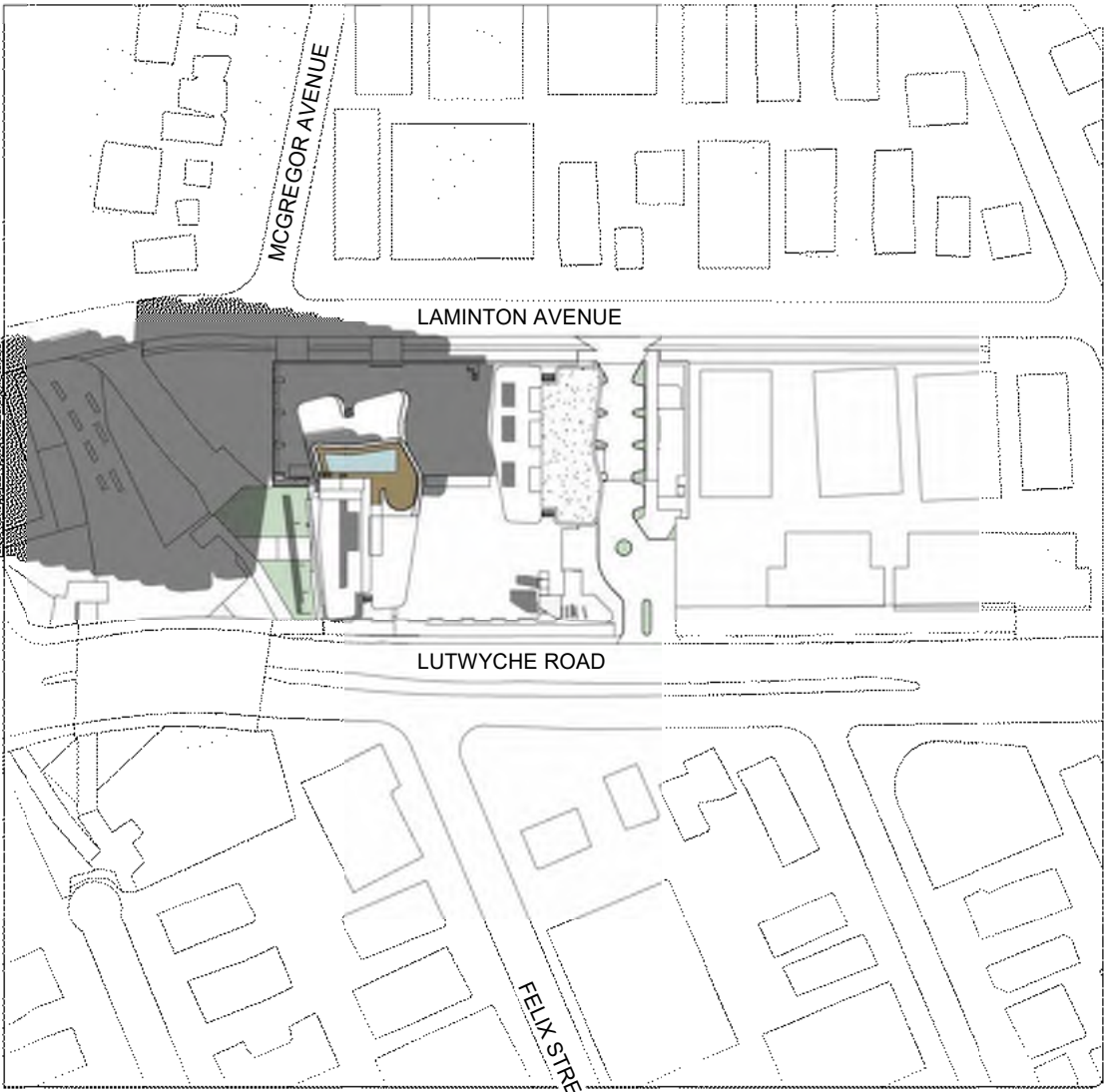
1 Summer 9 am



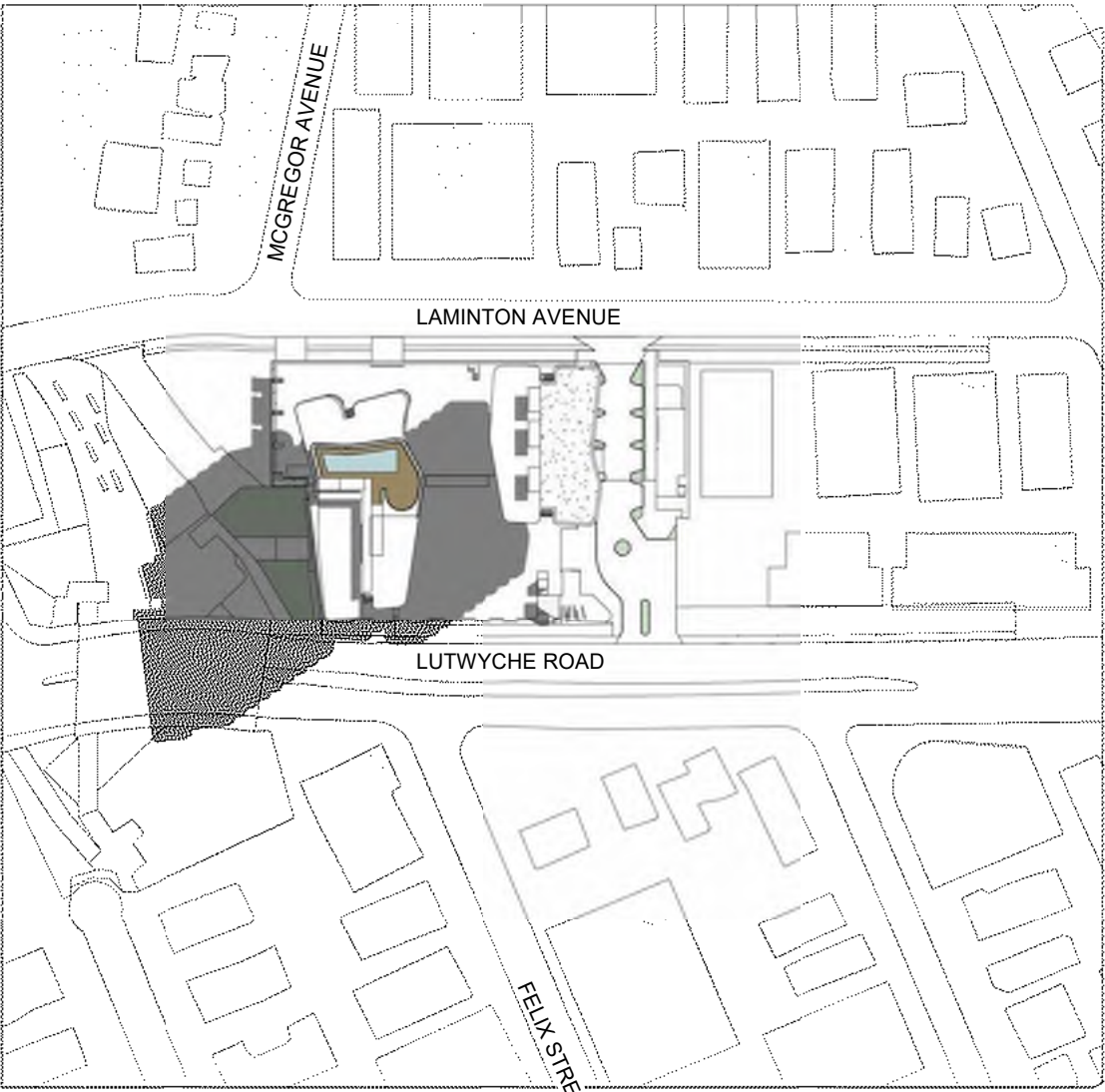
2 Summer 12 pm



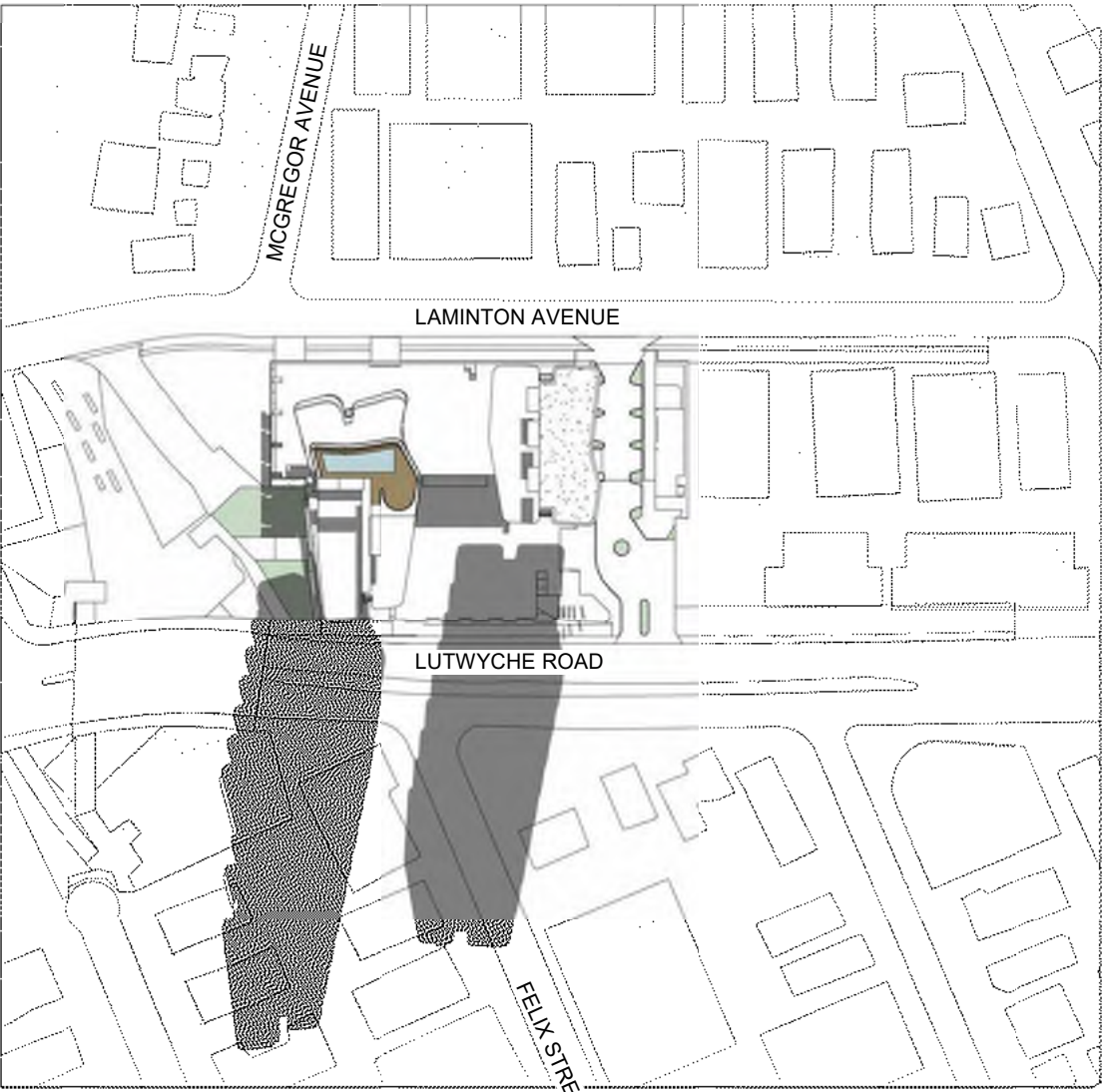
3 Summer 3 pm



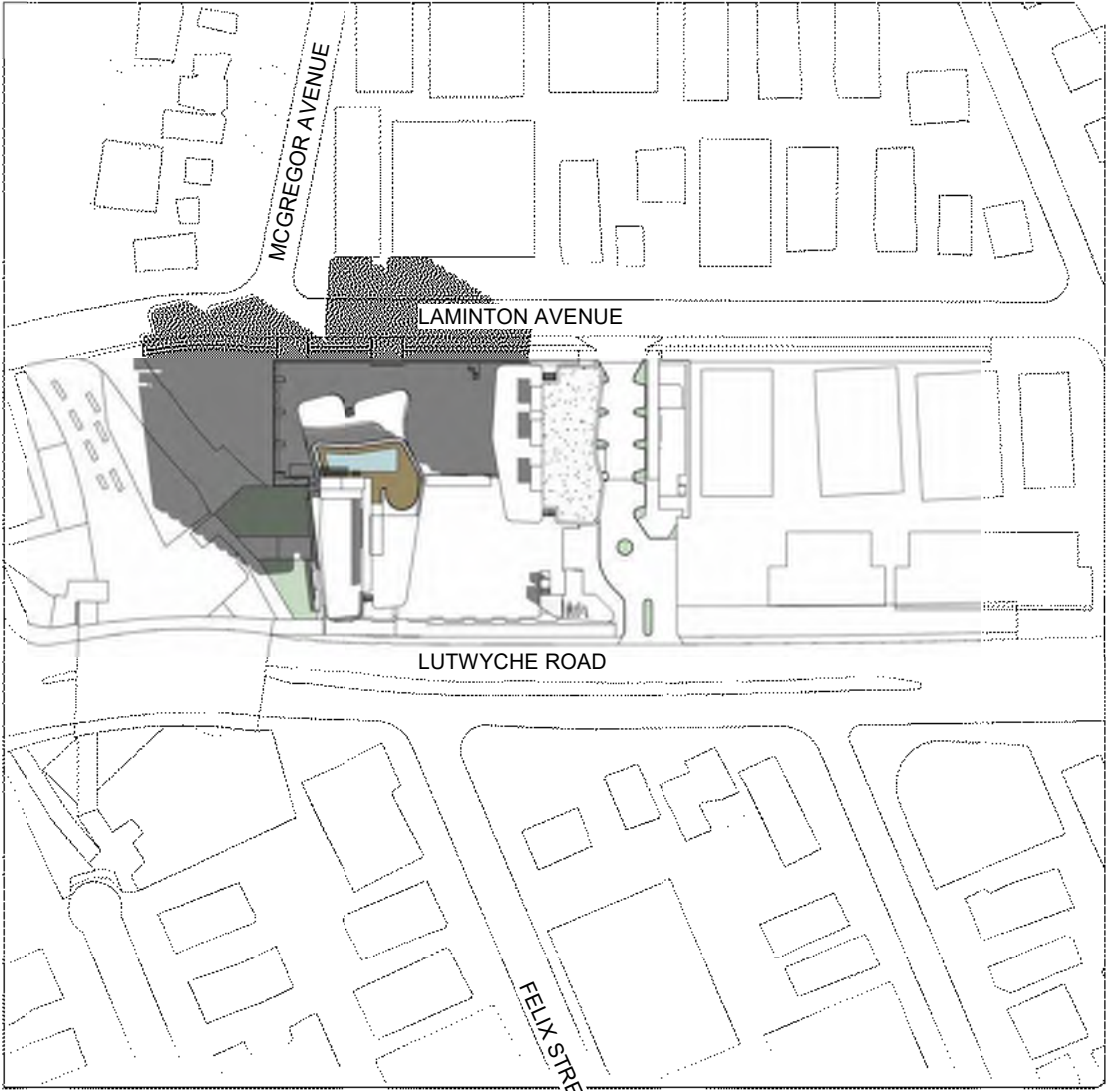
4 Winter 9 am



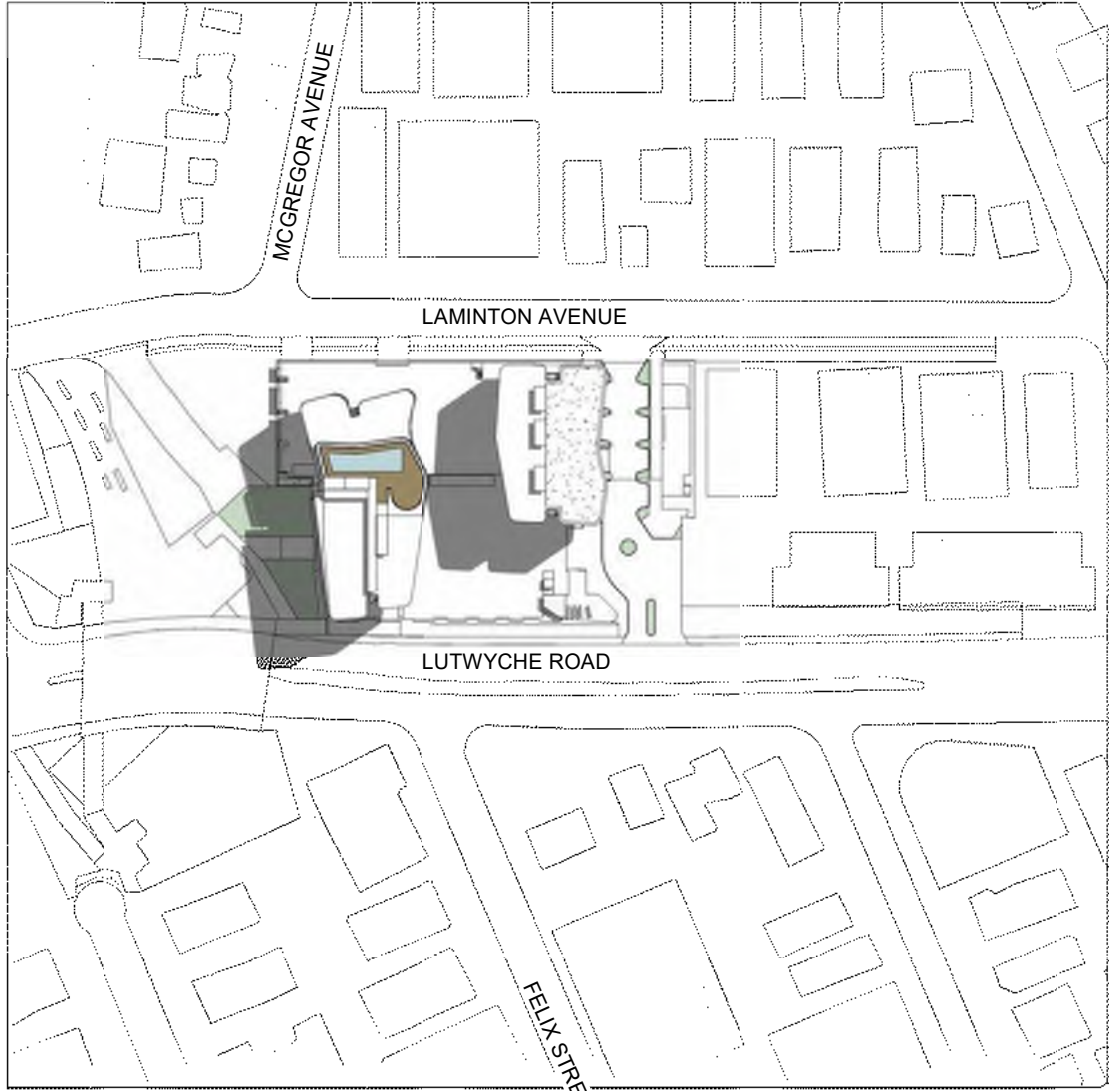
5 Winter 12 pm



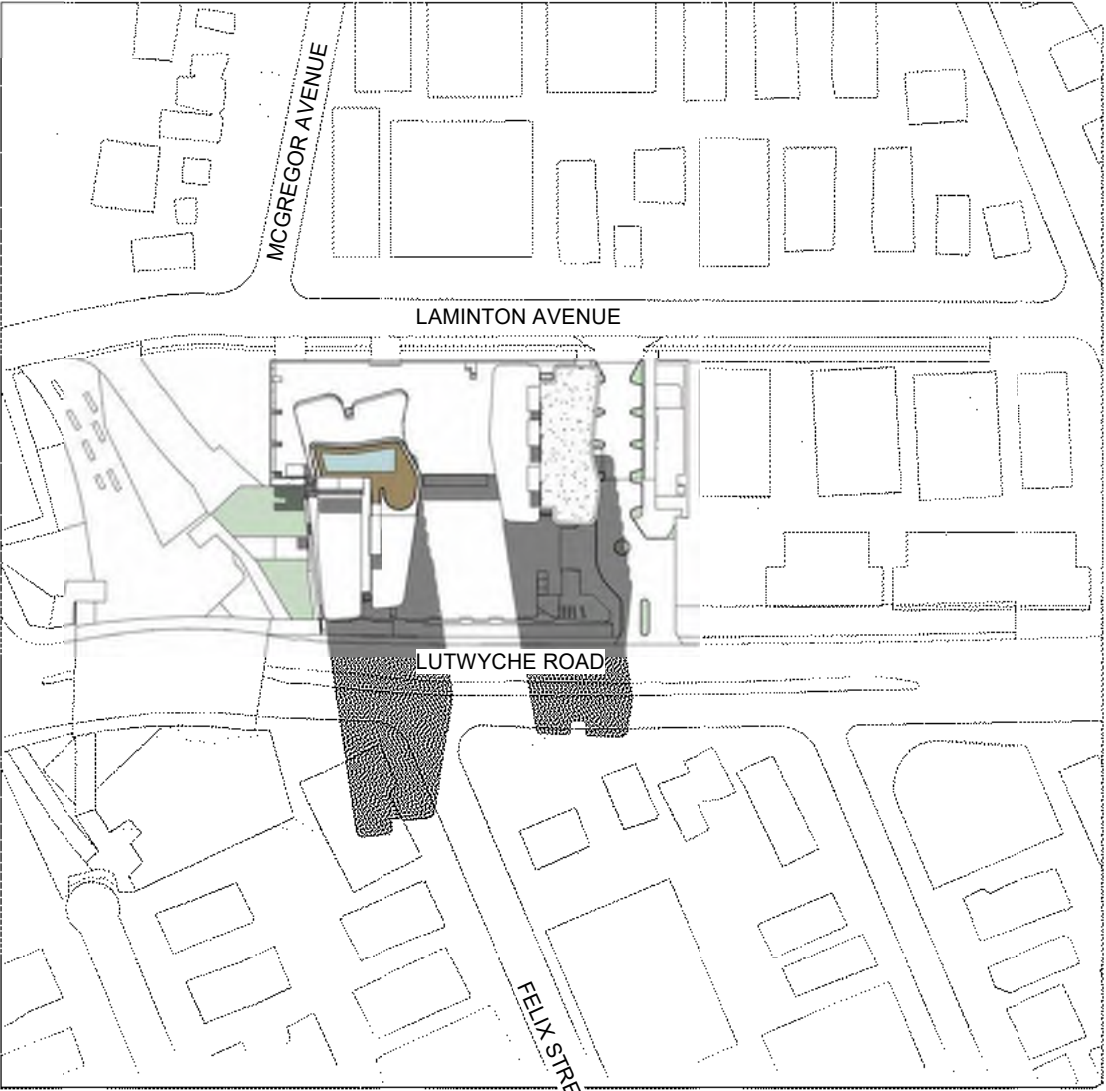
6 Winter 3 pm



7 Equinox 9 am



8 Equinox 12 pm



9 Equinox 3 pm

Revision			
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B	DA Issue	18.12.19	NA

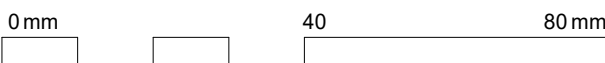
Client
**MARKETPLACE
DEVELOPMENTS**

Project
**Lamington Markets,
Lutwyche**

Drawing
Solar Studies

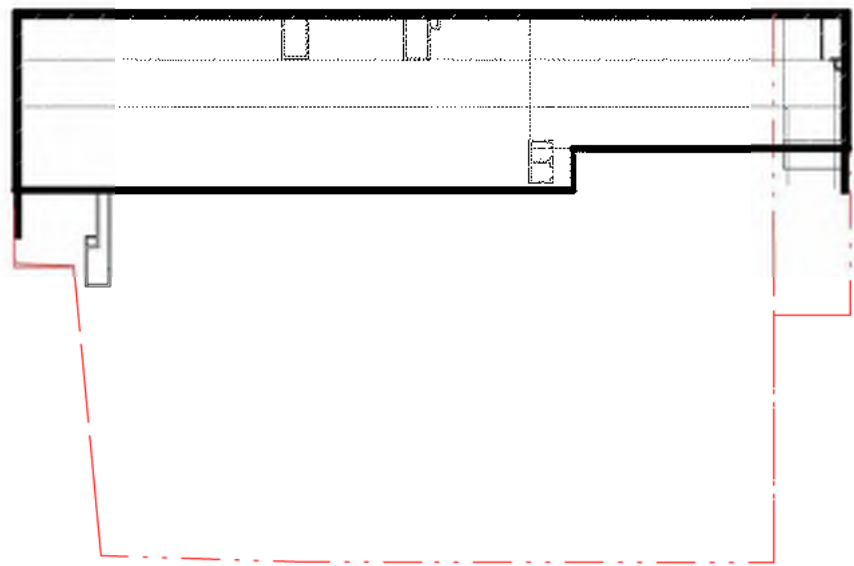
A1 Scale
Project 14037
Issue B
Drawn Author
Drawing DA 56

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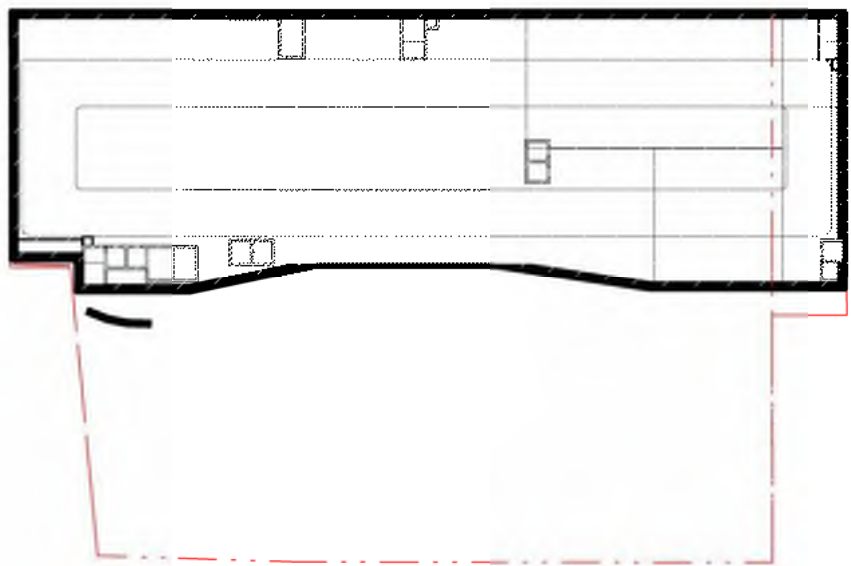
DEVELOPMENT APPROVAL

AREA OVERVIEW



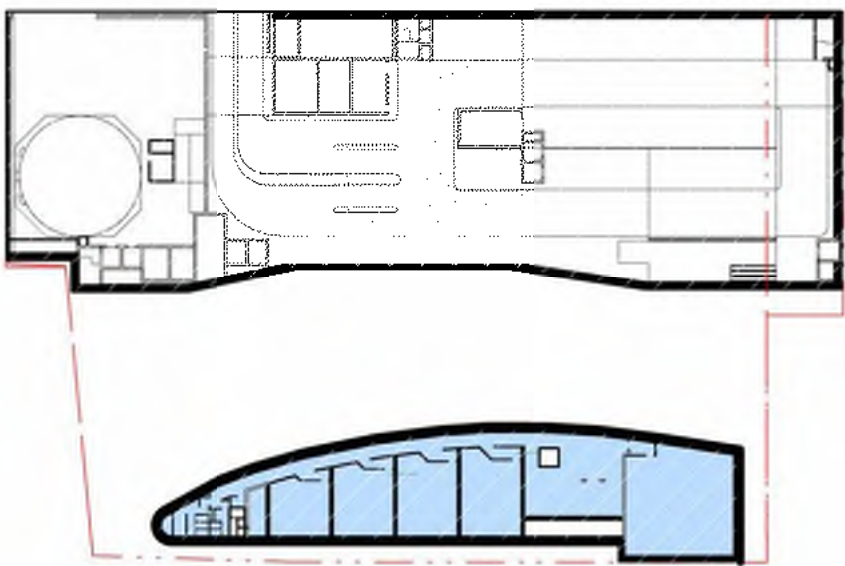
BASEMENT 06

GROSS BUILDING AREA 2,604 sqm
GROSS FLOOR AREA (BCC) -



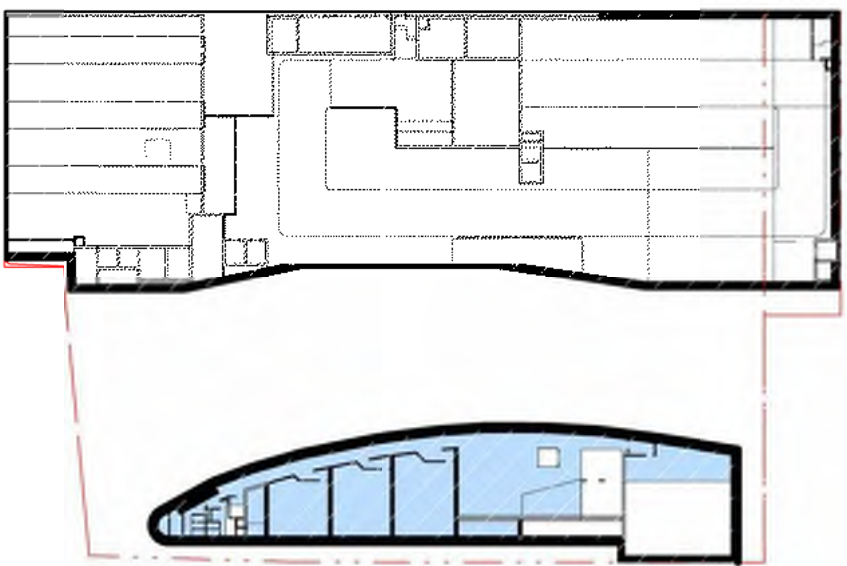
BASEMENT 05-03

GROSS BUILDING AREA 3901x3 = 11,703 sqm
GROSS FLOOR AREA (BCC) -



BASEMENT 02

GROSS BUILDING AREA 4,930 sqm
GROSS FLOOR AREA (BCC) 895 sqm



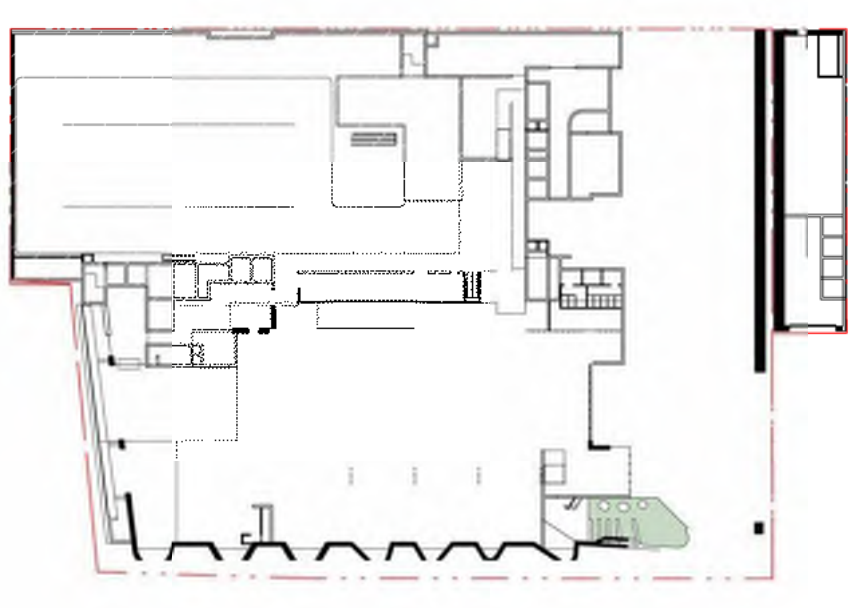
BASEMENT 01

GROSS BUILDING AREA 4,930 sqm
GROSS FLOOR AREA (BCC) 696 sqm



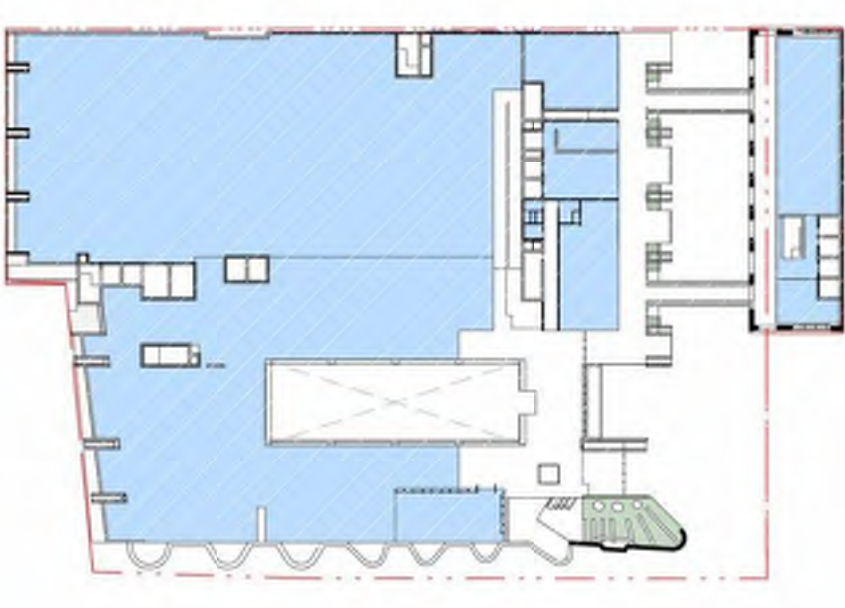
GROUND FLOOR

GROSS BUILDING AREA 5,466 sqm
GROSS FLOOR AREA (BCC) 2,390 sqm



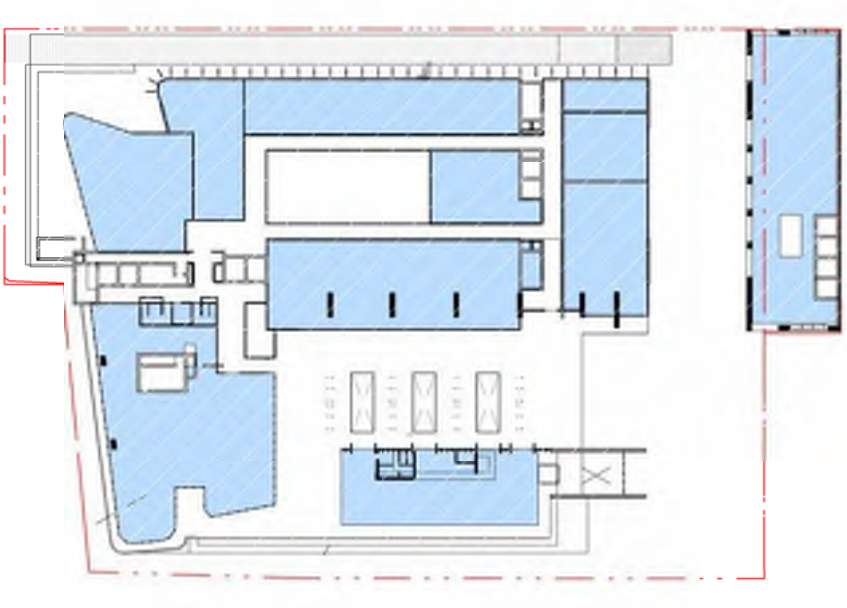
GROUND MEZZANINE

GROSS BUILDING AREA 2,415 sqm
GROSS FLOOR AREA (BCC) -



LEVEL 01

GROSS BUILDING AREA 6,002 sqm
GROSS FLOOR AREA (BCC) 4,036 sqm



LEVEL 02

GROSS BUILDING AREA 5,505 sqm
GROSS FLOOR AREA (BCC) 2,748 sqm



LEVEL 03

GROSS BUILDING AREA 2,752 sqm
GROSS FLOOR AREA (BCC) 2,178 sqm



LEVEL 04-09

GROSS BUILDING AREA 2610x6 = 15,660 sqm
GROSS FLOOR AREA (BCC) 2108x6 = 12,648 sqm



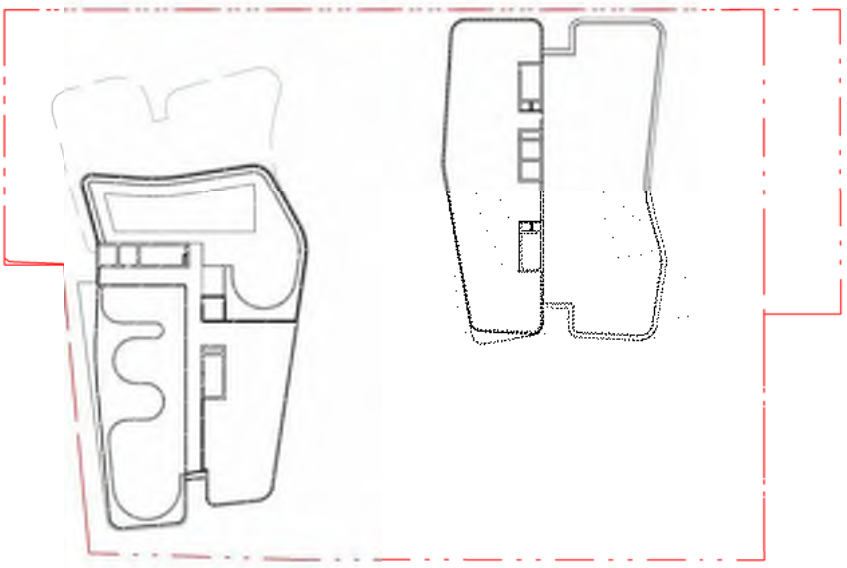
LEVEL 10

GROSS BUILDING AREA 2,610 sqm
GROSS FLOOR AREA (BCC) 1,784 sqm



LEVEL 11

GROSS BUILDING AREA 2,260 sqm
GROSS FLOOR AREA (BCC) 1,577 sqm



LEVEL 12 (Roof Terrace)

GROSS BUILDING AREA 1,173 sqm
GROSS FLOOR AREA (BCC) -

AREA SUMMARY

SITE INFORMATION

SITE AREA INCLUDING PROPOSED RESUMPTION
7,332 sqm

LEGEND

 GROSS FLOOR AREA (BCC DEFINITION)

DEVELOPMENT PROPOSAL

GROSS BUILDING AREA 68,010 sqm
GROSS FLOOR AREA (BCC) 28,952 sqm
PROPOSED PLOT RATIO 4

Revision			
REV	DESCRIPTION	DATE	INT.
A	Draft DA Issue	08.05.19	NA
B	Draft DA Set	25.11.19	NA
C	Draft DA Set	03.12.19	NA
D	DA Issue	18.12.19	NA

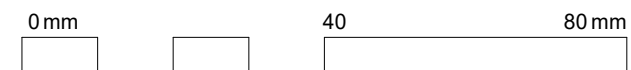
Client
MARKETPLACE DEVELOPMENTS

Project
Lamington Markets, Lutwyche

Drawing
Development Area Summary

A1 Scale As indicated
Project 14037
Issue D
Drawn Author
Drawing DA 61

Details
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Nominated Architect : Lawrence Toaldo NSW Reg. 10255.



DEVELOPMENT APPROVAL



Revision			
REV	DESCRIPTION	DATE	INT.
A	Concept Design	23.01.19	NA
B	Pre - Lodgement	14.03.19	NA
C	Tenancy Issue	20.03.19	NA
D	Draft DA Issue	08.05.19	
E	Draft DA Set	25.11.19	NA
F	Draft DA Set	03.12.19	NA
G	DA Issue	18.12.19	NA

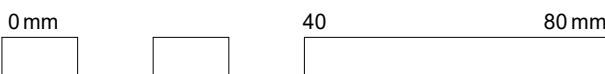
Client
**MARKETPLACE
DEVELOPMENTS**

Project
**Lamington Markets,
Lutwyche**

Drawing
**3D View - From
Lutwyche Road Looking
North Night**

A1 Scale
Project 14037
Issue G
Drawn Author
Drawing DA 90

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DEVELOPMENT APPROVAL



Revision			
REV	DESCRIPTION	DATE	INT.
A	Concept Design	23.01.19	NA
B	Pre - Lodgement	14.03.19	NA
C	Tenancy Issue	20.03.19	NA
D	Draft DA Issue	08.05.19	
E	Draft DA Set	25.11.19	NA
F	Draft DA Set	03.12.19	NA
G	DA Issue	18.12.19	NA

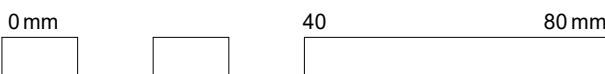
Client
**MARKETPLACE
DEVELOPMENTS**

Project
**Lamington Markets,
Lutwyche**

Drawing
**3D View - From
Lutwyche Road looking
North**

A1 Scale
Project 14037
Issue G
Drawn Author
Drawing DA 90

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Nominated Architect : Lawrence Toaldo NSW Reg. 10255.



DEVELOPMENT APPROVAL



Revision			
REV	DESCRIPTION	DATE	INT.
A	Pre - Lodgement	14.03.19	NA
B	Tenancy Issue	20.03.19	NA
C	Draft DA Issue	08.05.19	
D	Draft DA Set	25.11.19	NA
E	Draft DA Set	03.12.19	NA
F	DA Issue	18.12.19	NA

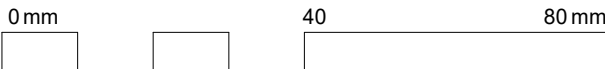
Client
**MARKETPLACE
DEVELOPMENTS**

Project
**Lamington Markets,
Lutwyche**

Drawing
**3D View - From
Lamington Avenue**

A1 Scale
Project 14037
Issue F
Drawn Author
Drawing DA 92

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DEVELOPMENT APPROVAL



Revision		
REV	DESCRIPTION	DATE INT.
A	Draft DA Issue	29.05.19 NA
B	Draft DA Set	25.11.19 NA
C	Draft DA Set	03.12.19 NA
D	DA Issue	18.12.19 NA

Client
MARKETPLACE DEVELOPMENTS

Project
Lamington Markets, Lutwyche

Drawing
3D View - From Lutwyche Road looking North Day

A1 Scale
Project 14037
Issue D
Drawn Author
Drawing DA 95

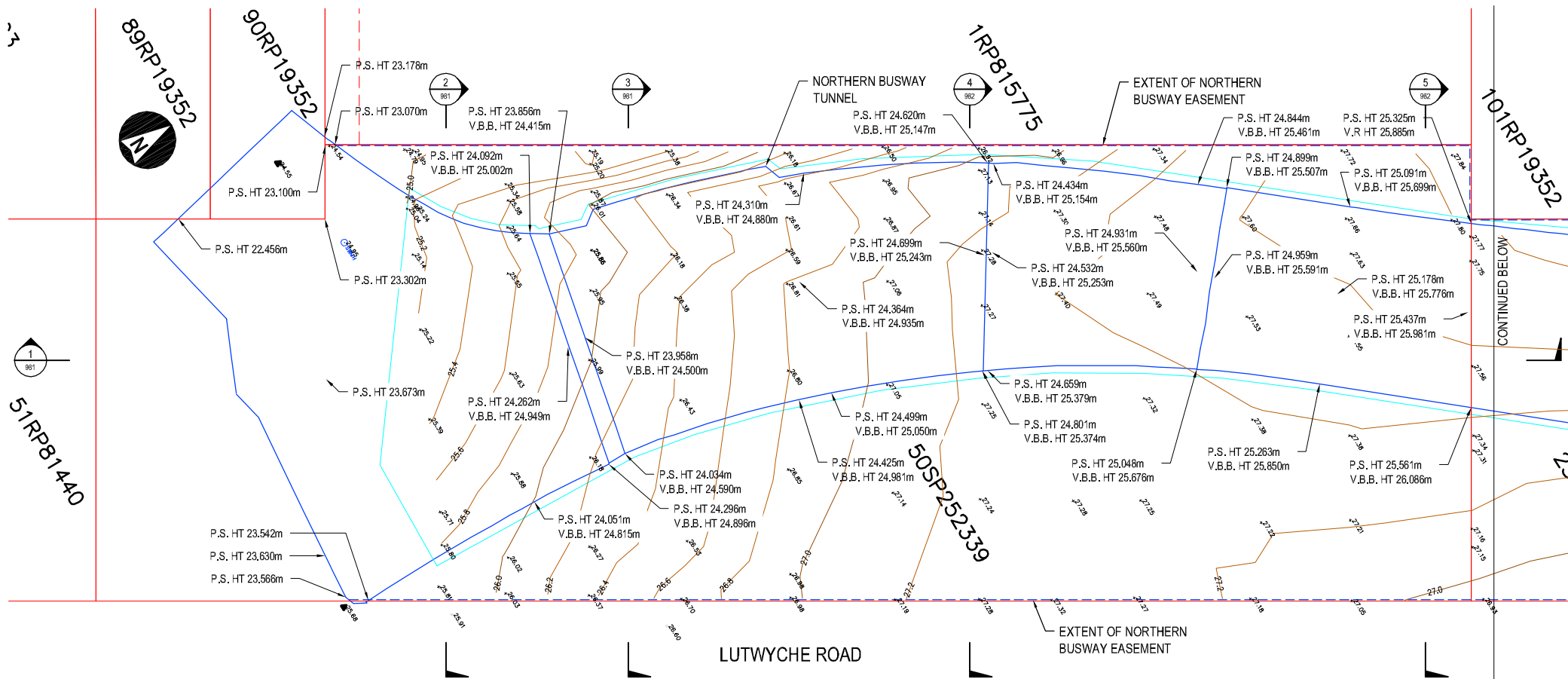
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Nominated Architect : Lawrence Toaldo NSW Reg. 10255.
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SCALE 1:1 mm

DEVELOPMENT APPROVAL

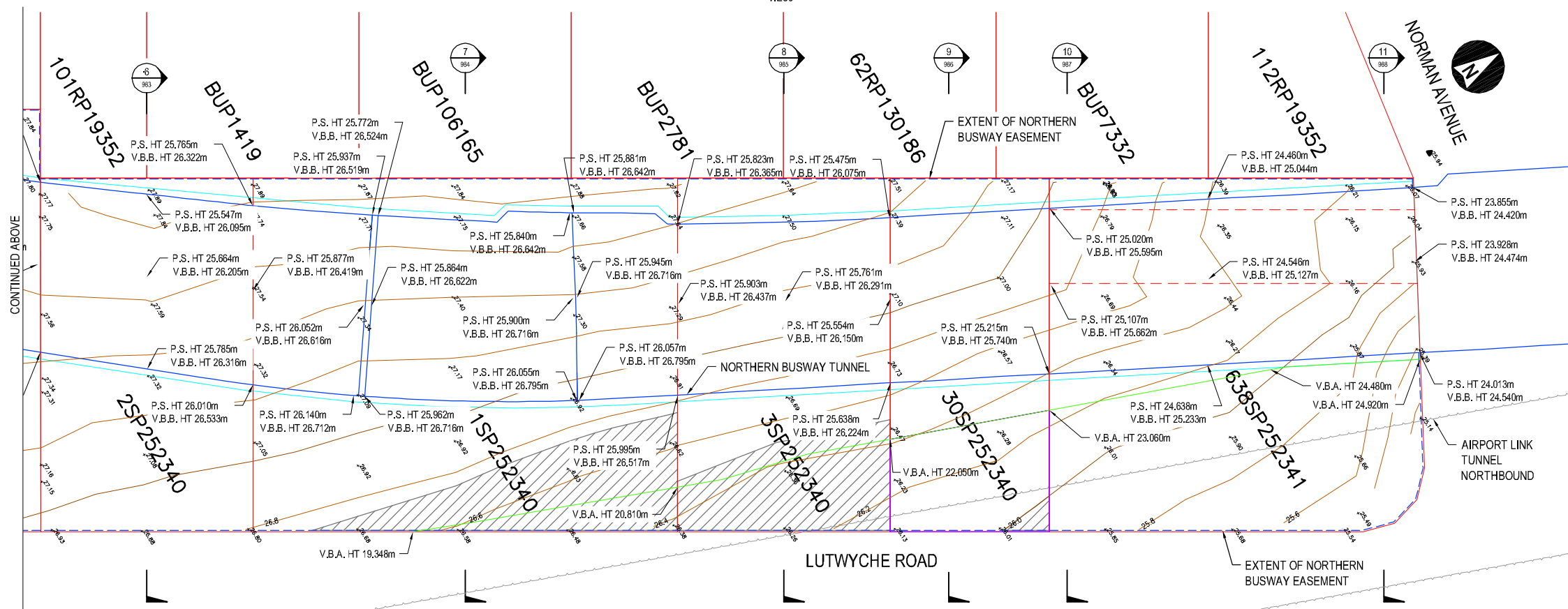
APPENDIX C

SURVEY





PLAN
1:250



PLAN - CONTINUED
1:250

- NOTES
1. ALL HEIGHTS ARE TO AHD.
 2. HEIGHTS OF THE EXISTING SURFACE, VOLUMETRIC BOUNDARY AND TUNNEL STRUCTURES VARY OVER THE EXTENT OF THE PROPERTY.
 3. THE PROFILE AND LOCATION OF THE AIRPORT LINK TUNNELS ARE BASED ON DESIGN INFORMATION ONLY. REFER TO AS-BUILT DRAWINGS FOR CONSTRUCTED LOCATION AND PROFILE.
 4. THIS SKETCH MUST BE READ IN CONJUNCTION WITH THE 'ENGINEERING SPECIFICATIONS (FOR AN EASEMENT LOCATED ABOVE AND ADJACENT TO THE NORTHERN BUSWAY CUT AND COVER TUNNEL)' FOR THE APPLICABLE LOT.
 5. DIMENSIONS SHALL NOT BE DETERMINED FROM THE SKETCH BY SCALING.
 6. DCDB LOT BOUNDARIES AND NUMBERS AS SUPPLIED BY DTMR.
 7. SURFACE CONTOURS ARE AS PER DRAWING NUMBER 6797 S 01 DT A.dwg AS SUPPLIED BY DTMR.

LEGEND

- P.S. - CUT AND COVER PROTECTION SLAB
V.B.B. - BUSWAY VOLUMETRIC BOUNDARY
V.B.A. - AIRPORT LINK TUNNELS VOLUMETRIC BOUNDARY
- APPROXIMATE AREA WHERE ALLOWABLE EXCAVATION IS ABOVE EXISTING SURFACE. REFER SECTIONS.
- EXISTING SURFACE SPOT HEIGHTS
- EXISTING SURFACE HEIGHT CONTOURS
- EASEMENT BOUNDARY
- DCDB PROPERTY BOUNDARIES
- NORTHERN BUSWAY CUT AND COVER STRUCTURE
- NORTHERN BUSWAY VOLUMETRIC BOUNDARIES
- AIRPORT LINK TUNNELS VOLUMETRIC BOUNDARIES

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

Rev.	Date	Revision Details	By	Ver.	App.
B	2/08/13	AIRPORT LINK VOLUMETRIC ADDED	JLP		
A	1/08/13	ISSUED FOR INFORMATION	JLP		

SKM Connell Wagner
JOINT VENTURE

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1. using the drawings and other data in electronic form without requesting and checking then for accuracy against the original hard copy versions;
2. using the drawings or other data for any purpose not agreed to in writing by SKM-CW JV

Client:

Queensland Government

Project:

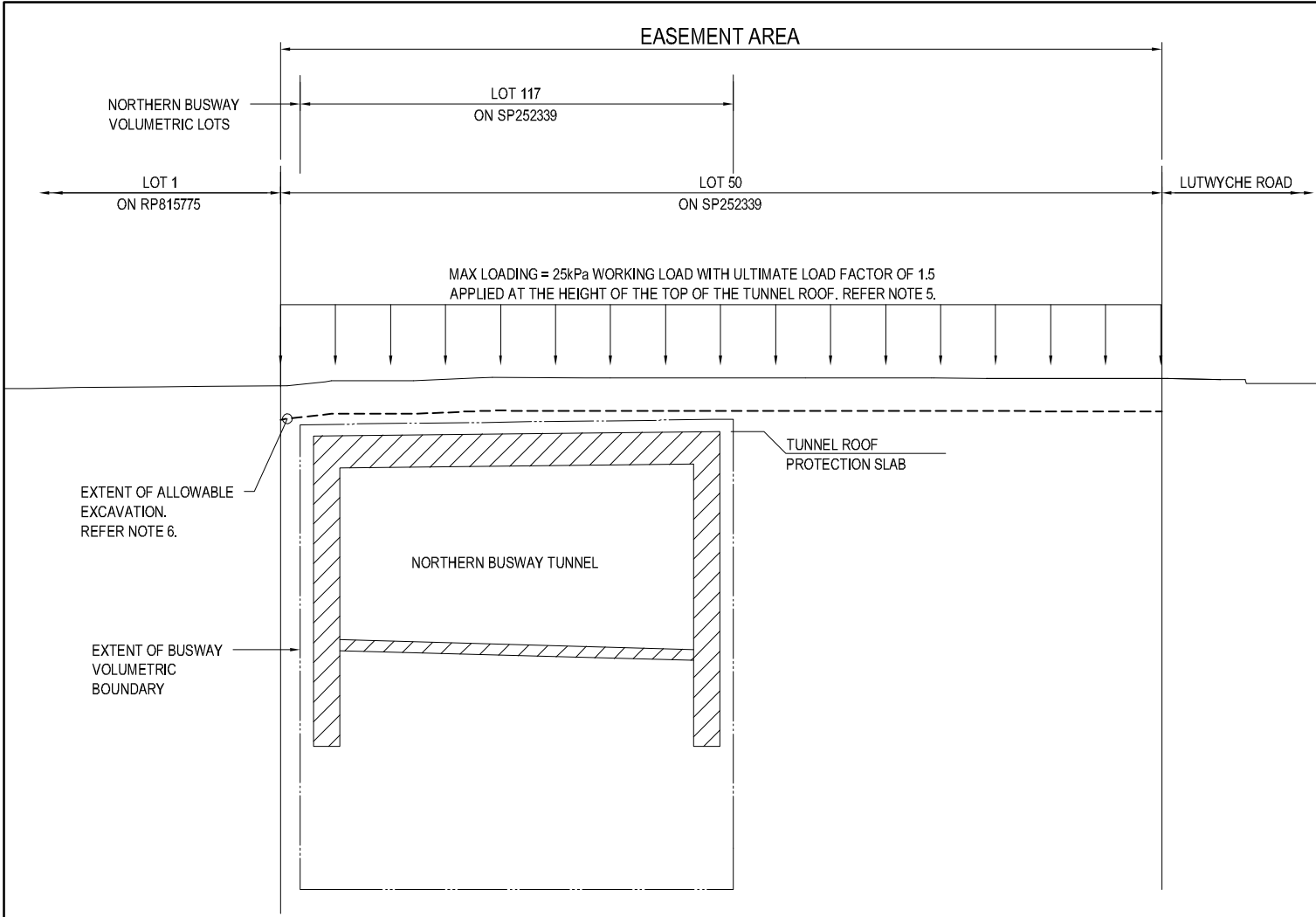
**NORTHERN BUSWAY PROJECT
(WINDSOR TO KEDRON)**

Drawn	Signed	Date
JLP	Signed	Date
Designed	Signed	Date
TP	Signed	Date
Verified	Signed	Date
	Signed	Date
Approved	Signed	Date
	Signed	Date

Drawing Title:

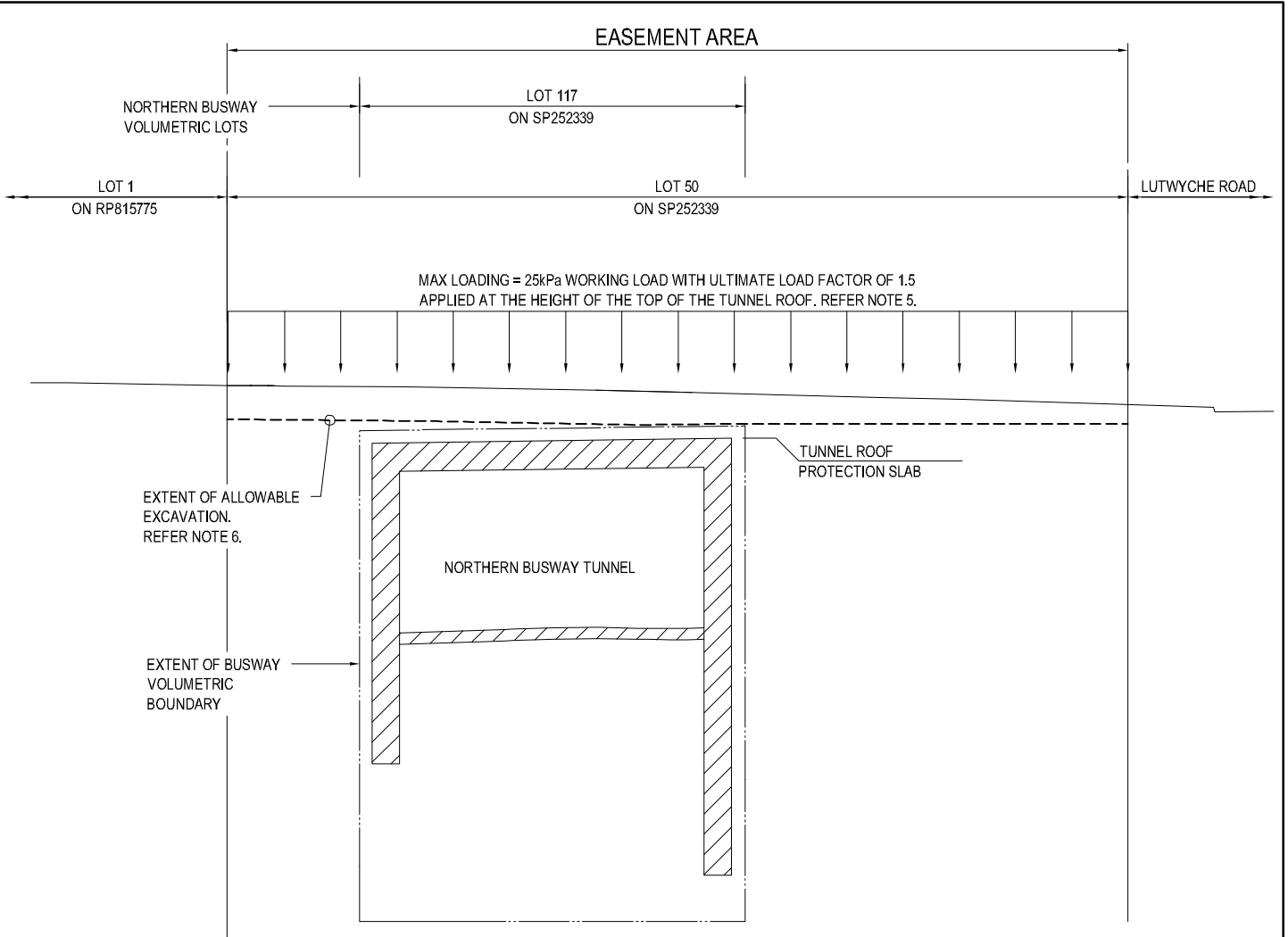
**LUTWYCHE WEST
LOADING AND UNLOADING CONDITIONS
PLAN**

Project No.	22904
Scale	1:250
Sheet Size	A1
Drawing No.	SK980
Rev.	B



LOT 50 ON SP252339
1:150

SECTION 4
1:150 980



LOT 50 ON SP252339
1:150

SECTION 5
1:150 980

NOTES

- ALL HEIGHTS ARE TO AHD.
- HEIGHTS OF THE EXISTING SURFACE, VOLUMETRIC BOUNDARY AND TUNNEL STRUCTURES VARY OVER THE EXTENT OF THE PROPERTY.
- THE PROFILE AND LOCATION OF THE AIRPORT LINK TUNNELS ARE BASED ON DESIGN INFORMATION ONLY. REFER TO AS-BUILT DRAWINGS FOR CONSTRUCTED LOCATION AND PROFILE.
- THIS SKETCH MUST BE READ IN CONJUNCTION WITH THE 'ENGINEERING SPECIFICATIONS (FOR AN EASEMENT LOCATED ABOVE AND ADJACENT TO THE NORTHERN BUSWAY CUT AND COVER TUNNEL)' FOR THE APPLICABLE LOT.
- THE MAX. LOADING WITHIN THE EASEMENT AREA IS PERMITTED IN ADDITION TO THE EXISTING SOIL LOADS BASED ON THE EXISTING SURFACE AS DEFINED BY THE EXISTING SURFACE SPOT HEIGHTS AND EXISTING SURFACE CONTOURS PROVIDED ON PLAN SK980 REV B.
- THE ALLOWABLE EXCAVATION HEIGHT IS BASED ON THE HIGHER OF:
 - 1500mm BELOW THE EXISTING SURFACE AS DEFINED BY THE EXISTING SURFACE SPOT HEIGHTS AND EXISTING SURFACE CONTOURS PROVIDED ON PLAN SK980 REV B OR,
 - THE TOP OF THE BUSWAY VOLUMETRIC BOUNDARY.
- WHERE THE EXCAVATION HEIGHT IS ABOVE THE EXISTING SURFACE THEN FILL WILL BE REQUIRED TO THIS HEIGHT. THE ASSOCIATED LOADING OF ANY FILL REQUIRED WILL BE PART OF THE MAX. LOADING ALLOWANCE.
- DIMENSIONS SHALL NOT BE DETERMINED FROM THE SKETCH BY SCALING.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

B	5/08/13	PLAN REFERENCE REVISED	JLP		
A	1/08/13	ISSUED FOR INFORMATION	JLP		
Rev.	Date	Revision Details	By	Ver.	App.



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Client:

Queensland Government

Project:

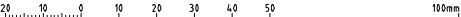
NORTHERN BUSWAY PROJECT
(WINDSOR TO KEDRON)

Drawn	Signed	Date
JLP		
Designed	Signed	Date
TP		
Verified	Signed	Date
Approved	Signed	Date

Drawing Title:

LOADING AND UNLOADING CONDITIONS
SCHEMATIC CROSS SECTIONS
LOT 50 ON SP252339 – SHEET 2 OF 2
VOLUMETRIC LOT 117

Project No.	22904
Scale	1:150
Sheet Size	A1
Drawing No.	SK982
Rev.	B

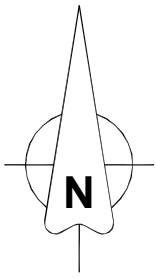


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APPENDIX D

ESC CALCULATIONS + EROSION HAZARD ASSESSMENT





IMPORTANT NOTE
THE TITLE BOUNDARIES AS SHOWN HEREON WERE NOT MARKED AT THE TIME OF SURVEY AND HAVE BEEN DETERMINED BY PLAN DIMENSIONS ONLY AND NOT BY FIELD SURVEY.
LOCATION OF SERVICES SHOWN HEREON ARE INDICATIVE ONLY. PRIOR TO DETAILED DESIGN, EXCAVATION OR CONSTRUCTION, THE RELEVANT AUTHORITY SHOULD BE CONTACTED FOR POSSIBLE LOCATION OF FURTHER UNDERGROUND SERVICES AND DETAILED LOCATIONS OF ALL SERVICES.
THIS NOTE IS AN INTEGRAL PART OF THIS PLAN.

CLIENT <div>MPH1 PTY LTD</div>			PLAN <div>SPOT HEIGHTS PLAN</div>			<div><div><div>RPS</div></div><div><div>© COPYRIGHT PROTECTS THIS PLAN Unauthorised reproduction or amendment not permitted. Please contact the author.</div><div><div>Local Authority B.B.C.</div><div>Plan A3</div><div>Plan Ref 120968-SS-1</div><div>Sheet 1 of 1</div></div></div></div> <div><div>RPS Australia East Pty Ltd ACN 140 292 762 ABN 44 140 292 762 Suite 4, Robina East Quay Corporate Park (North Building) 34-36 Glenferrie Drive, Robina PO Box 1048 Robina DC, Qld 4226 T+61 7 555 36900 F+61 7 555 36999 W rpsgroup.com.au</div></div>		
Level Datum	AHD	Date	19 December 2013			<div>over Lot 1 on SP252287 & Lot 50 on SP263291</div> <div>LUTWYCHE ROAD</div> <div>LUTWYCHE</div> <div>SCALE: 1:500 (A3)<div><div></div><div>5</div><div>0</div><div>5</div><div>10</div><div>15</div><div>20</div></div></div>		
Level Origin	PSM193017 RL 23.892	Surveyed	SPK					
		Drafted	BJB					
Data Origin	CS CGAD	Parish	ENOGGERA					
5999D001		County	STANLEY					

1. Erosion Hazard and Sediment Basins

Site Name:

Site Location:

Precinct/Stage:

Other Details:

Site area	Sub-catchment or Name of Structure						Notes
	1	2	3				
Total catchment area (ha)	0.3541	0.1424	0.2093				
Disturbed catchment area (ha)	0.3541	0.1424	0.2093				
Soil analysis (enter sediment type if known, or laboratory particle size data)							
Sediment Type (C, F or D) if known:							If known. Type D is worst-case.
% sand (fraction 0.02 to 2.00 mm)	40	40	40				Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)	20	20	20				
% clay (fraction finer than 0.002 mm)	40	40	40				
Dispersion percentage	20.0	20.0	20.0				E.g. enter 10 for dispersion of 10%
% of whole soil dispersible	10	10	10				Pg 3.15 (IECA, 2008)
Soil Texture Group	D	D	D				Automatic calculation from above
Rainfall data							
Rainfall R-factor (if known)							Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)	12.8	12.8	12.8				
RUSLE Factors							
Rainfall erosivity (R-factor)	3540	3540	3540				Auto-filled from above
Soil erodibility (K-factor)	0.025	0.025	0.025				RUSLE LS factor calculated for a high rill/interrill ratio. See Appendix E of IECA (2008)
Slope length (m)	104.5	40.2	53.9				
Slope gradient (%)	5.9	4	2.2				
Length/gradient (LS-factor)	1.69	0.63	0.39				
Erosion control practice (P-factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (C-factor)	1	1	1	1	1	1	
Calculations Erosion Hazard							
Soil loss (t/ha/yr)	195	73	44				
Soil Loss Class	2	1	1				Pg 3.4 (IECA, 2008)
Soil loss (m ³ /ha/yr)	150	56	34				Conversion to cubic metres - assumes 1.3 t/m ³
Is a Basin Required?	Yes	No	No	No	No	No	Refer to Table B1 Pg B.6 (IECA, 2018)
Sediment Basin Type							
Soil/Catchment Details							
Duration of soil disturbance	< 12 months	< 12 months	< 12 months				<70% effective ground cover (C ≥ 0.05)
Is the soil coarse?	No	No	No				< 33% finer than 0.02mm & ≤ 10% dispersive
Are WQOs likely to be met by Type C basin?	Yes	Yes	Yes				Particle settlement testing is recommended
Is automated dosing reasonable or practicable?	Yes	Yes	Yes				Does physical layout allow forebay inflow?
Required Basin Type	B	N/A	N/A	N/A	N/A	N/A	Refer to Table B2 Pg B.7 (IECA, 2018)

2. Sediment Basin Type B

Basin Name	Sub-catchment or Name of Structure					Notes
	1a	1b	1c	1d	1e	
Catchment Area (ha)	#N/A	#N/A	#N/A	#N/A	#N/A	Must be same as site area on Worksheet 1
Peak Flow Calculation	Q = C x I x A / 360					Total catchment area - autofilled from Worksheet 1
Peak 1 year flow - Q1 (m ³ /s)	0.137	0.137	0.137	0.137	0.137	Peak Q1 flow
0.5 x Q1 flow (m ³ /s)	0.069	0.069	0.069	0.069	0.069	Half Q1 flow
Settling Zone Dimensions						
Length to width ratio X : 1	3	3	3	3	3	3:1 recommended
Batter slope (1 in X)	2	2	2	2	2	Table B4 (IECA). Max 1V:2H. If accessible by public < 1V:5H
Option 1B	Calculates minimum settling pond surface area (As) and depth (Ds)					
Jar test settlement rate after 15 mins (mm)	50	75	100	150	200	See Table B17, pg B.26. Jar test as per Pg B.83 (IECA, 2018)
Sediment settlement coeff. - Ks (s/m)	24000	16000	12000	8000	6000	Refer Table B17, page B.26 (IECA, 2018)
Minimum surface area - As (m ²)	1644.0	1096.0	822.0	548.0	411.0	Minimum required 'average' surface area as per Eqn B19
Minimum settling depth - Ds (m)	0.50	0.50	0.50	0.68	0.90	Refer to Table B17, page B.26 (IECA, 2018)
Critical settling zone length - L _s (m)	180	120	90	81	81	Refer to Table B17, page B.26 (IECA, 2018)
Approx. width of basin - Ws (m)	23.4	19.1	16.6	13.5	11.7	Average only - confirm with earthworks design software
Approx. length of basin (m)	70.2	57.3	49.7	40.5	35.1	Average only - confirm with earthworks design software
Check Ls is less than critical	OK	OK	OK	OK	OK	Supernatant velocity will not resuspend settled sediment if basin length is less than Ls. Use Large Basin design if length > Ls
Large Basin Design - 1B	Large basins require a different sizing based on reducing supernatant velocity. If above method does not satisfy Ls requirements use method below					
Large basin - Ds (m)						The depth Ds or width Ws must be increased to limit the supernatant velocity for large basins. Refer Equation B22 (IECA)
Large basin width - Ws (m)						
Large basin length (m)						
Large basin length (m)						Assumes 3:1 length to width ratio
Sediment Storage Zone (SS)						
Soil loss (t/ha/yr)	#N/A	#N/A	#N/A	#N/A	#N/A	Calculated on worksheet 1
Sediment density (t / m ³)	1.3	1.3	1.3	1.3	1.3	Generally saturated sediment has a density of 1.3 t / m ³
Soil loss (m ³ /ha/yr)	#N/A	#N/A	#N/A	#N/A	#N/A	Based on sediment density above
Put an X here for 30% of water zone	X	X	X	X	X	Fill in one or the other - either an X or nominate the number of months. Refer to Page B.40 (IECA, 2018)
Storage (soil) zone design (months)						
Basin storage (soil) volume (m ³)	247.0	164.0	123.0	112.0	111.0	Refer to Page B.40 (IECA, 2018)
Summary of Type B Basin Dimensions						
Basin Name	1a	1b	1c	1d	1e	
Adopted basin type	Option 1B	Option 1B	Option 1B	Option 1B	Option 1B	
Settling zone surface area - As (m ²)	1644.0	1096.0	822.0	548.0	411.0	
Depth of settling zone - Ds (m)	0.5	0.5	0.50	0.68	0.90	
Settling zone volume - Vs (m ³)	822.0	548.0	411.0	372.6	369.9	
Basin storage (soil) volume (m ³)	247.0	164.0	123.0	112.0	111.0	30% of V _{ss} or x months storage. See pg B.40 (IECA, 2018)
Total basin volume to spillway level (m ³)	1069.0	712.0	534.0	484.6	480.9	



Erosion Hazard Assessment - June 2014

Brisbane City Council (BCC), *Erosion Hazard Assessment* form must be read in conjunction with the *Erosion Hazard Assessment- Supporting Technical Notes* (June 2014 or later version) for explanatory terms and Certification information.

What is an Erosion Hazard Assessment?

Soil erosion and sediment from urban development, particularly during construction activities, is a significant source of sediment pollution in Brisbane's waterways. The Erosion Hazard Assessment determines whether the risk of soil erosion and sediment pollution to the environment is 'low', 'medium' or 'high'.

When is the EHA required?

An *Erosion Hazard Assessment* form must be completed and lodged with BCC for any Development Application (ie MCU or ROL) that will result in soil disturbance OR Operational Works or Compliance Assessment Application for 'Filling' or Excavation.

Failure to submit this form during lodgement of an application may result in assessment delays or refusal of the application.

Privacy Statement

The personal information collected on this form will be used by Brisbane City Council for the purposes of fulfilling your request and undertaking associated Council functions and services. Your personal information will not be disclosed to any third party without your consent, unless this is required or permitted by law.

Assessment Details

1 Please turn over and complete the erosion hazard assessment.

2 Based on the erosion hazard assessment overleaf, is the site:

☐ A 'low' risk site

Best practice erosion and sediment control (ESC) must be implemented but no erosion and sediment control plans need to be submitted with the development application. Factsheets outlining best practice ESC can be found at <http://www.waterbydesign.com.au/factsheets>

☒ A 'medium' risk site

If the development is approved, the applicant will need to engage a Registered Professional Engineer (RPEQ) or Certified Professional in Erosion and Sediment Control (CPESC) to prepare an ESC Program and Plan and supporting documentation — in accordance with the requirements of the Infrastructure Design Planning Scheme Policy.

☐ A 'high' risk site

If the development is approved, the applicant will need to engage a RPEQ and CPESC to prepare an ESC Program and Plan and supporting documentation — in accordance with the requirements of the Infrastructure Design Planning Scheme Policy. The plans and program will need to be certified by a CPESC.

3 Site Information and Certification

Application number (if known)

Site address

612 Lutwyche Road
Lutwyche QLD 4030

Postcode

I certify that:

- ☒ I have made all relevant enquiries and am satisfied no matters of significance have been withheld from the assessment manager.
- ☒ I am a person with suitable qualifications and/or experience in erosion and sediment control.
- ☒ The Erosion Hazard Assessment was completed in accordance with the Erosion Hazard Assessment Supporting Technical Notes and the BCC Infrastructure Design Planning Scheme Policy.
- ☒ The Erosion Hazard Assessment accurately reflects the site's overall risk of soil erosion and sediment pollution to the environment.
- ☒ I acknowledge and accept that the BCC, as assessment manager, relies, in good faith, on this certification as part of its development assessment process and the provision of false or misleading information to the BCC constitutes an offence for which BCC may take punitive steps/ action against me/ enforcement action against me.

Certified by Print name

STEFAN SPIRIG

Certifier's signature

Date

13/12/2019

Table 1: Low Risk Test

		Yes	No
1.1	is the area of land disturbance > 1000 m ²	<input type="checkbox"/>	<input checked="" type="checkbox"/>
1.2	does any land disturbance occur in a BCC mapped waterway corridor	<input type="checkbox"/>	<input checked="" type="checkbox"/>
1.3	is there any slope on site (longer than three metres in length) before, during or after construction that is steeper than 5%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
1.4	does any land disturbance occur below 5 m AHD	<input type="checkbox"/>	<input checked="" type="checkbox"/>
1.5	does development involve endorsement of a staging plan	<input checked="" type="checkbox"/>	<input type="checkbox"/>
1.6	is there an upstream catchment passing through the site > 1 hectare	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Have you answered 'yes' to any of the questions in Table 1?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

If 'No' then site is low risk with respect to erosion and sediment control

If 'Yes' then proceed to Table 2

Table 2: Medium Risk Test

		Yes	No
2.1	is the area of land disturbance > 1 hectare	<input type="checkbox"/>	<input checked="" type="checkbox"/>

If 'No' then site is medium risk with respect to erosion and sediment control

If 'Yes' then proceed to Table 3

Table 3: High Risk Test

3.1	is there an upstream catchment passing through the site > 1 hectare	<input type="checkbox"/>	<input type="checkbox"/>
3.2	does any land disturbance occurs in a BCC mapped waterway corridor	<input type="checkbox"/>	<input type="checkbox"/>
3.3	is there any slope on site (longer than three metres in length) before, during or after construction that is steeper than 15%	<input type="checkbox"/>	<input type="checkbox"/>

Have you answered 'yes' to any of the questions in Table 3?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

If 'No' then site is medium risk with respect to erosion and sediment control

If 'Yes' then site is high risk with respect to erosion and sediment control

APPENDIX E

GEOTECHNICAL REPORT





Douglas Partners
Geotechnics | Environment | Groundwater

Report on
Geotechnical Investigation

Proposed Mixed Use Development
33 to 57 Lamington Avenue and 612 Lutwyche Road,
Lutwyche

Prepared for
Kane Constructions Pty Ltd

Project 87424.00
February 2016

Integrated Practical Solutions





Douglas Partners

Geotechnics | Environment | Groundwater

Document History

Document details

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Report prepared for	Kane Constructions Pty Ltd		
File name	P:\87424.00 - LUTWYCHE, Proposed Mixed Use Development\8.0 Documents\87424.00.R.001.doc		

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0	1	0	D Laycock, Kane Constructions Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this report, but excluding any information provided by others, has been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		8 February 2016
Reviewer		8 February 2016



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Report on Geotechnical Investigation

Proposed Mixed Use Development

33 to 57 Lamington Avenue and 612 Lutwyche Road, Lutwyche

1. Introduction

This report presents the results of a geotechnical investigation carried out for a proposed mixed use development to be located at 33 to 57 Lamington Avenue and 612 Lutwyche Road, Lutwyche. The investigation was undertaken at the request of Mr David Laycock of Kane Constructions Pty Ltd, the project builder.

It is understood that the proposed development will comprise a six storey mixed building over a two to three level in-ground basement car park. The aim of this report, as outlined in DP's Proposal BNE150645 dated 25 June 2015, was to assess the conditions at the site in order to provide comments on:

- subsurface conditions, including groundwater (if encountered);
- excavation conditions and suitable excavation methods;
- earthworks requirements, re-use of excavated materials and temporary batter slopes;
- basement retention options and geotechnical basement retaining wall design parameters (comprising unit weight, active, passive and at rest earth pressure coefficients, ultimate passive pressures in rock),
- soil and rock anchor design parameters, comprising preliminary bond stresses and pull-out profiles;
- groundwater conditions and design requirements to address same;
- suitable spread footing options, maximum allowable bearing pressures and estimated settlements (if appropriate);
- suitable pile footing options, ultimate end bearing and shaft adhesion pressures for axially loaded piles in compression;
- assessment of site sub-soil class to AS1170.4-2007 Part 4 (Ref. 1) within the depths drilled; and
- site erosion potential.

The investigation comprised the drilling and sampling of five bores, laboratory testing, engineering analysis and reporting. Details of the field work and laboratory testing are presented in this report together with comments and recommendations on the items listed above.

This report must be read in conjunction with the notes entitled '*About This Report*' in Appendix A and other explanatory notes, and should be kept in its entirety without separation of individual pages or sections.

2. Site Description

The development site is located at 33 to 57 Lamington Avenue and 612 Lutwyche Road, Lutwyche, as indicated on Drawing 1 in Appendix B. The site is an irregular shaped area measuring approximately 73 m by 120 m and is dissected by the Northern Busway Tunnel. The Lutwyche Bus Station is located on the southern side of the site, and residential properties adjoin the northern side.

At the time of the investigation, the eastern half of the site was vacant, and has remained so since the construction of the Northern Busway Tunnel was completed beneath it in late 2011. The western half of the site is mostly occupied by two blocks of residential units which are three storeys high and of brick construction with concrete car parking along the eastern side. An elevated weatherboard cottage and surrounding gardens is located at 57 Lamington Avenue, and 33 and 35 Lamington Avenue were lawn areas adjacent to the busway portal.

The eastern half of the site slopes down towards the south-east from approximately RL 27.5 m to RL 25.5 m along the north-eastern boundary. The western half of the site has slightly more cross fall, falling from about RL 26.5 m to RL 18.0 m. A 1.5 m high retaining wall separates the southernmost unit block building from the vacant portion of the site.

Some photographs of the site at the time of the investigation are presented below as Figures 1 and 2.



Figure 1: Drilling rig on Bore 2 in southwestern corner of site (bus station in background)



Figure 2: Drilling rig on Bore 3 in northern portion of the site (northern unit block behind fence)

A series of historical aerial photographs for the site (from Nearmap) are presented in Figures 2 to 7 below. The eastern portion of the site was resumed from a previous commercial usage prior to 2008 and the Northern Busway was constructed as part of the Airport Link project. It appears that in late 2010 the tunnel was excavated after two rows of contiguous piles were installed to form the walls, then a roof structure was constructed. From the photographs shown below, it doesn't appear that the site was excavated substantially beyond the extent of the tunnel.



Figure 3: Aerial photograph on 21 November 2009 (from Nearmap, site shown in red outline)

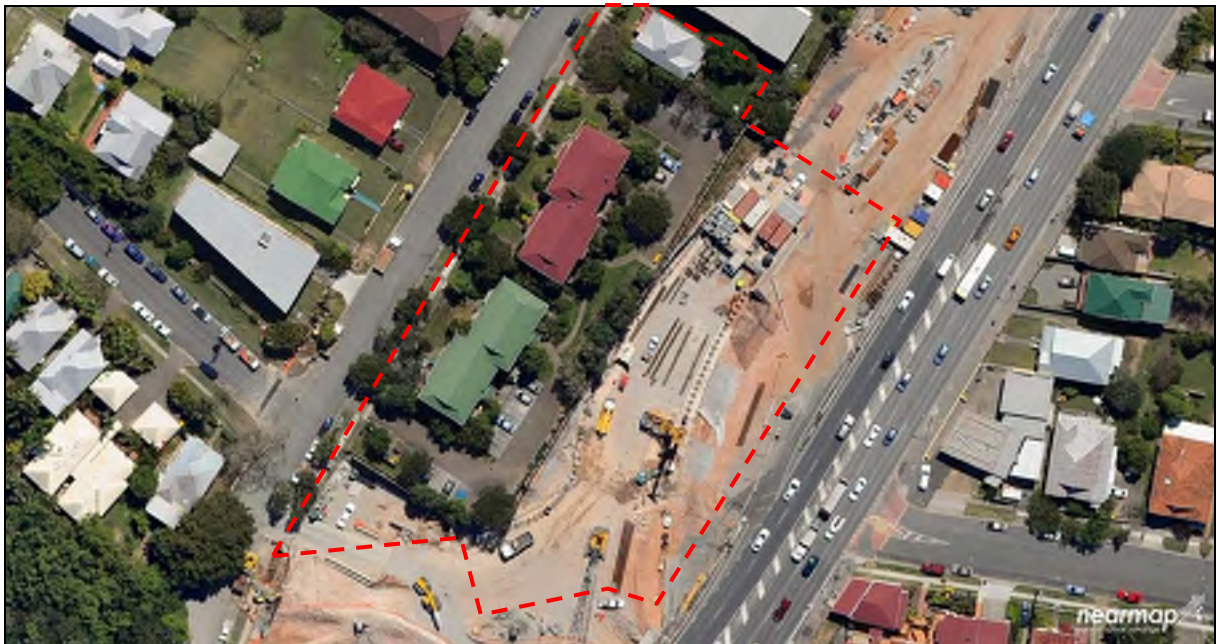


Figure 4: Aerial photograph on 12 September 2010 (from Nearmap)



Figure 5: Aerial photograph on 14 January 2011 (from Nearmap)



Figure 6: Aerial photograph on 2 March 2012 (from Nearmap)



Figure 7: Aerial photograph on 12 January 2016 (from Nearmap)

3. Regional Geology

The Geological Survey of Queensland's 1:100,000 series 'Brisbane Sheet' indicates that the site is underlain by the Late Triassic aged Brisbane Tuff, typically comprising "ignimbrite, stratified and massive rhyolitic tuff, conglomerate, sandstone, scree breccia".

The residual soil and tuff encountered during the field work are generally consistent with the published geology.

4. Field Work Methods

The field work was undertaken between 19 and 25 November 2015 and comprised the drilling of five bores (designated Bores 2 to 6). Bore 1 was abandoned due to a lack of access for the drilling rig and will be drilled at a later date. The bores were drilled to between 18.0 m and 25.25 m depth using a truck-mounted Hydrapower Scout drilling rig, initially by continuous solid flight auger techniques to 2.5 m depth. Temporary steel casing was then installed and the bores were advanced by rotary washbore and NMLC rock coring techniques to the termination depths.

Standard penetration tests (SPTs) were carried out at 1.5 m intervals from 1.0 m depth to provide an indication of soil strength consistency/relative density and to collect samples for visual identification and laboratory testing. On completion of drilling, and after checking for groundwater, Bores 3 to 6 were backfilled with drill spoil and capped with rapid set concrete. Bore 2 was plugged at 6 m depth then a hand-slotted 50 mm DWV PVC standpipe piezometer was installed for future groundwater monitoring. The piezometer was bailed dry at the time of the field work.

The test locations were determined with reference to existing site features, and the approximate locations are indicated on Drawing 1 in Appendix B. Ground surface levels were interpolated from a client supplied survey drawing (Lawson Surveys Pty Ltd Drawing Reference 18439 dated 23 October 2015).

The field work was supervised by a geotechnical engineer who positioned and logged the bores, and also collected samples for visual and tactile assessment and for laboratory testing purposes.

5. Field Work Results

The subsurface conditions encountered in the bores are described in detail on the borehole logs in Appendix C. These should be read in conjunction with the notes entitled 'About This Report' and other explanatory notes in Appendix A which describe sampling methods, soil and rock descriptions, symbols and abbreviations used in their preparation.

The subsurface conditions encountered in the bores can be summarised as follows:

- **Filling:** Filling comprising medium dense to dense silty sand and stiff gravelly clay was encountered in Bores 2, 4, 5 and 6 to between 0.5 m and 1.5 m depth.
In the absence of documentation to prove otherwise the filling is assumed to be 'uncontrolled'.
- **Residual Soils:** Stiff to very stiff then very stiff and hard silty clay, sandy clay, clayey silt, silty sandy clay and gravelly sandy clay, and medium dense clayey sand residual soils were encountered below the filling to between 3.9 m and 16.5 m depth.

- **Tuff:** Extremely low strength or very low strength tuff was then encountered and increased to predominantly high and very high strength within 1.0 m to 3.1 m penetration. The rock increased to very high strength below 9.5 m and 4.3 m depth in Bores 1 and 2 respectively. The rock was generally fresh stained, with some slightly weathered and fresh bands, and slightly fractured with some relatively extensive unbroken zones.

Free groundwater was not encountered during auger drilling in the bores and the use of water as a drilling fluid generally precluded observation of groundwater thereafter. The standpipe piezometer installed in Bore 2 was dipped for groundwater on 26 November 2015 and groundwater was observed at 12.4 m depth (RL 7.6 mAHD). The drilling fluid was also purged from Bore 5 at the completion of drilling and groundwater recovered to 10.8 m depth (RL 14.4mAHD). It should be noted that groundwater depths are affected by climatic conditions and soil and rock permeability and will therefore vary with time.

6. Laboratory Testing

Geotechnical laboratory testing was conducted on samples collected from the bores and comprised:

- Atterberg limits and linear shrinkage testing was carried out on samples of silty clay recovered from Bores 2 and 3; and
- Emerson class number tests for dispersion and soil pH were undertaken on a disturbed samples from Bores 2 and 3 to determine the soils' potential for erosion as detailed in Brisbane City Council's Erosion Hazard Assessment Technical Notes (Ref. 2).

The results of the laboratory tests are given in Appendix D and are summarised below.

Table 1: Results of Plasticity Testing

Bore	Depth (m)	Description	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
2	1.0-1.45	Silty clay	15.5	49	20	29	13.5
3	1.0-1.45	Silty clay/sandy clay	12.5	43	17	26	11.5

Table 2: Summary of Dispersion and pH Test Results

Bore	Depth (m)	Description	Emerson Class No.	Potential for Erosion (from Ref. 2)	pH
2	1.0-1.45	Silty clay	4	'Moderate'	5.1
3	1.0-1.45	Silty clay/sandy clay	4	'Moderate'	3.6

Selected lengths of rock core recovered from the bores were tested in the laboratory for point load index (I_s), both in axial and diametral orientations, to assess intact rock strength. The results [corrected to I_{s50}] are given on the borehole log report sheets and are in the range 1 MPa to 10 MPa, generally indicating high to very high strength rock. Some slightly lower and higher results were obtained which are considered to be slight variations on the above, and visual and tactile assessment was used in connection with the testing to further assess the validity of such results and descriptions were adopted as considered appropriate.

7. Proposed Development

It is understood that the proposed development will comprise three buildings generally constructed from a two to three storey podium level. The main building will be mixed commercial and residential and up to 11 storeys high (including the podium) over up to five levels of basement car parking. Two smaller residential buildings will be constructed adjacent to the western and northern boundary of the site, west of the busway tunnel, and be either four or five storeys high above the podium level.

It is anticipated that the buildings will be reinforced concrete framed structures with suspended concrete floors and walls. From similar type developments, column loads for the main mixed commercial and residential part of the development are anticipated to be in the order of 8000 kN to 10 000 kN (working) at lowest basement level.

The most significant basement will be limited to the western side of the busway, with between 12 m and 18 m depth of excavation required below existing site levels to achieve a lowest basement floor level of RL 10.2 mAHD (anticipated bulk excavation level (BEL) of RL 9.9 mAHD). Apart from the lowest basement level, it is understood that the basement excavation will extend close to the boundaries on the western side of the busway tunnel. A smaller, more localised basement excavation will also be constructed on the eastern side of the tunnel for cinemas, with a proposed lower floor level of RL 21.4 mAHD resulting in an approximately 7 m depth of excavation. Locally deeper excavations are expected to be necessary for confined excavations (i.e. lift shaft, pad footings, etc.).

Supplied cross-sections of the proposed development indicate that the lowest basement level is approximately 4.5 m below the tunnel invert level, although from the supplied plans the location of this cross-section is not clear.

The highest part of the building will be on the eastern side of the busway tunnel, where construction will be from existing ground level.

8. Comments

8.1 Appreciation of Ground Conditions

The subsurface conditions encountered in the bores generally comprised variable depths of filling then residual soils comprising stiff to very stiff then very stiff and hard clays and medium dense clayey sands over extremely low strength tuff, which grades to predominantly high and very high strength within about 3 m of penetration.

Monitoring of the standpipe in Bore 2 and in Bore 5 while it remained open indicates that free groundwater at the site is between RL 7.6 m and RL 14.4mAHD, which is within the high and very high strength tuff. Groundwater inflow is generally expected to be minor in the longer term, although slightly higher inflows can occur through open joints initially and therefore will need to be considered in the design of basement walls and on-ground floor slabs.

Due to the subsurface conditions encountered and the need to excavate close to the boundaries on the western side of the busway site, there will be implications for the design and construction of the building basement on this site, as follows:

- excavatability of rock;
- control of vibrations and movement;
- stability of excavated faces during construction; and
- stability of adjoining building (to the north) and the busway tunnel during construction.

8.2 Site Classification

The site classification in accordance with AS 2870 (Ref. 3) would be 'Class P', due to the presence of 'uncontrolled' filling. As a general guide for information purposes, it is anticipated that characteristic surface movements at the site would probably be about 20 mm, which would be consistent with a 'Class M' site if the 'uncontrolled' filling did not exist.

8.3 Basement Construction

Excavation in the order of 12 m to 18 m generally will be required below existing site levels to achieve the BEL of RL 9.9 mAHD. It is understood that the line of the excavation will extend close to the site boundaries for all but the lowest basement level. The need to maintain stability of the excavation faces and of the adjacent tunnel, building to the north, and footpaths and in-ground services will impact on the method of construction adopted.

The close proximity of the basement walls to the site boundaries effectively negates the option of battering to ensure short term stability of excavation faces.

The upper soil and extremely low strength rock was indicated to extend to between 7.0 m and 16.0 m depth on the western side of the tunnel which will generally need to be retained by an anchored or propped in-situ retaining wall prior to excavation of the site.

8.3.1 Positive Support

Positive excavation support will be required prior to excavation of the site to minimise ground movements behind the excavation faces and to ensure the risk of damage to adjoining structures, roadways and in-ground services is minimised as a result of basement construction.

Contiguous pile walls are considered to be the most suitable means of providing positive excavation support for the excavation on the western side of the busway tunnel. Deadman anchors will probably be required on the eastern side of the busway tunnel to restrain piles along this face and rock anchors installed as excavation progresses are suggested on the remaining sides to minimise movements in retaining walls. Further comments on these systems are given below.

8.3.1.1 Pile Walls

The bored piles should socket into high to very high strength tuff below the base of the excavation to provide toe restraint and some overturning moment fixity, although consideration may be given to terminating the piles above the base of the excavation on the sides that don't adjoin the tunnel. This would require penetration of the high to very high strength tuff, with additional anchoring provided for toe restraint and moment fixity. Below the toe of these piles, a regular grid of prestressed cable-type rock anchors and/or spot bolting would be necessary to minimise excavation movements. Locally pinned/anchored shotcrete and mesh will still be required over any clay seams and highly fractured zones in the rock, to reduce the likelihood of local instability of the faces between the anchors. Excavation should only proceed in maximum 1.5 m lifts, so adversely dipping joints, highly fractured zones and clay seams are identified and appropriate support measures may be advised by a geotechnical professional.

Soldier piles may also be considered as an alternative to contiguous piles where the risk of damage associated with movement or loss of retained soil from between the piles is not as critical, although it should be noted that soldier piles are considered unacceptable adjacent to the tunnel. Soldier piles can be typically spaced at up to about three pile diameter centres.

It should be noted that the ability to drill bored piles in rock is not only dependent on the characteristics of rock (strength, fracture spacing etc.) but also the type of drilling rig (especially rotation torque and weight or crowd force) and the diameter of piles. Bored pile installation in high strength or stronger tuff will require the use of a heavy hydraulic rotary piling rig with torque in excess of 220 kNm such as those operated by experienced piling contractors. Slow drilling penetration rates and high bit wear should be allowed for in piling tenders. Specialist techniques such as rock coring buckets, rock augers or pilot hammer holes through a base template may be required to drill sockets in the very high strength tuff. It is recommended that the drilling contractors assess the size of equipment required on the basis of the logs and inspection of the rock core samples.

Once the piles are installed, excavation should proceed in 1.5 m to 2 m vertical height lifts, with anchors (and also strip drains mesh and shotcrete for soldier piles) installed prior to proceeding with the next lift.

8.3.1.2 Rock Anchors

Typically anchors would be spaced on a regular grid of 2 m to 3 m both horizontally and vertically to support piles and excavated faces in such an excavation. It is assessed that on this site spot bolting may be able to replace the regular grid of anchors where rock strength and fracturing are favourable below the upper piles (subject to further assessment at the time of construction).

An ultimate bond stress of 3000 kPa is suggested for the design of rock anchors and rock bolts bonding in high to very high strength tuff. This bond stress should be divided by a factor of safety of 2 to assess suitable working bond stress in the design of fixed anchor lengths. Higher bond stresses may be feasible in the very high strength tuff, however the extent of this material was slightly variable. It would be more appropriate for anchoring contractors to assess the strength of rock during drilling and select design bond stresses on the basis, provided that appropriate load testing is carried out to verify the selected parameters.

For the conditions indicated by the investigation, the preparation of all temporary anchors at the site should also include:

- a free length equal to their height above the base of the excavation (this includes anchors for lower wall panels);
- a minimum bond length of 3 m;
- a maximum bond length of 10 m (unless specialist single bore multi-anchored systems are adopted);
- test loading up to 130% of the working load with checks for any creep or loss of load and the resistance to uplift on an inverted cone of rock with a base angle of 90° as indicated in Figure B3, Appendix B of AS 4678 (Ref. 4), with lock-off at 90% of the working load.

Determination of anchor spacing and lengths is a matter for detailed design, DP can assist with this design if required.

8.3.1.3 Wall Design Pressures

Walls supported by multiple rows of anchors or props could be designed using a rectangular earth pressure distribution of $0.3\gamma H$ kPa over the full height of the wall, where H is the total vertical height of the wall in metres and γ is the bulk unit weight of the soil and rock retained. Suggested bulk unit weight values for soil and tuff are 20 kN/m^3 and 24 kN/m^3 respectively. It is probable that the actual earth pressures will be lower at the top and toward the base of the walls. DP should be contacted if further details are required.

Surcharge loadings bearing in soil and rock should be multiplied by lateral coefficients of 0.3 and 0.15 respectively to calculate the resulting additional lateral pressure on the walls.

Adequate drainage will need to be provided behind temporary shoring and/or permanent walls (for 'drained' basement) holes to ensure water pressure does not build up behind these walls.

8.3.2 Excavatability

Excavation of filling, residual soils and extremely low to very low strength tuff should be readily achieved using conventional earthmoving plant (i.e. 30 tonne hydraulic excavator, drott etc.). Where high strength or stronger, slightly fractured rock is encountered large excavators with heavy rock breakers (i.e. 75 to 80 tonne excavators with 5 tonne hammers) will be required, however slow production rates would be expected. Blasting would increase production rates, however on this site blasting is unlikely to be deemed acceptable by the adjoining tunnel asset owner due to the potential for vibration affecting this structure.

Diamond blade rock saws will probably be suitable for detailed excavation for (say) pad footings or lift over-run pits at the base of the bulk excavation to control excavation overbreak and also for the corners of the excavation. Alternatively heavy rock breaking will be required which will likely give rise to overbreak in places.

Inspection of core samples by intending contractors is considered essential prior to the selection of the most suitable excavation technique and finalising of tender prices.

It should be recognised that the above excavatability estimates are based on materials encountered at the test locations only and that conditions may prove more difficult (or easier) for excavatability between and beyond these test locations. Site trials are recommended to confirm the above estimates.

8.3.3 Construction Vibration, Noise and Movements

Vibration will result from demolition, excavation and construction work on this site. There is significant debate as to the maximum amount of vibration that buildings can accommodate; however, vibration restrictions must be set with a realistic appreciation for the normal operational environment of the site. Tolerance to vibration will also depend upon the nature of the materials used in construction (ductile or brittle), the age of the buildings, and whether or not the buildings are already cracked or in disrepair.

From current information, it is considered likely that the structures adjacent to the site can withstand vibration levels higher than those required to maintain the comfort of their occupants. A human comfort criterion is therefore suggested and the vector sum peak particle velocity (VSPPV) is proposed as the control parameter. It is recommended that a Provisional Allowed Vibration Limit of 8.0 mm/sec (VSPPV) be set during normal working hours, at foundation level of the potentially affected building/s.

A properly designed vibration and movement monitoring program will need to be implemented during the excavation and construction phases of the project. During basement excavation and construction it is recommended that regular survey monitoring points (survey target, survey spigot or similar) be installed on the top of wall capping beams. A second row of survey monitoring points should also be set up parallel to the capping beams and be offset at least 6 m outside the basement excavation. The site survey points should be referenced to an off-site benchmark situated beyond the influence of any site ground movements.

Survey movement monitoring of the basement walls will be required as a minimum to the following monitoring frequency:

- once before excavation commences;
- twice weekly until the basement excavation is complete;
- every month for three months following completion of the basement.

The movement monitoring results should be provided to the project structural and geotechnical engineers for review throughout the project duration until project completion.

Excavation and construction noise and its impact upon nearby tenants and residents will also need to be considered. Dilapidation/building condition surveys of the adjacent buildings, prior to commencing site work, coupled with vibration, noise and movement monitoring, is also suggested. DP can undertake the vibration monitoring works if required.

8.3.4 Temporary Slope Batters

For construction outside the basement excavations, temporary batters of 2H:1V or flatter are suggested for temporary slopes up to 3 m vertical height in soils. If construction is carried out during the wetter months of the year and groundwater seeps from the face, then flatter batters may be necessary.

Vertical batters would be suitable in high strength or stronger rock up to 3 m height, if inspection during excavation confirms that there are no adversely orientated joints or shear planes, which might lead to wedge or block failure. Apart from wall panels, these batters should be kept well inside the line of excavation and are only suggested as temporary side slopes within the perimeter anchored basement walls. It is possible that water may seep from the faces of confined excavations and these excavations will need to be temporarily dewatered.

8.3.5 Site Preparation – Excavation Base

The exposed subgrade at the BEL of RL 9.9 m is expected to comprise high to very high strength tuff. The subgrade at the base of the deeper excavation should be air blasted to remove all loose material and then inspected. On the intermediate bench where the lowest western basement level is setback from the tunnel and also for the excavation on the eastern side of the tunnel, the base subgrade should comprise hard gravelly silty clay and very stiff to hard clayey silt. Additional preparation would probably be limited to the removal and replacement of loose spoil in any over-excavated zones with a suitable approved crushed rock product or similar. It may also be prudent to undertake a test roll with a 12 tonne or larger smooth drum roller to detect any loose or uncompacted zones also requiring removal.

Any new filling if required to achieve design levels or beyond the perimeter of the excavation, should be undertaken under 'Level 1' supervision and testing as detailed in AS 3798–2007 (Ref. 5). Filling should be placed in layers not exceeding 0.2 m 'loose' thickness, with each layer compacted to a minimum dry density ratio of 100% Standard compaction within 2% of optimum moisture content.

8.4 Foundations

It is anticipated that column loads at lowest basement level for the new building will be in the order of 8000 kN to 10 000 kN (working).

Based on the high to very high strength tuff conditions anticipated at lowest basement level, suitable foundations for most of the building are expected to comprise shallow pad and strip footings. For the intermediate zone where the lowest basement level is setback from the tunnel on the western side of the site and all of the eastern side of the tunnel, piled footings will also be necessary be expensive to construct and probably unnecessary.

Pad or strip footings founding in rock and bored piles founded a minimum of three pile diameters into natural soil or a minimum one pile diameter into rock, could be sized using the maximum allowable values given in Table 3 below.

Table 3: Allowable Foundation Design Pressures

Material	Maximum Allowable Pressure (kPa)	
	Shaft Adhesion	End Bearing
Very stiff (or stronger) residual clay	20	Not applicable
Extremely low strength tuff	70	Not applicable
High to very high strength (or stronger) tuff	1200	12 000

Total and differential settlements for footings up to 1 m wide, designed and constructed on the above basis, are not expected to exceed 10 mm and 5 mm respectively. The base of all footings should be clean and dry at the time of casting.

Where limit state methods are used to design the foundations, the ultimate unfactored geotechnical strength ($R_{d,ug}$) can be estimated by multiplying the allowable values given above by a factor of safety of 2.5, and then multiplying by a suitable geotechnical strength reduction factor (ϕ_g) to obtain the design geotechnical strength ($R_{d,g}$). As a guide, where the average risk rating is assessed to be high and there is low redundancy in foundations, a ϕ_g value of 0.45 would apply. Guidance on the choice of ϕ_g is provided in Section 4 of AS 2159 (Ref. 6).

All footing excavations will need to be inspected by a qualified geotechnical engineer/engineering geologist prior to casting of concrete to confirm rock quality. As part of the inspection process, probe drilling and spoon testing will need to be carried out on strip and pad footings proportioned for the above pressure. This is required to ensure a suitable thickness (i.e. 1.5 to two times the footing width) of intact rock (free of clay seams and highly fractured zones) is present beneath the footings, suitable for the support of the suggested bearing pressure.

8.5 Earthquake Site Factor

In accordance with AS1170.4, it is recommended that a site sub-soil classification of "Class C_e – Shallow Soil Site" be adopted, in accordance with the definitions presented in *Section 4.2 – Class Definitions*. This classification is based on no more than 40 m depth of stiff soil.

8.6 On-Ground Floor Slabs

Following basement excavation, most of the exposed subgrade is expected to comprise high to very high strength tuff with some localised very stiff to hard clays in the western basement excavation and across the base of the eastern basement excavation.

Provided subgrade preparation is carried out in accordance with Section 8.3.5 above, moduli of subgrade reaction (k) of 25 kPa/mm and 80 kPa/mm are suggested for the design of floor slabs subjected to standard wheel loads (i.e. car traffic) where very stiff to hard clays/silts and high to very high strength tuff rock respectively are exposed. These are based on a soaked California bearing ratio (CBR) values of 3% and 15% where the subgrade comprises very stiff to hard clays/silts and high to very high strength tuff rock respectively. For loaded areas of different proportion or different load intensity to standard wheel loads, Douglas Partners should be contacted for further advice.

It is envisaged that the basement will be 'drained' and therefore on-ground basement floor slabs will need to be designed with appropriate hydrostatic pressure relief such as a gravel drainage layer with a grid of 'ag' pipes linked to sumps for removal by pumps.

8.7 Erosion

The results of Emerson Class dispersion tests indicate that the silty clay had a moderate potential for erosion referred from Brisbane City Council's Erosion Hazard Assessment (Ref. 2). Given the expected depth of excavation required for the basement proposed at the site, it is considered that there is a relatively low erosion risk associated with surface water flow, as the soils exposed to water runoff will largely be contained with the basement excavation.

Any erosion control measures at the ground surface will require detailed design. It is expected that, as a minimum, such measures will include silt fences, hay bales and other precautions to limit water runoff velocity.

9. Limitations

DP has prepared this report for the proposed mixed use development at 33 to 57 Lamington Avenue and 612 Lutwyche Road, Lutwyche, in accordance with DP's Proposal BNE150645 dated 25 June 2015 and acceptance received from Mr David Laycock of Kane Constructions Pty Ltd. The work was carried out under a DP's *Conditions of Engagement*. This report is provided for the exclusive use of Kane Constructions Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report, DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the subsurface conditions only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Subsurface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions across the site and between sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP, as this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required by the Health and Safety Legislation and Regulations, to be included in a safety report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

10. References

1. Australian Standard AS 1170.4–2007, “Structural Design Actions, Part 4: Earthquake actions in Australia” Standards Australia.
2. Erosion Hazard Assessment Supporting Technical Notes–February 2010, Brisbane City Council.
3. Australian Standard AS 2870–2011 “Residential Slabs and Footings”, Standards Australia.
4. Australian Standard AS 4678–2002 “Earth-Retaining Structures”, Standards Australia.
5. Australian Standard AS 3798–2007 “Guidelines on earthworks for commercial and residential developments”, Standards Australia.
6. Australian Standard AS 2159–2009 “Piling – design and installation”, Standards Association of Australia.

Douglas Partners Pty Ltd

Appendix A

About This Report
Sampling Methods
Soil Descriptions
Rock Descriptions
Symbols and Abbreviations

About this Report

Douglas Partners



Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:
4,6,7
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 - 5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.



Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Douglas Partners



Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U ₅₀	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

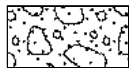
Symbols & Abbreviations

Graphic Symbols for Soil and Rock

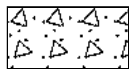
General



Asphalt



Road base

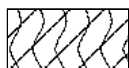


Concrete

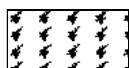


Filling

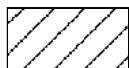
Soils



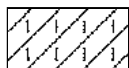
Topsoil



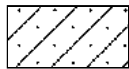
Peat



Clay



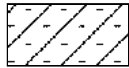
Silty clay



Sandy clay



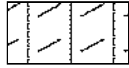
Gravelly clay



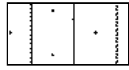
Shaly clay



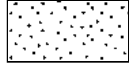
Silt



Clayey silt



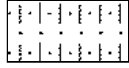
Sandy silt



Sand



Clayey sand



Silty sand



Gravel



Sandy gravel

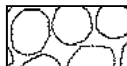


Cobbles, boulders



Talus

Sedimentary Rocks



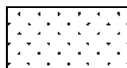
Boulder conglomerate



Conglomerate



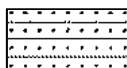
Conglomeratic sandstone



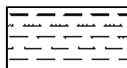
Sandstone



Siltstone



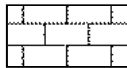
Laminite



Mudstone, claystone, shale

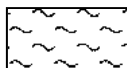


Coal

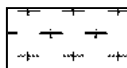


Limestone

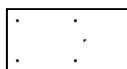
Metamorphic Rocks



Slate, phyllite, schist

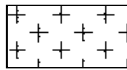


Gneiss

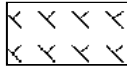


Quartzite

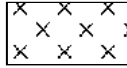
Igneous Rocks



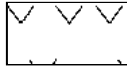
Granite



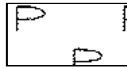
Dolerite, basalt, andesite



Dacite, epidote



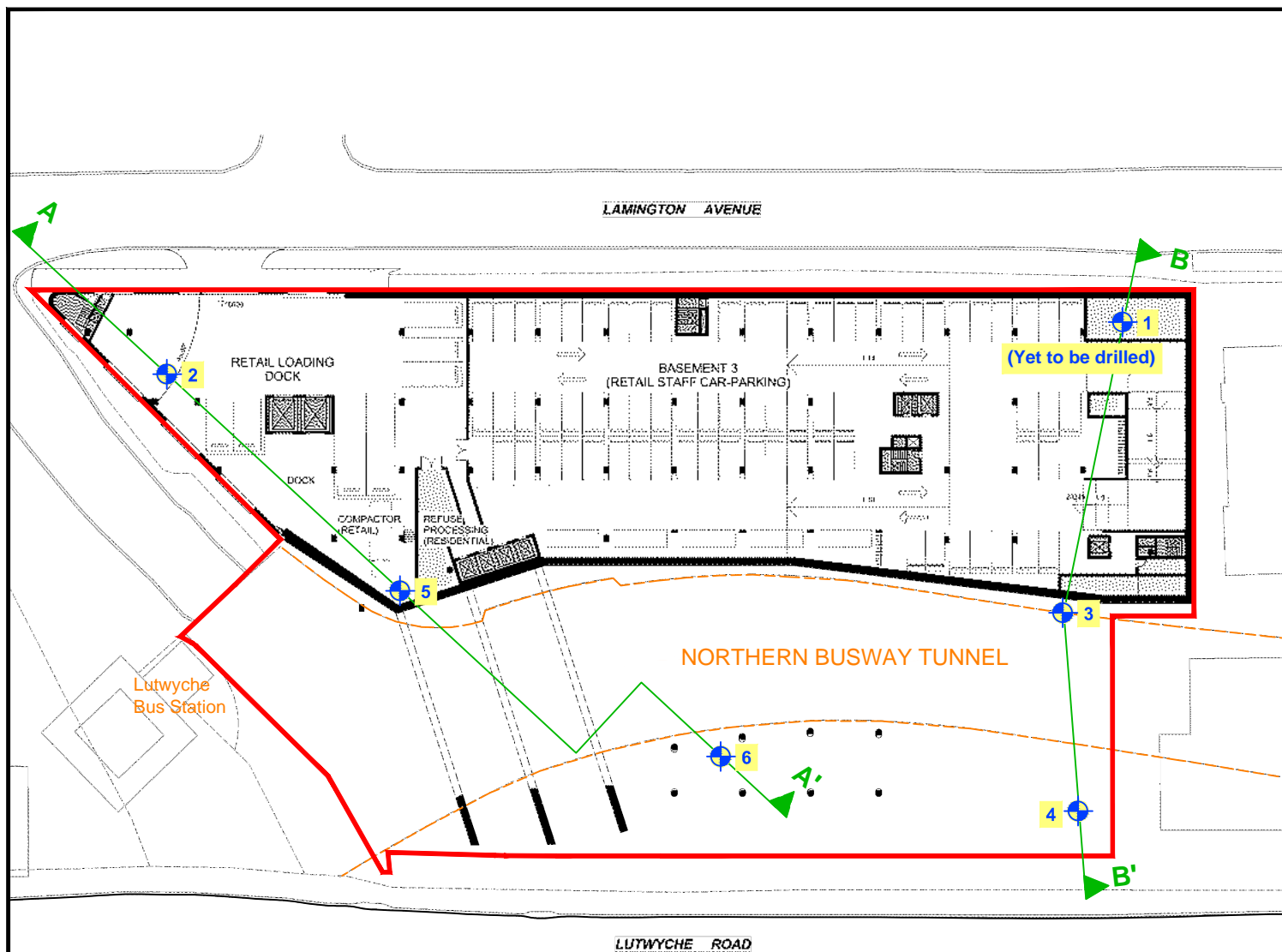
Tuff, breccia



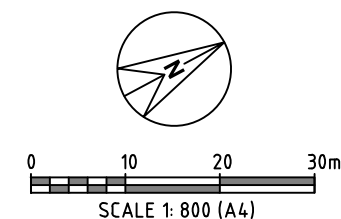
Porphyry

Appendix B

Drawing 1 – Test Location Plan



Location Plan



LEGEND:-

- Test Bore Location and Number
- Site Boundary

NOTE:-

1. Test locations are approximate only and are shown with reference to existing site features.
2. Plan adapted from Drawing No.DA14B provided by Kane Constructions Pty Ltd.

Appendix C

Borehole Logs

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd,
 Lutwyche

SURFACE LEVEL: 20.0 m AHD
EASTING: 503337
NORTHING: 6967085
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 87424.00
DATE: 25/11/2015
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High		Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
20		FILLING - medium dense to dense, brown, gravelly silty sand filling with a trace of clay, moist																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 7.0m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	p	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 20.0 m AHD
EASTING: 503337
NORTHING: 6967085
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 87424.00
DATE: 25/11/2015
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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10		TUFF - very high strength, fresh stained, slightly fractured, light grey and light purple, fine to coarse grained tuff with some slightly weathered fractured bands (continued)							✓																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								</

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 7.0m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test ls(50) (MPa)
		PL(D)	Point load diametral test ls(50) (MPa)
		p	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 20.0 m AHD
EASTING: 503337
NORTHING: 6967085
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 87424.00
DATE: 25/11/2015
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
0		TUFF - very high strength, fresh stained, slightly fractured, light grey and light purple, fine to coarse grained tuff with some slightly weathered fractured bands <i>(continued)</i>						✓																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							</

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 7.0m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	p	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 27.8 m AHD
EASTING: 503418
NORTHING: 6967157
DIP/AZIMUTH: 90°/-

BORE No: 3
PROJECT No: 87424.00
DATE: 19 - 20/11/2015
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength				Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing						
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low			Low	Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
	0.05	TOPSOIL -loose to med dense brown, silty sand topsoil																				
	0.27	SILTY CLAY - very stiff, red-brown, silty clay with some gravel and sand, moist																U ₅₀				
	1	- gravel band																				
	1.1	- becomes sandy silty clay and hard																S				9,12,11 N = 23
	1.26	SANDY CLAY - very stiff to hard, light grey mottled red-brown, sandy clay with some silt, moist																				
	2																					
	2.5	- clayey sand band, red-brown mottled light grey																S				5,8,10 N = 18
	3																					
	4	- gravelly sand band																				
	4.0	CLAYEY SAND - dense, brown mottled light grey, clayey sand with a trace of gravel and silt, moist																S				8,14,18 N = 32
	5	- angular gravel band																				
	5.22	- angular gravel band, black																S				23, 30/80mm
	6																					
	6.4	CLAYEY SILT - very stiff, light grey, high plasticity clayey silt with a trace sand, moist (completely weathered tuff)																				
	7	- brown and light red-brown mottled light grey																S				8,11,17 N = 28
	8	- light grey and light yellow-brown																				
	9																	S				7,13,16 N = 29
	18																					

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 18.1m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	p	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 27.8 m AHD
EASTING: 503418
NORTHING: 6967157
DIP/AZIMUTH: 90°/-

BORE No: 3
PROJECT No: 87424.00
DATE: 19 - 20/11/2015
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing											
			EW	HW	MW	SW		FS	FR	Ex	Low	Very Low		Low	Medium	High	Very High	Ex	High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments	
	17	CLAYEY SILT - very stiff, light grey, high plasticity clayey silt with a trace sand, moist (completely weathered tuff) <i>(continued)</i> - light grey, yellow-brown and red-brown banding from 11.2m - hard, yellow-brown and light grey																												6,10,16 N = 26	
	16																														9,13,17 N = 30
	15																														10,13,14 N = 27
	14																														
	13																														7,12,18 N = 30
	12																														
	11																														
	16.0		- becoming light grey sandy clayey silt - hard																												
	16		TUFF - extremely low strength, extremely weathered, light grey, fine to medium grained tuff																												30/150mm
	17																														
	18																													30/140mm PL(A) = 5.01 PL(D) = 5.41	
	18.1	TUFF - high to very high strength, fresh stained, slightly fractured, light grey, fine to medium grained tuff																												PL(A) = 5.42 PL(D) = 2.13	
	19																													PL(A) = 2.47 PL(D) = 2.5	
	8																													PL(A) = 3.54 PL(D) = 2.56	

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 18.1m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	g	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd,
 Lutwyche

SURFACE LEVEL: 27.8 m AHD
EASTING: 503418
NORTHING: 6967157
DIP/AZIMUTH: 90°/-

BORE No: 3
PROJECT No: 87424.00
DATE: 19 - 20/11/2015
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS	Ex Low	Very Low	Low	Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		TUFF - high to very high strength, fresh stained, slightly fractured, light grey, fine to medium grained tuff (continued)																		
	21																C	100	97	PL(A) = 3.69 PL(D) = 3.45 PL(A) = 5.19 PL(D) = 5.04
	22	- slightly weathered then moderately weathered from 21.8m to 24.05m depth																		PL(A) = 2.89 PL(D) = 2.28
	23	- very high strength from 22.5m to 24m															C	100	97	PL(A) = 3.44 PL(D) = 3.18
	24	- fresh from 24.05m depth																		PL(A) = 4.37 PL(D) = 7.92
	25																C	100	100	PL(A) = 2.64 PL(D) = 1.92
	25.25	Bore discontinued at 25.25m depth - Limit of investigation																		PL(A) = 2.94 PL(D) = 2.58
	26																			
	27																			
	28																			
	29																			

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 18.1m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	p	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 27.1 m AHD
EASTING: 503441
NORTHING: 6967146
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 87424.00
DATE: 20/11/2015
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
27	0.1	TOPSOIL - stiff, brown-dark brown, silty sand topsoil																								
	0.6	FILLING - dense, brown and light grey, gravelly silty sand filling, moist																				S				21, 21, 30/140mm
26	1	GRAVELLY SANDY CLAY, hard, red-brown, low to medium plasticity gravelly sandy clay, moist																								
		- clayey sand with some fine to medium gravel																								
25	2																					S				13, 26, 30/110mm
24	3	- becomes gravelly sandy clay, red-brown mottled grey																				S				18, 30/140mm
23	4																									
22	5																					S				12, 30/120mm
21	6	CLAYEY SILT - hard, light grey mottled brown, clayey silt, moist (completely weathered tuff)																								
		- light grey mottled brown and light red-brown																				S				9, 19, 30/110mm
20	7																									
19	8	- pink and light grey																				S				11,20,29 N = 49
18	9																									12,18,27 N = 45

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 17.65m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	p	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd,
 Lutwyche

SURFACE LEVEL: 27.1 m AHD
EASTING: 503441
NORTHING: 6967146
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 87424.00
DATE: 20/11/2015
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing							
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
17		CLAYEY SILT - hard, light grey mottled brown, clayey silt, moist (completely weathered tuff) (continued) - mottled yellow-brown																									
16	11																					S				8, 14, 30/140mm	
15	12	- light grey mottled orange-brown and orange-brown mottled light grey colour banding - very stiff																				S				6,11,15 N = 26	
14	13																										
13	14	- very stiff to hard																				S				6,12,19 N = 31	
12	15																										
11	16																					S				10, 23, 30/90mm	
10	16.5	TUFF - extremely low strength, extremely weathered, light grey, tuff																				S				30/65mm	
9	17																										
8	17.65	TUFF - high and very high strength, fresh, slightly fractured, light grey, fine to medium grained tuff																								PL(A) = 5.01 PL(D) = 5.41	
	18																									PL(D) = 3.3	
	19																					C	100	100		PL(A) = 2.47 PL(D) = 2.5	

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 17.65m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 27.1 m AHD
EASTING: 503441
NORTHING: 6967146
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 87424.00
DATE: 20/11/2015
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)					Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
7	20.65	TUFF - high and very high strength, fresh, slightly fractured, light grey, fine to medium grained tuff <i>(continued)</i>							✓																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 17.65m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	▷	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		p	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 25.2 m AHD
EASTING: 503380
NORTHING: 6967096
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 87424.00
DATE: 20 - 23/11/2015
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
25	0.5	FILLING - very stiff to hard, brown, sandy gravelly clay filling with some ash fragments, moist																				
24	1	FILLING - estimated firm to stiff, brown, gravelly clay filling with some sand, moist																S				3,3,4 N = 7
23	1.5	SILTY CLAY - stiff, brown and yellow-brown, high plasticity silty clay with some sand and gravel, moist																				
22	2	- light grey and light red-brown																S				3,6,7 N = 13
21	3.9	SILTY SANDY CLAY - hard, dark brown-red mottled light grey, medium plasticity silty sandy clay, moist																S				30/150mm
20	5.0	SANDY GRAVELLY CLAY - hard, brown and orange-brown, low plasticity sandy gravelly clay, moist																S				30/40mm
19	6.5	GRAVEL - dense, red-brown, with some sand and a trace of clay, moist (completely weathered tuff)																				
18	7.0	- brown mottled pink TUFF - very low strength, highly weathered, light grey, fine to medium grained tuff																S				30/50mm
17	8.0	TUFF - high strength, fresh stained to fresh, fractured to slightly fractured then unbroken, fine to coarse grained tuff with some slightly weathered bands																				PL(A) = 2.07 PL(D) = 1.44 PL(A) = 3.33 PL(D) = 2.66 PL(A) = 2.73 PL(D) = 1.69
16	9																	C	100	90		

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 8.0m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		gp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 25.2 m AHD
EASTING: 503380
NORTHING: 6967096
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 87424.00
DATE: 20 - 23/11/2015
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
15		TUFF - high strength, fresh stained to fresh, fractured to slightly fractured then unbroken, fine to coarse grained tuff with some slightly weathered bands (continued)							✓																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 8.0m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	p	Pocket penetrometer (kPa)
D	Disturbed sample	Δ	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd, Lutwyche

SURFACE LEVEL: 25.2 m AHD
EASTING: 503380
NORTHING: 6967096
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 87424.00
DATE: 20 - 23/11/2015
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength						Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High	Very High		Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
5		TUFF - high strength, fresh stained to fresh, fractured to slightly fractured then unbroken, fine to coarse grained tuff with some slightly weathered bands (continued)							✓																	PL(A) = 1.57 PL(D) = 1.75	
21									✓														C	100	100		PL(A) = 2.51 PL(D) = 1.36
22									✓																		
3									✓												22.14m: J, sv, inf silt, ir, ro						
23									✓												22.67m: inf slt		C	100	100		PL(A) = 1.99 PL(D) = 2.22
2									✓																		PL(A) = 2.74 PL(D) = 2.72
24									✓																		
1									✓																		
25									✓																		PL(A) = 1.5 PL(D) = 2.14 PL(A) = 2.97 PL(D) = 2.65
25.15									✓														C	100	100		
			Bore discontinued at 25.15m depth - Limit of investigation																								
26																											
-1																											
27																											
-2																											
28																											
-3																											
29																											
-4																											

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 8.0m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		p	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd,
 Lutwyche

SURFACE LEVEL: 27.00 m AHD **BORE No:** 6
EASTING: 503414 **PROJECT No:** 87424.00
NORTHING: 6967113 **DATE:** 24/11/2015
DIP/AZIMUTH: 90°/- **SHEET 1 OF 2**

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
27		FILLING - medium dense to dense, brown, silty gravelly sand filling, moist																								
0.5		SANDY CLAY - very stiff, brown, medium plasticity sandy clay with some gravel, moist																								
26	1	- gravel band																				S				7,6,5 N = 11
		- becomes silty clay with some sand																								
25	2																									
2.3		GRAVELLY SANDY SILT - hard, red-brown, gravelly sandy silt with some clay, moist																				S				17,26,21 N = 47
24	3																									
		- dense, red-brown mottled light grey silty fine to medium sand band																				S				20, 30/135mm
23	4																									
4.3		SANDY GRAVELLY CLAY - hard, brown-grey mottled red-brown, sandy gravelly clay with some silt, moist																								
22	5																									
21	6																					S				11,17,22 N = 39
6.7		CLAYEY SILT - very stiff to hard, light grey mottled light red, red-brown and yellow-brown, clayey silt with some sand, moist (completely weathered tuff)																								
20	7																					S				16,10,18 N = 28
19	8																									
																								</		

RIG: Hydrapower Scout **DRILLER:** Ground Test **LOGGED:** LB **CASING:** HWT to 2.5m
TYPE OF BORING: Auger to 2.5m, rotary mud to 13.0m, then NMLC coring
WATER OBSERVATIONS: No free groundwater observed while augering
REMARKS:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		p	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Kane Constructions Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 33 to 57 Lamington Ave and 612 Lutwyche Rd,
 Lutwyche

SURFACE LEVEL: 27.00 m AHD **BORE No:** 6
EASTING: 503414 **PROJECT No:** 87424.00
NORTHING: 6967113 **DATE:** 24/11/2015
DIP/AZIMUTH: 90°/- **SHEET 2 OF 2**

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
17		CLAYEY SILT - very stiff to hard, light grey mottled light red, red-brown and yellow-brown, clayey silt with some sand, moist (completely weathered tuff) (continued)																								9,16,20 N = 36
16	11																					S				
15	12	- light grey mottled yellow-brown and purple-brown																								
12.5		TUFF - very low strength, highly weathered, light grey, fine to medium grained tuff																				S				16, 30/110mm
14	13.0	TUFF - very high strength, slightly weathered, slightly fractured, light grey, fine to medium grained tuff with some moderately weathered high strength bands																								PL(A) = 4.88 PL(D) = 2.65
13	14																					C	100	98		PL(A) = 4.12 PL(D) = 3.54
12	15																									
11	16	- fresh stained from 15.6m																								PL(A) = 10.8 PL(D) = 9.18
10	17																					C	100	97		PL(A) = 6.23 PL(D) = 2.98
9	18.0	Bore discontinued at 18.0m depth - Limit of investigation																								PL(A) = 5.58 PL(D) = 5.41
8	19																									

RIG: Hydrapower Scout

DRILLER: Ground Test

LOGGED: LB

CASING: HWT to 2.5m

TYPE OF BORING: Auger to 2.5m, rotary mud to 13.0m, then NMLC coring

WATER OBSERVATIONS: No free groundwater observed while augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

Appendix B

Laboratory Report Sheets

Determination of Emerson Class Number and pH Value of Soil

Client:	Kane Constructions Pty Ltd		Project No:	87424		
Project:	Proposed Mixed Use Development		Report No:	BO16-0257		
Location:	Lamington Avenue, Lutwyche		Report Date:	05.02.2016		
			Date Sampled:	26.11.2015		
			Date of Test:	04.02.2016		
			Page:	1 of 1		

SAMPLE NO	DEPTH (m)	DESCRIPTION	WATER TYPE	WATER TEMP	CLASS NO.	PH VALUE
Bore 2	1.00 - 1.45	Silty clay	De-ionised	22	4	5.1
Bore 3	1.00 - 1.45	Silty clay/sandy clay	De-ionised	22	4	3.6

Test Method(s): AS 1289 3.8.1, AS 1289 4.3.1

Sampling Method(s): Sampled by Brisbane Engineering Department.

Remarks:

Results of Moisture Content, Plasticity and Linear Shrinkage Tests

Client : Kane Constructions Pty Ltd

Project No. : 87424

Project : Proposed Mixed Use Development

Report No. : BO16-0258

Report Date : 05.02.2016

Location : Lamington Avenue, Lutwyche

Date Sampled : 26.11.2015

Date of Test: 03.02.2016

Page: 1 of 1

TEST LOCATION	DEPTH (m)	DESCRIPTION	Code	W _F %	W _L %	W _P %	PI %	*LS %
Bore 2	1.00 - 1.45	Silty clay	2.5 - CR	15.5	49	20	29	13.5
Bore 3	1.00 - 1.45	Silty clay/sandy clay	2.5 - CR	12.5	43	17	26	11.5

Legend:

- W_F Field Moisture Content
 W_L Liquid limit
 W_P Plastic limit
 PI Plasticity index
 LS Linear shrinkage from liquid limit condition (Mould length 250mm)

Test Methods:

- Moisture Content: AS 1289.2.1.1
 Liquid Limit: AS 1289.3.1.2
 Plastic Limit: AS 1289.3.2.1
 Plasticity Index: AS 1289.3.3.1
 Linear Shrinkage: AS 1289.3.4.1
 Sampling Method(s): Sampled by Brisbane Engineering Department

Code
Sample history for plasticity tests

- 1 Air dried
 2 Low temperature (<50°C) oven dried
 3 Oven (105°C) dried
 4 Unknown

Method of preparation for plasticity tests

- 5 Dry sieved
 6 Wet sieved
 7 Natural

*Specify if sample crumbled CR or curled CU

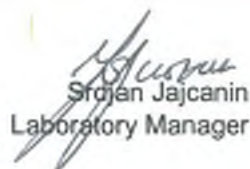
Remarks



NATA Accredited Laboratory Number 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian national standards. Accredited for compliance with ISO/IEC 17025

Tested	AC
Checked	SJ


 Srdjan Jajcanin
 Laboratory Manager

APPENDIX F

APPLICABLE PLANNING CODES



Filling and excavation code

Performance outcomes	Acceptable outcomes	Assessment
PO1 Development for filling or excavation minimises visual impacts from retaining walls and earthworks.	AO1 Development ensures that the total height of any cut and fill, whether or not retained, does not exceed: (a) 2.5m in a zone in the Industry zones category; (b) 1m in all other zones, or if adjoining a sensitive zone.	The site will be piled and excavated. Excavations will be stabilised.
PO2 Development of a retaining wall proposed as a result of filling or excavation: (a) is designed and constructed to be fit for purpose; (b) does not impact adversely on significant vegetation; (c) is capable of easy maintenance. Editor's note—A retaining wall also needs to comply with the Building Regulation and embankment gradients will need to comply with the Building Regulation. Note—Guidance on the protection of native vegetation is included in the Biodiversity areas planning scheme policy.	AO2.1 Development of a retaining structure, including footings, surface drainage and subsoil drainage: (a) is wholly contained within the site; (b) if the total height to be retained is greater than 1m, then: (i) the retaining wall at the property boundary is no greater than 1m above the ground level; (ii) all further terracing from the 1m high boundary retaining wall is 1 vertical unit:1 horizontal unit; (iii) the distance between each successive retaining wall (back of lower wall to face of higher wall) is no less than 1m horizontally to incorporate planting areas.	Development meets AO2.1 - Retaining structures, including footings, surface drainage and subsoil drainage will be wholly located within the site.
	AO2.2 Development of a retaining wall over 1m in height protects significant vegetation on the site and on adjoining land and is designed and constructed in	The excavation will be piled and certified by a structural RPEQ. Currently other than that no retaining walls are proposed.

	accordance with the structures standards in the Infrastructure design planning scheme policy and certified by a Registered Professional Engineer Queensland.	
	AO2.3 Development provides a retaining wall finish that presents to adjoining land that is maintenance free if the setback is less than 750mm from the boundary.	The excavation will be piled and certified by a structural RPEQ. Currently other than that no retaining walls are proposed.
	AO2.4 Development for filling only uses clean fill that does not include any construction rubble, debris, weed seed or viable parts of plant species listed as an undesirable plant species in the Planting species planning scheme policy.	No filling required, if any than very small quantity. Engineered fill from an approved source will be specified for filling applications free from contaminates or deleterious
PO3 Development ensures that a rock anchor is designed and constructed to be fit for purpose.	AO3 Development ensures that a rock anchor: <ul style="list-style-type: none"> (a) is constructed in accordance with the standards in the Infrastructure design planning scheme policy; (b) where it extends beyond the property boundary, is supported by a letter of consent from the adjoining land and building owners. 	The excavation will be piled and certified by a structural RPEQ.
PO4 Development protects all services and public utilities.	AO4 Development protects services and public utilities and ensures that any alteration or relocation of services or public utilities meets the standard design specifications of the responsible service authorities.	Development will meet AO4 – service relocations (if any) will be constructed to the standard design specifications of each provider.

<p>PO5</p> <p>Development provides surface and sub-surface drainage to prevent water seepage, concentration of run-off or ponding of stormwater on adjacent land.</p>	<p>AO5</p> <p>Development ensures all flows and subsoil drainage are directed to a lawful point of discharge of a surface water diversion drain, including to the top or toe of a retaining wall in accordance with the stormwater drainage section of the Infrastructure design planning scheme policy.</p>	<p>Development will meet AO5 - Stormwater flows will be directed to a lawful point of discharge</p>
<p>PO6</p> <p>Development ensures that the design and construction of all open drainage works is undertaken in accordance with natural channel design principles, being the development of a stormwater conveyance system for major flows, by using a vegetated open channel or drain that approximates the features and functions of a natural waterway to enhance or improve riparian values of those stormwater conveyance systems.</p> <p>Editor's note—Guidance on natural channel design principles can be found in the Council's publication Natural channel design guidelines.</p>	<p>AO6</p> <p>Filling or excavation does not involve the construction of open drainage.</p>	<p>Development meets AO6 - Filling or excavation does not involve the construction of open drainage.</p>
<p>PO7</p> <p>Development for filling or excavation:</p> <p>(a) does not degrade water quality or adversely affect environmental values in receiving waters;</p> <p>(b) ensures site sediment and erosion control standards are best practice.</p>	<p>AO7.1</p> <p>Development for filling or excavation provides water quality treatment that complies with the stormwater drainage section of the Infrastructure design planning scheme policy.</p>	<p>Development will meet AO7.1 - Water quality treatment will be implemented as part of the development and contractor construction management plan.</p>
	<p>AO7.2</p> <p>Development provides erosion and sediment control standards that are in accordance with the stormwater drainage section of the Infrastructure design planning scheme policy.</p>	<p>Development will meet AO7.2 - Erosion and sediment control standards will be implemented as part of the development and contractor construction management plan.</p>

<p>PO8</p> <p>Development for filling or excavation is conducted such that adverse impacts at a sensitive use due to noise and dust are prevented or minimised.</p> <p>Note—A noise and dust impact management plan prepared in accordance with the Management plans planning scheme policy can assist in demonstrating achievement of this performance outcome.</p>	<p>AO8.1</p> <p>Development ensures that no dust emissions extend beyond the boundary of the site, including dust from construction vehicles entering and leaving the site.</p> <p>AO8.2</p> <p>Development for filling or excavation activity only occurs between the hours of 6:30am and 6:30pm Monday to Saturday, excluding public holidays.</p>	<p>Development will meet AO8.1 – Dust control standards will be implemented as part of the development and contractor construction management plan.</p> <p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
<p>PO9</p> <p>Development ensures that vibration generated by the filling or excavation operation does not exceed the vibration criteria in Table 9.4.3.3.B, Table 9.4.3.3.C, Table 9.4.3.3.D and Table 9.4.3.3.E.</p> <p>Note—A noise management report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.</p>	<p>AO9</p> <p>Development involving filling or excavation does not cause a ground-borne vibration beyond the boundary of the site.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
<p>PO10</p> <p>Development ensures that heavy trucks hauling material to and from the site do not affect the amenity of established areas and limits environmental nuisance impact on adjacent land.</p>	<p>AO10</p> <p>Development ensures that heavy trucks hauling material to and from the site:</p> <ul style="list-style-type: none"> (a) occur for a maximum of 3 weeks; (b) use a major road to access the site; (c) only use a minor road for the shortest-most-direct route that has the least amount of environmental nuisance if there is no major road alternative. 	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
<p>PO11</p> <p>Development for filling or excavation protects the environment and community health and wellbeing</p>	<p>AO11</p> <p>Development does not involve:</p> <ul style="list-style-type: none"> (a) excavation on land previously occupied by a notifiable activity or on land listed on the 	<p>Development will meet AO11 – The site has not been identified as previously occupied by a notifiable activity or registered on the EMR or CLR and certified fill will be used.</p>

from exposure to contaminated land and contaminated material.	Environmental Management Register or the Contaminated Land Register; (b) filling with material containing a contaminant.	
PO12 Development provides for: (a) landscaping for water conservation purposes; (b) water sensitive urban design measures which are employed within the landscape design to maximise stormwater use and to reduce any adverse impacts on the landscape; (c) stormwater harvesting to be maximised and any adverse impacts of stormwater minimised.	AO12.1 Development provides landscaping which is designed using the standards in the Landscape design guidelines for water conservation planning scheme policy.	Refer landscape architects plans.
	AO12.2 Development ensures that the design and requirements for irrigation are in compliance with the standards in the Landscape design guidelines for water conservation planning scheme policy.	Development meets AO12.2 – 50kL rainwater reuse tank will be implemented.
	AO12.3 Development provides areas of pavement, turf and mulched garden beds which are drained. Note—This may be achieved through the provision and/or treatment of swales, spoon drains, field gullies, sub-surface drainage and stormwater connections.	Development contains areas of pavement, turf and mulched beds. Refer architects/ landscape architects plans.
PO13 Development ensures cutting and filling for the development of canals or artificial waterways avoids adverse impacts on coastal resources and processes.	AO13 Development does not involve the creation of canals or artificial waterways.	Development does not involve the creation of canals or artificial waterways.

Infrastructure design code

Performance outcomes	Acceptable outcomes	Assessment
<p>PO1</p> <p>Development provides roads, pavement, edging and landscaping which:</p> <ul style="list-style-type: none"> (a) are designed and constructed in accordance with the road hierarchy; (b) provide for safe travel for pedestrians, cyclists and vehicles; (c) provide access to properties for all modes; (d) provide utilities; (e) provide high levels of aesthetics and amenity, improved liveability and future growth; (f) provide for the amelioration of noise and other pollution; (g) provide a high-quality streetscape; (h) provide a low-maintenance asset with a minimal whole-of-life cost. <p>Note—This can be demonstrated in an engineering report prepared and certified by a Registered Professional Engineer Queensland in accordance with the Infrastructure design planning scheme policy.</p>	<p>AO1</p> <p>Development provides roads and associated pavement, edging and landscaping which are designed and constructed in compliance with the road corridor design standards in the Infrastructure design planning scheme policy.</p>	<p>Development complies with PO1. PO1 will be addressed at detailed design stage.</p>
<p>PO2</p> <p>Development provides road pavement surfaces which:</p> <ul style="list-style-type: none"> (a) are well designed and constructed; (b) durable enough to carry the wheel loads of the intended types and numbers of travelling and parked vehicles; 	<p>AO2</p> <p>Development provides road pavement surfaces which are designed and constructed in compliance with the road corridor design standards in the Infrastructure design planning scheme policy.</p>	<p>Development will be designed to comply with PO2. Refer engineering report for details. Pavement design details will be addressed at detailed design stage.</p>

<p>(c) ensures the safe passage of vehicles, pedestrians and cyclists, the discharge of stormwater run-off and the preservation of all-weather access;</p> <p>(d) allows for reasonable travel comfort.</p>		
<p>PO3</p> <p>Development provides a pavement edge which is designed and constructed to:</p> <p>(a) control vehicle movements by delineating the carriageway for all users;</p> <p>(b) provide for people with disabilities by allowing safe passage of wheelchairs and other mobility aids.</p>	<p>AO3</p> <p>Development provides pavement edges which are designed and constructed in compliance with the road corridor design standards in the Infrastructure design planning scheme policy.</p>	<p>Internal access road will be designed to comply with PO3. This will be addressed at detailed design stage.</p>
<p>PO4</p> <p>Development provides verges which are designed and constructed to:</p> <p>(a) provide safe access for pedestrians clear of obstructions and access areas for vehicles onto properties;</p> <p>(b) provide a sufficient area for public utility services;</p> <p>(c) be maintainable by the Council.</p>	<p>AO4</p> <p>Development provides verges which are designed and constructed in compliance with the road corridor design and streetscape locality advice standards in the Infrastructure design planning scheme policy.</p>	<p>Development will maintain the existing verges. Some additional driveways will be constructed.</p>
<p>PO5</p> <p>Development provides a lane or laneway identified on the Streetscape hierarchy overlay map or in a neighbourhood plan which:</p> <p>(a) allows equitable access for all modes;</p> <p>(b) is safe and secure;</p> <p>(c) has 24-hour access;</p> <p>(d) is a low-speed shared zone environment;</p>	<p>AO5</p> <p>Development provides a lane or laneway identified on the Streetscape hierarchy overlay map or in a neighbourhood plan which is embellished in compliance with the streetscape locality advice standards in the Infrastructure design planning scheme policy.</p>	<p>Development complies with AO5. Refer Civil Engineering Report.</p>

(e) has a high-quality streetscape.		
<p>PO6</p> <p>Development of an existing premises provides at the frontage to the site, if not already provided, the following infrastructure to an appropriate urban standard:</p> <ul style="list-style-type: none"> (a) an effective, high-quality paved roadway; (b) an effective, high-quality roadway kerb and channel; (c) safe, high-quality vehicle crossings over channels and verges; (d) safe, accessible, high-quality verges compatible and integrated with the surrounding environment; (e) safe vehicle access to the site that enables ingress and egress in a forward gear; (f) provision of and required alterations to public utilities; (g) effective drainage; (h) appropriate conduits to facilitate the provision of required street-lighting systems and traffic signals. 	<p>AO6</p> <p>Development of an existing premises provides at the frontage of the site, if not already existing, the following infrastructure to the standard that would have applied if the development involved new premises as stated in the road corridor design standards in the Infrastructure design planning scheme policy:</p> <ul style="list-style-type: none"> (a) concrete kerb and channel; (b) forming and grading to verges; (c) crossings over channels and verges; (d) a constructed bikeway; (e) a constructed verge or reconstruction of any damaged verge; (f) construction of the carriageway; (g) payment of costs for required alterations to public utility mains, services or installations; (h) construction of and required alterations to public utility mains, services or installations; (i) drainage works; (j) installation of electrical conduits. 	<p>N/A, Development will be a new premise.</p>
<p>PO7</p> <p>Development provides both cycle and walking routes which:</p> <ul style="list-style-type: none"> (a) are located, designed and constructed to their network classification (where applicable); (b) provide safe and attractive travel routes for pedestrians and cyclists for commuter and recreational purposes; 	<p>AO7</p> <p>Development provides cycle and walking routes which are located, designed and constructed in compliance with the road corridor design and off-road pathway design standards in the Infrastructure design planning scheme policy.</p>	<p>Refer to architectural plans for walking routes.</p>

<p>(c) provide safe and comfortable access to properties for pedestrians and cyclists;</p> <p>(d) incorporate water sensitive urban design into stormwater drainage;</p> <p>(e) provide for utilities;</p> <p>(f) provide for a high level of aesthetics and amenity, improved liveability and future growth;</p> <p>(g) are a low-maintenance asset with a minimal whole-of-life cost;</p> <p>(h) minimise the clearing of significant native vegetation.</p> <p>Note—This can be demonstrated in an engineering report prepared and certified by a Registered Professional Engineer Queensland in accordance with the Infrastructure design planning scheme policy.</p>		
<p>PO8</p> <p>Development provides refuse and recycling collection, separation and storage facilities that are located and managed so that adverse impacts on building occupants, neighbouring properties and the public realm are minimised.</p>	<p>AO8.1</p> <p>Development provides refuse and recycling collection and storage facilities in accordance with the Refuse planning scheme policy.</p>	<p>Development will be designed to meet AO8.1 - Refuse location is provided within the loading dock, refer to plans. Detailed design stage will address the refuse requirements</p>
	<p>AO8.2</p> <p>Development ensures that refuse and recycling collection and storage location and design do not have any adverse impact including odour, noise or visual impacts on the amenity of land uses within or adjoining the development.</p> <p>Note—Refer to the Refuse planning scheme policy for further guidance.</p>	<p>Development will be designed to meet AO8.2: Refuse storage location is within the development in a dedicated storage area away from other parties.</p>

PO9 Development ensures that: (a) land used for an urban purpose is serviced adequately with regard to water supply and waste disposal; (b) the water supply meets the stated standard of service for the intended use and fire-fighting purposes.	AO9.1 Development ensures that the reticulated water and sewerage distribution system for all services is in place before the first use is commenced.	Development will be designed to meet AO9.1 Further detail will be provided in the detailed design phase.
	AO9.2 Development provides the lot with reticulated water supply and sewerage to a standard acceptable to the distributor–retailer.	Sewer and water connections are proposed within Lamington Ave. A SAN (Service Advice Notice) will be conducted with QUU in the detailed design stage.
PO10 Development provides public utilities and street lighting which are the best current or alternative technology and facilitate accessibility, easy maintenance, minimal whole-of-life costs, and minimal adverse environmental impacts.	AO10.1 Development provides public utilities and street lighting which are located and aligned to: (a) avoid significant native vegetation and areas identified within the Biodiversity areas overlay map; (b) minimise earthworks; (c) avoid crossing waterways, waterway corridors and wetlands or if a crossing is unavoidable, tunnel-boring techniques are used to minimise disturbance, and a disturbed area is reinstated and restored on completion of the work. Note—Guidance on the restoration of habitat is included in the Biodiversity areas planning scheme policy.	Detailed design stage will address AO10.1
	AO10.2 Development provides compatible public utility services and street-lighting services which are co-located in common trenching for underground services.	Detailed design stage will address AO10.2
	AO10.3	Detailed design stage will address AO10.3

	Development provides public utilities and street lighting which are designed and constructed in compliance with the public utilities standards in the Infrastructure design planning scheme policy.	
PO11 Development ensures that land used for urban purposes is serviced adequately with telecommunications and energy supply.	AO11 Development provides land with the following services to the standards of the approved supplier: (a) electricity; (b) telecommunications services; (c) gas service where practicable.	It is proposed to utilise existing infrastructure to meet AO12. Suitability will be addressed within the detailed design phase.
PO12 Development ensures that major public projects promote the provision of affordable, high-bandwidth telecommunications services throughout the city.	AO12 Development provides conduits which are provided in all major Council and government works projects to enable the future provision of fibre optic cabling, if: (a) the additional expense is unlikely to be prohibitive; or (b) further major work is unlikely or disruption would be a major concern, such as where there is a limited capacity road; or (c) there is a clear gap in the telecommunications network; or (d) there is a clear gap in the bandwidth available to the area. Editor's note—An accurate, digital 'as built' three-dimensional location plan is to be supplied for all infrastructure provided in a road.	It is proposed to utilise existing infrastructure to meet AO12, suitability and further information will be provided in the detailed design stage.

<p>PO13</p> <p>Development provides public art identified in a neighbourhood plan or park concept plan which:</p> <ul style="list-style-type: none"> (a) is provided commensurate with the status and scale of the proposed development; (b) is sited and designed: <ul style="list-style-type: none"> (i) as an integrated part of the project design; (ii) as conceptually relevant to the context of the location; (iii) to reflect and respond to the cultural values of the community; (iv) to promote local character in a planned and informed manner. 	<p>AO13</p> <p>Development provides public art identified in a neighbourhood plan or park concept plan which is sited and designed in compliance with the public art standards in the Infrastructure design planning scheme policy.</p>	
<p>PO14</p> <p>Development provides signage of buildings and spaces which promote legibility to help users find their way.</p>	<p>AO14</p> <p>Development provides public signage:</p> <ul style="list-style-type: none"> (a) at public transport interchanges and stops, key destinations, public spaces, pedestrian linkages and at entries to centre developments; (b) which details the location of the key destinations, public spaces and pedestrian linkages in the vicinity, the services available within the development and where they are located. <p>Editor's note—Signage is to be in accordance with Local Law Number 1 (Control of Advertisements Local Law).</p>	

<p>PO15</p> <p>Development that provides community facilities which form part of the development is functional, safe, low maintenance, and fit for purpose.</p>	<p>AO15</p> <p>Development that provides community facilities which form part of the development is designed in compliance with the community facilities standards in the Infrastructure design planning scheme policy.</p>	
<p>PO16</p> <p>Development provides public toilets which:</p> <ul style="list-style-type: none"> (a) are required as part of a community facility or park; (b) are located, designed and constructed to be: <ul style="list-style-type: none"> (i) safe; (ii) durable; (iii) resistant to vandalism; (iv) able to service expected demand; (v) fit for purpose. 	<p>AO16</p> <p>Development that provides public toilets is designed and constructed in compliance with the public toilets standards in the Infrastructure design planning scheme policy.</p>	<p>The development complies with AO16 - Multiple public toilet facilities throughout the various floors and areas.</p>
<p>PO17</p> <p>Development provides bridges, tunnels, elevated structures and water access structures that are designed and constructed using proven methods, materials and technology to provide for:</p> <ul style="list-style-type: none"> (a) safe movement of intended users; (b) an attractive appearance appropriate to the general surroundings and any adjacent structures; (c) functionality and easy maintenance; (d) minimal whole-of-life cost; (e) longevity; (f) current and future services. 	<p>AO17</p> <p>Development that provides bridges, tunnels, elevated structures and water access structures is designed and constructed in compliance with the standards in the Infrastructure design planning scheme policy.</p>	<p>Development does not have any of the specified structures.</p>

<p>Note—All bridges and elevated and associated elements must be designed and certified by a Registered Professional Engineer Queensland in accordance with the Infrastructure design planning scheme policy.</p>		
<p>PO18</p> <p>Development provides culverts which are designed and constructed using proven methods, materials and technology to provide for:</p> <ul style="list-style-type: none"> (a) safety; (b) an attractive appearance appropriate to the general surroundings; (c) functionality and easy maintenance; (d) minimal whole-of-life cost; (e) longevity; (f) future widening; (g) current and future services; (h) minimal adverse impacts, such as increase in water levels or flow velocities, and significant change of flood patterns. <p>Note—All culverts and associated elements are to be designed and certified by a Registered Professional Engineer Queensland in accordance with the applicable design standards.</p>	<p>AO18</p> <p>Development that provides culverts is designed and constructed in compliance with the structures standards in the Infrastructure design planning scheme policy.</p>	<p>No culverts are specified for this development.</p>
<p>PO19</p> <p>Development provides batters, retaining walls, and seawalls and river walls which are designed and constructed using proven methods, materials and technology to provide for:</p> <ul style="list-style-type: none"> (a) safety; (b) an attractive appearance appropriate to the surrounding area; 	<p>AO19</p> <p>Development that provides batters, retaining walls, seawalls and river walls is designed and constructed in compliance with the structures standards in the Infrastructure design planning scheme policy.</p>	<p>Detailed design stage will address AO19 - Retaining walls as part of this development will be designed and detailed in the detailed design phase.</p>

<p>(c) easy maintenance;</p> <p>(d) minimal whole-of-life cost;</p> <p>(e) longevity;</p> <p>(f) minimal water seepage.</p> <p>Note—All retaining walls and associated elements are to be designed and certified by a Registered Professional Engineer Queensland in accordance with the applicable design standards.</p>		
If for development with a gross floor area greater than 1,000m²		
<p>PO20</p> <p>Development ensures that construction is managed so that use of public spaces and movement on pedestrian, cyclist and other traffic routes is not unreasonably disrupted and existing landscaping is adequately protected from short- and long-term impacts.</p> <p>Note—The preparation of a construction management plan can assist in demonstrating achievement of this performance outcome.</p> <p>Note—The Transport, access, parking and servicing planning scheme policy provides advice on the management of vehicle parking and deliveries during construction.</p>	<p>AO20</p> <p>Development ensures that during construction:</p> <ul style="list-style-type: none"> (a) the ongoing use of adjoining and surrounding parks and public spaces, such as malls and outdoor dining, is not compromised; (b) adjoining and surrounding landscaping is protected from damage; (c) safe, legible, efficient and sufficient pedestrian, cyclist and vehicular accessibility and connectivity to the wider network are maintained. 	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
<p>PO21</p> <p>Development ensures that construction and demolition activities are guided by measures that prevent or minimise adverse impacts including sleep disturbance at a sensitive use, due to noise and dust, including dust from construction vehicles entering and leaving the site.</p>	<p>AO21.1</p> <p>Development ensures that demolition and construction:</p> <ul style="list-style-type: none"> (a) only occur between 6:30am and 6:30pm Monday to Saturday, excluding public holidays; (b) do not occur over periods greater than 6 months. 	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>

<p>Note—A noise and dust impact management plan prepared in accordance with the Management plans planning scheme policy can assist in demonstrating achievement of this performance outcome.</p>	<p>AO21.2 Development including construction and demolition does not release dust emissions beyond the boundary of the site.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
	<p>AO21.3 Development construction and demolition does not involve asbestos-containing materials.</p>	<p>Asbestos testing of existing building required.</p>
<p>PO22 Development ensures that:</p> <ul style="list-style-type: none"> (a) construction and demolition do not result in damage to surrounding property as a result of vibration; (b) vibration levels achieve the vibration criteria in Table 9.4.4.3.B, Table 9.4.4.3.C, Table 9.4.4.3.D and Table 9.4.4.3.E. <p>Note—A vibration impact assessment report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.</p>	<p>AO22 Development ensures that the nature and scale of construction and demolition do not generate noticeable levels of vibration.</p>	<p>Expected vibrations will be assessed in the detailed design phase.</p>
<p>If for a material change of use or reconfiguring a lot in an urban area (as defined in the Regulation) involving premises that is, or will be, accessed by common private title, where involving buildings, either attached or detached, that are not covered by other legislation mandating fire hydrants</p>		
<p>PO23 Development ensures that fire hydrants are:</p> <ul style="list-style-type: none"> (a) installed and located to enable fire services to access water safely, effectively and efficiently; (b) suitably identified so that fire services can locate them at all hours. 	<p>AO23.1 Above or below ground fire hydrants are provided on residential, commercial and industrial streets and private roads, at not more than 90m intervals, and at each street intersection.</p> <p>Note—On residential streets, above ground fire hydrants may be single outlet. On commercial and industrial streets above ground fire hydrants should have dual valved outlets.</p>	<p>Development will be designed to meet AO23.1 To be addressed at detailed design phase.</p>

	AO23.2 Fire hydrants are identified by: (a) raised reflectorised pavement markers (RRPM) on sealed roads; (b) marker posts at the fence line where on an unsealed road, as road (HR) or path (HP) hydrants.	Development will be designed to meet AO23.2 To be addressed at detailed design phase.
PO24 Development ensures road widths and construction within the development, are adequate for refuse vehicles and for fire emergency vehicles to gain access to a safe working area close to buildings and near water supplies whether or not on-street parking spaces are occupied.	AO24 Internal private roads have a minimum roadway clearance between obstructions of 3.5m wide and 4.8m high in addition to any width required for on-street parking.	Internal roads are min. 3.5m wide with 5m clearance.
Development for major electricity infrastructure and bulk water supply infrastructure identified on the State Planning Policy Interactive Mapping System where not in the Utility services zone precinct of the Special purpose zone		
PO25 Development avoids or otherwise minimises adverse impacts on surrounding land uses through the use of buffers and setbacks and the appropriate design and location of plant and operational areas within the site.	AO25 No acceptable outcome is prescribed.	Electricity and bulk water supply infrastructure is not identified within the State Planning Policy Interactive Mapping for the development site area
Development potentially impacting on major electricity infrastructure and bulk water supply infrastructure identified on the State Planning Policy Interactive Mapping System where the infrastructure is not in the Utility services zone precinct of the Special purpose zone		
PO26 Development is sited and designed to: (a) avoid safety risks to people or property; (b) minimise noise and visual impacts to people and property;	AO26 No acceptable outcome is prescribed.	Electricity and bulk water supply infrastructure is not identified within the State Planning Policy Interactive Mapping for the development site area

(c) ensure the physical integrity and operation, maintenance and expansion of the infrastructure is not compromised.		
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Stormwater code

Performance outcomes	Acceptable outcomes	Assessment
Section A—If for a material change of use, reconfiguring a lot, operational work or building work		
Note—Compliance with the performance outcomes and acceptable outcomes in this section should be demonstrated by the submission of a site-based stormwater management plan for high risk development only.		
PO1 Development provides a stormwater management system which achieves the integrated management of stormwater to: <ul style="list-style-type: none"> (a) minimise flooding; (b) protect environmental values of receiving waters; (c) maximise the use of water sensitive urban design; (d) minimise safety risk to all persons; (e) maximise the use of natural waterway corridors and natural channel design principles. Editor's note—The stormwater management system to be developed to address PO1 is not intended to require management of stormwater quality.	AO1 Development provides a stormwater management system designed in compliance with the Infrastructure design planning scheme policy.	The development complies with AO1. The civil engineering report addresses these issues.
PO2 Development ensures that the stormwater management system and site work does not adversely impact flooding or drainage	AO2.1 Development does not result in an increase in flood level or flood hazard on up slope, down slope or adjacent premises.	Development does not result in an increase of the flood level or flood hazard.

characteristics of premises which are up slope, down slope or adjacent to the site.	AO2.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	The proposed stormwater system complies with the PSP.
PO3 Development ensures that the stormwater management system does not direct stormwater run-off through existing or proposed lots and property where it is likely to adversely affect the safety of, or cause nuisance to properties.	AO3.1 Development ensures that the location of the stormwater drainage system is contained within a road reserve, drainage reserve, public pathway, park or waterway corridor.	The stormwater drainage system is contained within the road reserve of Lutwyche Rd.
	AO3.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	Development complies with AO3.2 - The civil engineering report addresses these issues.
	AO3.3 Development obtains a lawful point of discharge in compliance with the standards in the Infrastructure design planning scheme policy.	Development complies with this item. Refer to Civil Engineering Report for details.
	AO3.4 Where on private land, all underground stormwater infrastructure is secured by a drainage easement.	Development complies with this item. Refer to Civil Engineering Report for details.
PO4 Development provides a stormwater management system which has sufficient capacity to safely convey run-off taking into account increased run-off from impervious surfaces and flooding in local catchments.	AO4.1 Development provides a stormwater conveyance system which is designed to safely convey flows in compliance with the standards in the Infrastructure design planning scheme policy.	Development complies with this item. Refer to Civil Engineering Report for details.
	AO4.2	Development complies with this item. Refer to Civil Engineering Report for details.

	Development provides sufficient area to convey run-off which will comply with the standards in the Infrastructure design planning scheme policy.	
PO5 Development designs stormwater channels, creek modification works, bridges, culverts and major drains to protect and enhance the value of the waterway corridor or drainage path for fauna movement.	AO5 Development ensures the design of stormwater channels, creek modifications or other infrastructure, permits terrestrial and aquatic fauna movement.	Stormwater channels will not be constructed as part of this development
PO6 Development ensures that location and design of stormwater detention and water quality treatment: <ul style="list-style-type: none"> (a) minimises risk to people and property; (b) provides for safe access and maintenance; (c) minimises ecological impacts to creeks and waterways. 	AO6.1 Development locates stormwater detention and water quality treatment: <ul style="list-style-type: none"> (a) outside of a waterway corridor; (b) offline to any catchment not contained within the development. 	Stormwater detention and water quality will be provided within the building.
	AO6.2 Development providing for stormwater detention and water quality treatment devices are designed in compliance with the standards in the Infrastructure design planning scheme policy.	Stormwater detention and water quality treatment have been design as per the PSP.
PO7 Development is designed, including any car parking areas and channel works to: <ul style="list-style-type: none"> (a) reduce property damage; (b) provide safe access to the site during the defined flood event. 	AO7.1 Development (including any ancillary structures and car parking areas) is located above minimum flood immunity levels in Table 9.4.9.3.B, Table 9.4.9.3.C, Table 9.4.9.3.D, Table 9.4.9.3.E and Table 9.4.9.3.F. Note—Compliance with this acceptable outcome can be demonstrated by the submission of a hydraulic and hydrology report identifying flood levels and development design levels (as part of a site-based stormwater management plan).	The site is located outside a flood impacted area.

	<p>AO7.2 Development including the road network provides a stormwater management system that provides safe pedestrian and vehicle access in accordance with the standards in the Infrastructure design planning scheme policy.</p>	<p>The detention tank within the basement will limit the discharged stormwater back - Further information will be provided at detailed design phase.</p>
<p>PO8 Development designs stormwater channels, creek modification works and the drainage network to protect and enhance the environmental values of the waterway corridor or drainage path.</p>	<p>AO8.1 Development ensures natural waterway corridors and drainage paths are retained.</p>	<p>No works are required within a natural waterway corridor or drainage path.</p>
	<p>AO8.2 Development provides the required hydraulic conveyance of the drainage channel and floodway, while maximising its potential to maximise environmental benefits and minimise scour.</p> <p>Editor's note—Guidance on natural channel design principles can be found in the Council's publication Natural channel design guidelines.</p>	<p>The stormwater gets discharged directly into the stormwater system in the road.</p>
	<p>AO8.3 Development provides stormwater outlets into waterways, creeks, wetlands and overland flow paths with energy dissipation to minimise scour in compliance with the standards in the Infrastructure design planning scheme policy.</p>	<p>Development will not discharge directly to waterways, creeks, wetlands and overland flow paths.</p>
	<p>AO8.4 Development ensures that the design of modifications to the existing design of new stormwater channels, creeks and major drains is in compliance with the standards in the Infrastructure design planning scheme policy.</p>	<p>Development complies with this item. Refer to Civil Engineering Report for details.</p>

PO9 Development is designed to manage run-off and peak flows by minimising large areas of impervious material and maximising opportunities for capture and re-use.	AO9 No acceptable outcome is prescribed.	The Development complies. Rainwater tank and reuse will be employed within the development.
PO10 Development ensures that there is sufficient site area to accommodate an effective stormwater management system. Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.	AO10 No acceptable outcome is prescribed.	The Development complies. Stormwater management system is contained within the site.
PO11 Development provides for the orderly development of stormwater infrastructure within a catchment, having regard to the: (a) existing capacity of stormwater infrastructure within and external to the site, and any planned stormwater infrastructure upgrades; (b) safe management of stormwater discharge from existing and future up-slope development; (c) implication for adjacent and down-slope development.	AO11.1 Development with up-slope external catchment areas provides a drainage connection sized for ultimate catchment conditions that is directed to a lawful point of discharge.	The Development complies. Stormwater management system is contained within the site.
	AO11.2 Development ensures that existing stormwater infrastructure that is undersized is upgraded in compliance with the Infrastructure design planning scheme policy.	The existing stormwater pipes in the Lamington Ave will be upsized to 375 pipes.
PO12 Development provides stormwater infrastructure which: (a) remains fit for purpose for the life of the development and maintains full functionality in the design flood event; (b) can be safely accessed and maintained cost effectively;	AO12.1 The stormwater management system is designed in compliance with the Infrastructure design planning scheme policy.	Development complies with this item. Refer to Civil Engineering Report for details.
	AO12.2 Development provides a clear area with a minimum of 2m radius from the centre of an existing manhole cover and with a minimum height clearance of 2.5m.	Development complies with this item.

(c) ensures no structural damage to existing stormwater infrastructure.		
<p>PO13</p> <p>Development ensures that all reasonable and practicable measures are taken to manage the impacts of erosion, turbidity and sedimentation, both within and external to the development site from construction activities, including vegetation clearing, earthworks, civil construction, installation of services, rehabilitation, revegetation and landscaping to protect:</p> <ul style="list-style-type: none"> (a) the environmental values and water quality objectives of waters; (b) waterway hydrology; (c) the maintenance and serviceability of stormwater infrastructure. <p>Note—The Infrastructure design planning scheme policy outlines the appropriate measures to be taken into account to achieve the performance outcome.</p>	<p>AO13</p> <p>No acceptable outcome is prescribed.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
<p>PO14</p> <p>Development ensures that:</p> <ul style="list-style-type: none"> (a) unnecessary disturbance to soil, waterways or drainage channels is avoided; (b) all soil surfaces remain effectively stabilised against erosion in the short and long term. 	<p>AO14</p> <p>No acceptable outcome is prescribed.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
<p>PO15</p> <p>Development does not increase:</p> <ul style="list-style-type: none"> (a) the concentration of total suspended solids or other contaminants in stormwater flows during site construction; (b) run-off which causes erosion either on site or off site. 	<p>AO15</p> <p>No acceptable outcome is prescribed.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>

Section B—Additional performance outcomes and acceptable outcomes which apply to high-risk development, being one or more of the following: (a) a material change of use for an urban purpose which involves greater than 2,500m ² of land that: (i) will result in an impervious area greater than 25% of the net developable area; or (ii) will result in 6 or more dwellings. (b) reconfiguring a lot for an urban purpose that involves greater than 2,500m ² of land and will result in 6 or more lots; (iii) operational work for an urban purpose which involves disturbing greater than 2,500m ² of land.		
PO16 Development ensures that the entry and transport of contaminants into stormwater is avoided or minimised to protect receiving water environmental values. Note—Prescribed water contaminants are defined in the <i>Environmental Protection Act 1994</i> . Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.	AO16 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	Development complies with AO16. Refer civil engineering report.
PO17 Development ensures that: (a) the discharge of wastewater to a waterway or external to the site is avoided; or (b) if the discharge cannot practicably be avoided, the development minimises wastewater discharge through re-use, recycling, recovery and treatment. Note—The preparation of a wastewater management plan can assist in demonstrating achievement of this performance outcome. Editor's note—This code does not deal with sewerage which is the subject of the Wastewater code.	AO17 No acceptable outcome is prescribed.	No wastewater will be discharged to waterways. A 50kl rainwater tank is proposed.
Section C—Additional performance outcomes and acceptable outcomes for assessable development for a material change of use or reconfiguring a lot		

<p>PO18</p> <p>Development protects stormwater infrastructure to ensure the following are not compromised:</p> <ul style="list-style-type: none"> (a) the long term infrastructure for the stormwater network in the Long term infrastructure plans; (b) the existing and planned infrastructure for the stormwater network in the Local government infrastructure plan; (c) the provision of long term, existing and planned infrastructure for the stormwater network which: <ul style="list-style-type: none"> (i) is required to service the development or an existing and future urban development in the planning scheme area; or (ii) is in the interests of rational development or the efficient and orderly planning of the general area in which the site is situated. <p>Editor's note—A condition which requires a proposed development to keep permanent improvements and structures associated with the approved development clear of the area of long term infrastructure, may be imposed.</p>	<p>AO18</p> <p>Development protects stormwater infrastructure in compliance with the following:</p> <ul style="list-style-type: none"> (a) for long term infrastructure for the stormwater network, the Long term infrastructure plans; (b) for existing and planned infrastructure for the stormwater network, the Local government infrastructure plan; (c) the standards for stormwater drainage in the Infrastructure design planning scheme policy. 	<p>Development complies with AO18. Refer civil engineering report.</p>
<p>PO19</p> <p>Development provides for the payment of extra trunk infrastructure costs for the following:</p> <ul style="list-style-type: none"> (a) for development completely or partly outside the priority infrastructure area in the Local government infrastructure plan; (b) for development completely inside the priority infrastructure area in the Local government infrastructure plan involving: <ul style="list-style-type: none"> (i) trunk infrastructure that is to be provided earlier than planned in the Local government infrastructure plan; (ii) long term infrastructure for the stormwater network which is made necessary by 	<p>AO19</p> <p>No acceptable outcome is prescribed.</p>	<p>Development complies with AO19. Refer civil engineering report.</p>

<p>development that is not assumed future urban development;</p> <p>(iii) other infrastructure for the stormwater network associated with development that is not assumed future urban development which is made necessary by the development.</p> <p>Editor's note—The payment of extra trunk infrastructure costs for development completely inside the priority infrastructure area in the Local government infrastructure plan is to be worked out in accordance with the Charges Resolution.</p> <p>Editor's note—See section 130 Imposing Development conditions (Conditions for extra trunk infrastructure costs) of the <i>Planning Act 2016</i>.</p>		
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State code 3: Development in a busway environment

Table 3.2.1: Development in a busway environment

Performance outcomes	Acceptable outcomes	Response
Buildings and structures		
<p>PO1 The location of buildings, structures, infrastructure, services and utilities does not create a safety hazard in a busway corridor or cause damage to, or obstruct busway transport infrastructure.</p> <p>Note: Section 3.1 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>	<p>AO1.1 Buildings, structures, infrastructure, services and utilities are not located in a busway corridor. AND</p> <p>AO1.2 Buildings, structures, infrastructure, services and utilities can be maintained without requiring access to a busway corridor.</p>	<p>Complies with PO# / AO# <i>Use this column to indicate whether compliance is achieved with the relevant PO or AO (or if they do not apply), and explain why</i></p> <p>Complies with AO1.2</p>
<p>PO2 Development does not add or remove loading that will cause damage to bus transport infrastructure or a busway corridor.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p> <p>Section 3.1 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>PO3 Road, pedestrian and bikeway bridges over a busway corridor are designed and constructed to prevent projectiles from being thrown onto a busway.</p> <p>Note: Section 3.1 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>	AO3.1 Road, pedestrian and bikeway bridges include throw protection screens in accordance with section 4.9.3 of the Design Criteria for Bridges and Other Structures Manual, Department of Transport and Main Roads, 2018.	Not applicable
<p>PO4 Construction activities do not cause ground movement or vibration impacts in a busway corridor.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p> <p>Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report

Performance outcomes	Acceptable outcomes	Response
2017, provides further guidance on how to comply with this performance outcome.		
Filling, excavation and retaining structures		
<p>PO5 Filling, excavation and retaining structures do not interfere with, or result in damage to, infrastructure or services in a busway corridor.</p> <p>Note: Information on the location of services and public utilities in a busway can be obtained from the 'Dial Before You Dig' service. Where development will impact on a service or public utility plant in a busway corridor, such that the service or public utility plant will need to be relocated, an applicant should contact the relevant service or public utility plant provider for standards and design specifications for the alternative alignment. Any costs of relocation are to be borne by the developer.</p> <p>Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>PO6 Filling, excavation, building foundations and retaining structures do not undermine or cause subsidence of, a busway corridor.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p> <p>Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>PO7 Filling, excavation, building foundations and retaining structures do not cause ground water disturbance in a busway corridor.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended an RPEQ certified geotechnical assessment is provided.</p> <p>Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>PO8 Excavation, boring, piling, blasting or fill compaction during construction of a development does not result in ground movement or vibration</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report

Performance outcomes	Acceptable outcomes	Response
<p>impacts that would cause damage or nuisance to busway transport infrastructure or busway transport infrastructure works.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p> <p>Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>		
<p>PO9 Filling and excavation material does not cause an obstruction or nuisance in a busway corridor.</p> <p>Note: Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads 2017, provides further guidance on how to comply with this performance outcome.</p>	<p>AO9.1 Development does not store fill, spoil or any other material in, or adjacent to, a busway corridor.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
<p>PO10 Filling and excavation does not cause wind-blown dust nuisance in a busway corridor.</p>	<p>AO10.1 Compaction of fill is carried out in accordance with the requirements of AS1289.0 2000 – Methods of testing soils for engineering purposes. AND</p>	<p>Refer to WSP's Northern Busway Impacts Report</p>
	<p>AO10.2 Dust suppression measures are used during filling and excavation activities such as wind breaks or barriers and dampening of ground surfaces.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
Stormwater and drainage		
<p>PO11 Development does not result in an actionable nuisance or worsening of stormwater, flooding or drainage impacts in a busway corridor.</p> <p>Note: Section 3.3 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.</p>	<p>No acceptable outcome is prescribed.</p>	<p>Not applicable</p>
<p>PO12 Run-off from the development site during construction of development does not cause siltation of stormwater infrastructure affecting a busway.</p> <p>Note: Section 3.3 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.</p>	<p>AO12.1 Run-off from the development site during construction of development is not discharged to stormwater infrastructure for a busway.</p>	<p>To be addressed at construction phase with contractor and their Construction Management Plan.</p>
Access		

Performance outcomes	Acceptable outcomes	Response
PO13 Development prevents unauthorised access to a busway corridor. Note: Section 3.4 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.	AO13.1 Where development is abutting a busway corridor, a fence is provided along the property boundary in accordance with clause 4.1.6 of the Guide to Road Design Part 6B, Austroads 2015 and Part 6B of the Road Planning and Design Manual, 2 nd edition, Department of Transport and Main Roads, 2016.	Not applicable
PO14 Vehicular access for a development does not create a safety hazard or result in worsening of operating conditions on busways. Note: Section 3.4 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.	No acceptable outcome is prescribed.	
PO15 Development does not damage or interfere with public passenger transport infrastructure, public passenger services or pedestrian and cycle access to public passenger transport infrastructure and public passenger services. Note: Section 3.5 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.	AO15.1 Vehicular access and associated road access works are not located within 5 metres of public passenger transport infrastructure. AND	Not applicable, vehicular access is further than 5m away from public passenger infrastructure
	AO15.2 Development does not necessitate the relocation of existing public passenger transport infrastructure. AND	Not applicable, relocation of existing public passenger transport infrastructure is not required
	AO15.3 On-site vehicle circulation is designed to give priority to entering vehicles at all times so vehicles using a vehicular access do not obstruct public passenger transport infrastructure and public passenger services or obstruct pedestrian or cycle access to public passenger transport infrastructure and public passenger services. AND	
	AO15.4 The normal operation of public passenger transport infrastructure or public passenger services is not interrupted during construction of the development.	To be addressed at construction phase with contractor and their Construction Management Plan.
Planned upgrades		
PO16 Development does not impede delivery of planned upgrades of busway transport infrastructure. Note: Section 3.6 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and	AO16.1 Development is not located on land identified by Department of Transport and Main Roads as land required for the planned upgrade of busway transport infrastructure. Note: Land required for the planned upgrade of busway transport infrastructure is identified in the DA mapping system.	Not applicable

Performance outcomes	Acceptable outcomes	Response
Main Roads, 2017, provides further guidance on how to comply with this performance outcome.	OR	
	AO16.2 Development is sited and designed so that permanent buildings, structures, infrastructure, services or utilities are not located on land identified by the Department of Transport and Main Roads as land required for the planned upgrade of busway transport infrastructure.	Not applicable
	OR all of the following acceptable outcomes apply:	
	AO16.3 Structures and infrastructure located on land identified by the Department of Transport and Main Roads as land required for the planned upgrade of a busway transport infrastructure are able to be readily relocated or removed without materially affecting the viability or functionality of the development. AND	Not applicable
	AO16.4 Development does not involve filling and excavation of, or material changes to, land required for a planned upgrade to busway transport infrastructure. AND	Not applicable
	AO16.5 Land is able to be reinstated to the pre-development condition at the completion of the use.	Not applicable

Table 3.2.2: Environmental emissions

Performance outcomes	Acceptable outcomes	Response
Noise		
Accommodation activities		
PO17 Development involving: 1. an accommodation activity; or 2. land for a future accommodation activity minimises noise intrusion from a busway in habitable rooms.	AO17.1 A noise barrier or earth mound is provided which is design, sited and constructed: 1. to meet the following external noise criteria at all facades of the building envelope: a. ≤55 dB(A) L_{eq} (1 hour) façade corrected (maximum hour between 6 am and 10 pm) b. ≤50 dB(A) L_{eq} (1 hour) façade corrected (maximum hour between 10 pm and 6 am) c. ≤64 dB(A) L_{max} façade corrected (between 10pm and 6am) 2. in accordance with chapter 7 – Integrated noise barrier design of the Transport Noise Management Code of Practice – Volume 1 Road	

Performance outcomes	Acceptable outcomes	Response
	<p>Traffic Noise, Department of Transport and Main Roads, 2013.</p> <p>Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment is provided, prepared in accordance with section 3.7 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017.</p> <p>If the building envelope is unknown, the deemed-to-comply setback distances for buildings stipulated by the local planning instrument or relevant building regulations should be used.</p> <p>In some instances, the design of noise barriers and mounds to achieve the noise criteria above the ground floor may not be reasonable or practicable. In these instances, any relaxation of the criteria is at the discretion of the Department of Transport and Main Roads.</p> <p>OR all of the following acceptable outcomes apply:</p>	
	<p>AO17.2 Buildings which include a habitable room are setback the maximum distance possible from a busway. AND</p>	
	<p>AO17.3 Buildings are designed and oriented so that habitable rooms are located furthest from a busway. AND</p>	
	<p>AO17.4 Buildings are designed and constructed using materials which ensure that habitable rooms meet the following internal noise criteria:</p> <ol style="list-style-type: none"> 1. ≤ 35 dB(A) L_{eq} (1 hour) (maximum hour over 24 hours). <p>Note: Noise levels from a busway are to be measured in accordance with AS1055.1–1997 Acoustics – Description and measurement of environmental noise.</p> <p>To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report is provided, prepared in accordance with section 3.7 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017.</p>	
<p>PO18 Development involving an accommodation activity minimises noise intrusion from a busway in outdoor spaces for passive recreation.</p>	<p>AO18.1 A noise barrier or earth mound is provided which is design, sited and constructed:</p> <ol style="list-style-type: none"> 1. to meet the following external noise criteria in outdoor spaces for passive recreation: 	

Performance outcomes	Acceptable outcomes	Response
	<p>a. ≤ 52 dB(A) L_{eq} (1 hour) free field (maximum hour between 6 am and 10 pm)</p> <p>b. ≤ 66 dB(A) L_{max} free field</p> <p>2. in accordance with chapter 7 – Integrated noise barrier design of the Transport Noise Management Code of Practice – Volume 1 Road Traffic Noise, Department of Transport and Main Roads, 2013.</p> <p>Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment is provided, prepared in accordance with section 3.7 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017.</p> <p>OR</p>	
	<p>AO18.2 Each dwelling has access to an outdoor space for passive recreation which is shielded from a busway by a building, a solid gap-free fence, or other solid gap-free structure.</p> <p>AND</p>	Not applicable
	<p>AO18.3 Each dwelling with a balcony directly exposed to noise from a busway has a continuous solid gap-free balustrade (other than gaps required for drainage purposes to comply with the Building Code of Australia).</p>	Not applicable
Childcare centres and educational establishments		
<p>PO19 Development involving a:</p> <p>1. childcare centre; or</p> <p>2. educational establishment</p> <p>minimises noise intrusion from a busway in indoor education areas and indoor play areas.</p>	<p>AO19.1 A noise barrier or earth mound is provided which is designed, sited and constructed:</p> <p>1. to meet the following external noise criteria at the building envelope:</p> <p>a. ≤ 55 dB(A) L_{eq} (1 hour) façade corrected (maximum hour during normal opening hours)</p> <p>2. in accordance with chapter 7 – Integrated noise barrier design of the Transport Noise Management Code of Practice – Volume 1 Road Traffic Noise, Department of Transport and Main Roads, 2013.</p> <p>Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report is</p>	

Performance outcomes	Acceptable outcomes	Response
	<p>provided, prepared in accordance with section 3.7 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017</p> <p>If the building envelope is unknown, the deemed-to-comply setback distances for buildings stipulated by the local planning instrument or relevant building regulations should be used.</p> <p>OR all of the following acceptable outcomes apply:</p>	
	<p>AO19.2 Buildings which include indoor education areas and indoor play areas are setback the maximum distance possible from a busway.</p> <p>AND</p>	
	<p>AO19.3 Buildings are designed and oriented so that indoor education areas and indoor play areas are located furthest from the busway.</p> <p>AND</p>	
	<p>AO19.4 Buildings are designed and constructed using materials which ensure indoor education areas and indoor play areas meet the following internal noise criteria:</p> <ol style="list-style-type: none"> 1. ≤ 35 dB(A) L_{eq} (1 hour) (maximum hour during opening hours). <p>Note: Noise levels from a busway are to be measured in accordance with AS1055.1–1997 Acoustics – Description and measurement of environmental noise.</p> <p>To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report is provided, prepared in accordance with section 3.7 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017.</p>	
<p>PO20 Development involving a:</p> <ol style="list-style-type: none"> 1. childcare centre; or 2. educational establishment <p>minimises noise intrusion from a busway in outdoor education areas and outdoor play areas.</p>	<p>AO20.1 A noise barrier or earth mound is provided which is design, sited and constructed:</p> <ol style="list-style-type: none"> 1. to meet the following external noise criteria in outdoor education areas and outdoor play areas: <ol style="list-style-type: none"> a. ≤ 52 dB(A) L_{eq} (1 hour) free field (maximum hour during normal opening hours) b. ≤ 66 dB(A) L_{max} free field (during normal opening hours) 	

Performance outcomes	Acceptable outcomes	Response
	<p>2. in accordance with chapter 7 – Integrated noise barrier design of the Transport Noise Management Code of Practice – Volume 1 Road Traffic Noise, Department of Transport and Main Roads, 2013.</p> <p>Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment is provided, prepared in accordance with section 3.7 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017.</p> <p>OR</p> <p>AO20.2 Each outdoor education area and outdoor play area is shielded from noise generated from a busway by a building, a solid gap-free fence, or other solid gap-free structure.</p>	
Hospitals		
PO21 Development involving a hospital minimises noise intrusion from a busway in patient care areas.	<p>AO21.1 Hospitals are designed and constructed using materials which ensure patient care areas meet the following internal noise criteria:</p> <p>1. $\leq 35 \text{ dB(A)} L_{eq}$ (1 hour) (maximum hour during opening hours).</p> <p>Note: Noise levels from a busway are to be measured in accordance with AS1055.1–1997 Acoustics – Description and measurement of environmental noise.</p> <p>To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report is provided, prepared in accordance with section 3.7 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017.</p>	
Vibration		
Hospitals		
PO22 Development involving a hospital minimises vibration impacts from a busway in patient care areas.	<p>AO22.1 Hospitals are designed and constructed to ensure vibration in the treatment area of a patient care area does not exceed a vibration dose value of $0.1 \text{ m/s}^{1.75}$.</p> <p>AND</p> <p>AO22.2 Hospitals are designed and constructed to ensure vibration in the ward area of a patient care</p>	<p>Refer to WSP's Northern Busway Impacts Report</p> <p>Refer to WSP's Northern Busway Impacts Report</p>

Performance outcomes	Acceptable outcomes	Response
	area does not exceed a vibration dose value of 0.4m/s ^{1.75} . Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified vibration assessment report is provided.	
Air and light		
PO23 Development involving an accommodation activity minimises air quality impacts from a busway in outdoor spaces for passive recreation.	AO23.1 Each dwelling has access to an outdoor space for passive recreation which is shielded from a busway by a building, a solid gap-free fence, or other solid gap-free structure.	
PO24 Development involving a: 1. childcare centre; or 2. educational establishment minimises air quality impacts from a busway in outdoor education areas and outdoor play areas.	AO24.1 Each outdoor education area and outdoor play area is shielded from a busway by a building, solid gap-free fence, or other solid gap-free structure.	
PO25 Development involving an accommodation activity or hospital minimises lighting impacts from a busway.	AO25.1 Buildings for an accommodation activity or hospital are designed to minimise the number of windows or transparent/translucent panels facing a busway. OR	
	AO25.2 Windows facing a busway include treatments to block light from a busway.	

Table 3.2.3: Development in a future busway environment

Performance outcomes	Acceptable outcomes	Response
PO26 Development does not impede delivery of busway transport infrastructure in a future busway corridor. Note: Section 3.6 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.	AO26.1 Development is not located in a future busway corridor. OR	Complies with PO# / AO# <i>Use this column to indicate whether compliance is achieved with the relevant PO or AO (or if they do not apply), and explain why</i>
	AO26.2 Development is sited and designed so that permanent buildings, structures, infrastructure, services or utilities are not located in a future busway corridor.	Not applicable
	OR all of the following acceptable outcomes apply:	
	AO26.3 Structures and infrastructure located in a future busway corridor are able to be readily relocated	Not applicable

Performance outcomes	Acceptable outcomes	Response
	or removed without materially affecting the viability or functionality of the development.	
	AND	
	AO26.4 Development does not involve filling and excavation of, or material changes to, a future busway corridor.	Not applicable
	AND	
	AO26.5 Land is able to be reinstated to the pre-development condition at the completion of the use.	Not applicable
<p>PO27 Filling, excavation, building foundations and retaining structures do not undermine or cause subsidence of a future busway corridor.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended that an RPEQ certified geotechnical assessment is provided.</p> <p>Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>PO28 Fill material from a development site does not result in contamination of land for a future busway corridor.</p> <p>Note: Section 3.2 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.</p>	<p>AO28.1 Fill material is free of contaminants including acid sulfate content.</p> <p>Note: Soil and rocks should be tested in accordance with AS1289 – Methods of testing soils for engineering purposes and AS4133 2005 – Methods of testing rocks for engineering purposes.</p>	Refer to WSP's Northern Busway Impacts Report
	<p>AND</p> <p>AO28.2 Compaction of fill is carried out in accordance with the requirements of AS 1289.0 2000 – Methods of testing soils for engineering purposes.</p>	
<p>PO29 Development does not result in an actionable nuisance, or worsening of, stormwater, flooding or drainage impacts in a future busway corridor.</p> <p>Note: Section 3.3 of the Interim Guide to Development in a Transport Environment: Busway, Department of Transport and Main Roads, 2017, provides further guidance on how to comply with this performance outcome.</p>	No acceptable outcome is prescribed.	Not applicable

State code 5: Development in a state-controlled transport tunnel environment

Table 5.2.1: Development in a state-controlled tunnel environment

Performance outcomes	Acceptable outcomes	Response
Buildings and structures		
PO1 The location of buildings, structures, infrastructure, services and utilities does not cause damage to a state-controlled transport tunnel, or obstruct state-controlled transport tunnel infrastructure.	AO1.1 Buildings, structures, infrastructure, services and utilities are not located on land identified as a state-controlled transport tunnel. AND	Complies with PO# / AO# <i>Use this column to indicate whether compliance is achieved with the relevant PO or AO (or if they do not apply), and explain why</i>
	AO1.2 Buildings, structures, infrastructure, services and utilities can be maintained without requiring access to land identified as a state-controlled transport tunnel.	Complies with AO1.2
PO2 Buildings, structures, infrastructure, services and utilities do not interfere with, or result in damage to, infrastructure or services in a state-controlled transport tunnel. Note: Information on the location of services and public utilities in a state-controlled transport tunnel can be obtained from the railway manager and/or Dial Before You Dig service. Where development will impact on a service or public utility plant in a state-controlled transport tunnel, such that the service or public utility plant will need to be relocated, an applicant should contact the relevant service or public utility plant provider for standards and design specifications for the alternative alignment. Any costs of relocation are to be borne by the developer.	No acceptable outcome is prescribed.	Not applicable

Performance outcomes	Acceptable outcomes	Response
<p>P03 Buildings, structures, infrastructure, services and utilities do not add or remove loading that will cause damage to a state-controlled transport tunnel or state-controlled tunnel infrastructure.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p>	No acceptable outcome is prescribed.	Not applicable
<p>P04 Buildings, structures, infrastructure, services and utilities do not cause ground movement or vibration impacts that would cause damage or nuisance to a state-controlled transport tunnel or state controlled transport tunnel infrastructure.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>P05 Buildings, structures, infrastructure, services and utilities do not cause ground water disturbance on land for a state-controlled transport tunnel.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment, is provided.</p>	No acceptable outcome is prescribed.	
Filling, excavation and retaining structures		
<p>P06 Filling, excavation and retaining structures do not interfere with, or result in damage to, infrastructure or services in a state-controlled transport tunnel.</p> <p>Note: Information on the location of services and public utilities in a state-controlled transport tunnel can be obtained from the railway manager and/or Dial Before You Dig service.</p> <p>Where development will impact on a service or public utility plant in a state-controlled transport tunnel, such that the service or public utility plant will need to be relocated, an applicant should contact the relevant service or public utility plant provider for standards and design specifications for the alternative alignment. Any costs of relocation are to be borne by the developer.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report

Performance outcomes	Acceptable outcomes	Response
<p>PO7 Filling, excavation, building foundations and retaining structures do not undermine or cause subsidence of land for a state-controlled transport tunnel.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>PO8 Excavation, boring, piling or fill compaction during construction of a development does not result in ground movement or vibration impacts that would cause damage or nuisance to a state-controlled transport tunnel.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
PO9 Development does not involve blasting.	No acceptable outcome is prescribed.	
<p>PO10 Filling and excavation, building foundations and retaining structures do not cause damage to a state-controlled transport tunnel by adding or removing loading.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p>	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
<p>PO11 Filling and excavation, building foundations and retaining structures do not cause ground water disturbance to a state-controlled transport tunnel corridor.</p> <p>Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.</p>	No acceptable outcome is prescribed.	
<p>PO12 Fill material from a development site does not result in contamination of a state-controlled transport tunnel corridor.</p>	<p>AO12.1 Fill material is free of contaminants including acid sulfate content.</p> <p>Note: Soil and rocks should be tested in accordance with AS 1289 – Methods of testing soils for engineering purposes and AS 4133 2005 – Methods of testing rocks for engineering purposes.</p>	

Performance outcomes	Acceptable outcomes	Response
	AND AO12.2 Compaction of fill is carried out in accordance with the requirements of AS 1289.0 2000 – Methods of testing soils for engineering purposes.	
PO13 Filling and excavation in the vicinity of a state-controlled transport tunnel portal does not cause wind-blown dust nuisance in a state-controlled transport tunnel.	AO13.1 Compaction of fill is carried out in accordance with the requirements of AS 1289.0 2000 – Methods of testing soils for engineering purposes. AND AO13.2 Dust suppression measures are used during filling and excavation activities such as wind breaks or barriers and dampening of ground surfaces.	To be addressed at construction phase with contractor and their Construction Management Plan.
PO14 Filling and excavation material does not cause damage, obstruction or nuisance in a state-controlled transport tunnel corridor.	AO14.1 Development does not store fill, spoil or any other material in a state-controlled transport tunnel corridor.	To be addressed at construction phase with contractor and their Construction Management Plan.
Stormwater and drainage		
PO15 Development does not result in an actionable nuisance or worsening of stormwater, flooding or drainage impacts in a state-controlled transport tunnel corridor or a state-controlled transport tunnel.	No acceptable outcome is prescribed.	Not Applicable
PO16 Run-off from the development site during construction of development does not cause siltation of stormwater infrastructure affecting a state-controlled transport tunnel.	AO16.1 Run-off from the development site during construction is not discharged to stormwater infrastructure for a state-controlled transport tunnel.	To be addressed at construction phase with contractor and their Construction Management Plan.
PO17 Development does not cause damage to tunnel drainage structures.	No acceptable outcome is prescribed.	Refer to WSP's Northern Busway Impacts Report
Access		
PO18 Vehicular access to a development is not from a state-controlled transport tunnel.	No acceptable outcome is prescribed.	Complies with AO18
PO19 Development does not obstruct or impede existing access to a state-controlled transport tunnel.	AO19.1 Development is designed and sited to ensure existing authorised access points and access routes for maintenance and emergency works to a state-controlled transport tunnel are clear from obstructions at all times.	Complies with AO19.1
Network safety		
PO20 Development involving dangerous goods	AO20.1 Development does not involve handling or	To be addressed at construction phase with

Performance outcomes	Acceptable outcomes	Response
<p>adjacent to a state-controlled transport tunnel corridor does not adversely impact on the safety or operations of a state-controlled transport tunnel.</p> <p>Note: Development involving dangerous goods, or hazardous chemicals above the threshold quantities listed in table 5.2 of the Model Planning Scheme Development Code for Hazardous Industries and Chemicals, Office of Industrial Relations, Department of Justice and Attorney-General, 2016, should demonstrate that impacts on a state-controlled transport tunnel from a fire, explosion, spill, gas emission or dangerous goods incident can be appropriately mitigated.</p>	<p>storage of hazardous chemicals above the threshold quantities listed in table 5.2 of Model Planning Scheme Development Code for Hazardous Industries and Chemicals, Office of Industrial Relations, Department of Justice and Attorney-General, 2016.</p>	<p>contractor and their Construction Management Plan.</p>
Air and light		
<p>PO21 Development involving an accommodation activity located near a state-controlled transport tunnel portal minimises air quality impacts from a state-controlled transport tunnel in outdoor spaces for passive recreation.</p>	<p>AO21.1 Each dwelling has access to an outdoor space for passive recreation which is shielded from a state-controlled transport tunnel portal by a building, solid gap-free fence, or other solid gap-free structure.</p>	
<p>PO22 Development involving a:</p> <ol style="list-style-type: none"> 1. child care centre; or 2. educational establishment <p>located near a state-controlled transport tunnel portal minimises air quality impacts from a state-controlled transport tunnel in outdoor education areas and outdoor play areas.</p>	<p>AO22.1 Each outdoor education area and outdoor play area is shielded from a state-controlled transport tunnel portal by a building, solid gap-free fence, or other solid gap-free structure.</p>	
<p>PO23 Development involving an accommodation activity or hospital located near a state-controlled transport tunnel portal minimises lighting impacts from a state-controlled transport tunnel.</p>	<p>AO23.1 Buildings for an accommodation activity or hospital are designed to minimise the number of windows or transparent/translucent panels facing a state-controlled transport tunnel portal.</p> <p>OR</p>	
	<p>AO23.2 Windows facing a state-controlled transport tunnel include treatments to block light from state-controlled transport tunnel portal.</p>	

Table 5.2.2: Development impacting on a future state-controlled tunnel environment

Performance outcomes	Acceptable outcomes	Response
PO24 Development does not impede the delivery of a future state-controlled transport tunnel.	AO24.1 Development is not located on land identified as a future state-controlled transport tunnel corridor.	Not Applicable
	OR	
	AO24.2 Development is sited and designed so that permanent buildings, structures, infrastructure, services or utilities are not located on land identified as a future state-controlled transport tunnel.	Not Applicable
	OR all of the following acceptable outcomes apply: AO24.3 Structures and infrastructure located on land identified as a future state-controlled transport tunnel are able to be readily relocated or removed without materially affecting the viability or functionality of the development. AND	Not Applicable
	AO24.4 Development does not involve filling and excavation of, or material changes to, land identified as a future state-controlled transport tunnel. AND	Not Applicable
	AO24.5 Land is able to be reinstated to the pre-development condition at the completion of the use.	Not Applicable
PO25 Filling and excavation, building foundations and retaining structures do not obstruct, undermine, or cause subsidence of land for a future state-controlled transport tunnel. Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided, prepared in accordance with volume 3 of the Road Planning and Design Manual 2nd edition, Department of Transport and Main Roads, 2016.	No acceptable outcome is prescribed.	Not Applicable
PO26 Filling and excavation, building foundations and retaining structures do not cause damage to land for a future state-controlled transport tunnel by adding or	No acceptable outcome is prescribed.	Not Applicable

Performance outcomes	Acceptable outcomes	Response
removing loading. Note: To demonstrate compliance with this performance outcome, it is recommended a RPEQ certified geotechnical assessment is provided.		
PO27 Fill material from a development site does not result in contamination of land for a future state-controlled transport tunnel.	AO27.1 Fill material is free of contaminants including acid sulfate content. Note: Soil and rocks should be tested in accordance with AS1289 – Methods of testing soils for engineering purposes and AS4133 2005 – Methods of testing rocks for engineering purposes. AND	Not Applicable
	AO27.2 Compaction of fill is carried out in accordance with the requirements of AS1289.0 2000 – Methods of testing soils for engineering purposes.	Not Applicable
PO28 Development does not result in an actionable nuisance or worsening of stormwater, flooding or drainage impacts on land for a future state-controlled transport tunnel.	No acceptable outcome is prescribed.	Not Applicable

APPENDIX G

DIAL BEFORE YOU DIG



APPENDIX G


G.1 - NBN

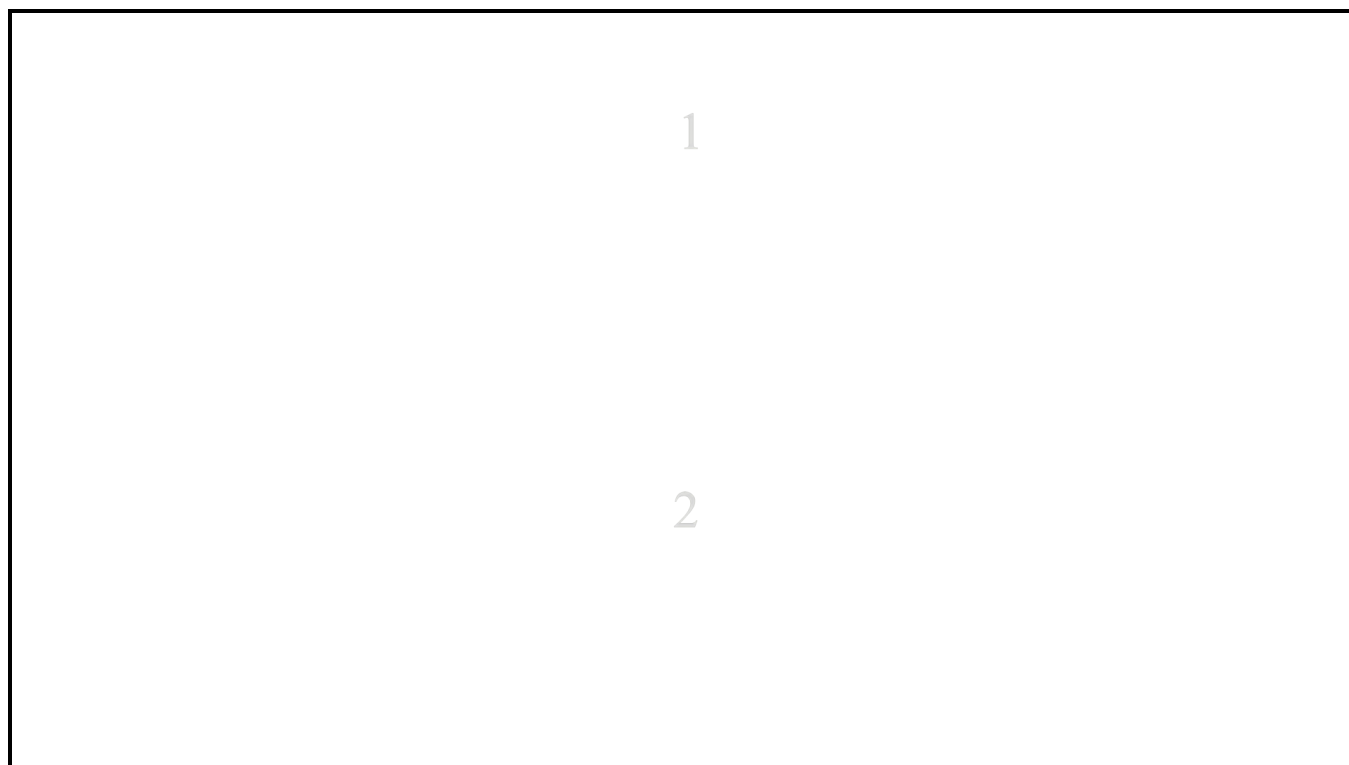
DIAL BEFORE YOU DIG










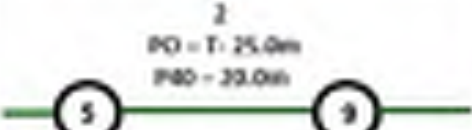





Indicative Plans

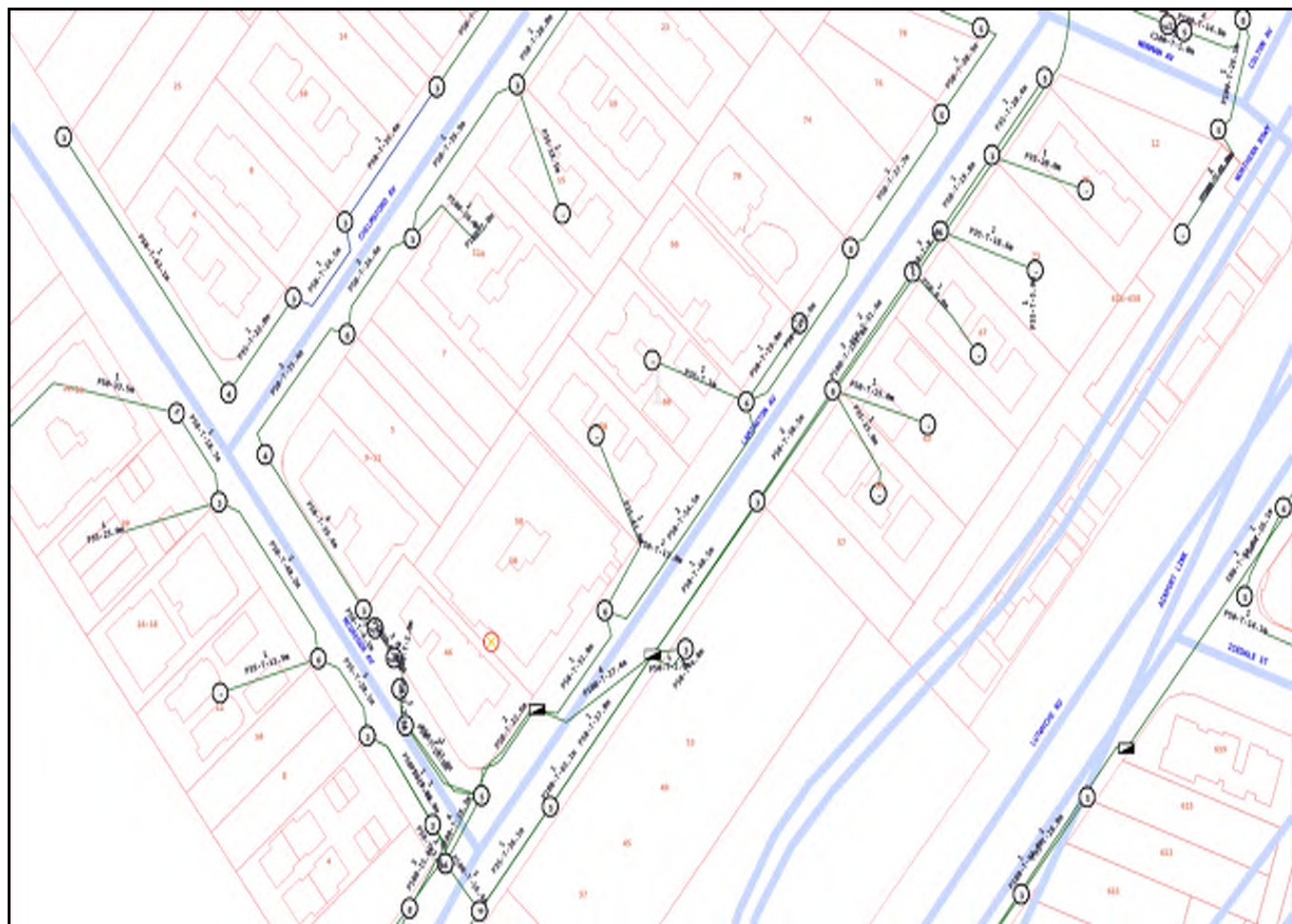
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Location:	5 Lamington Ave , Lutwyche , QLD , 4030	

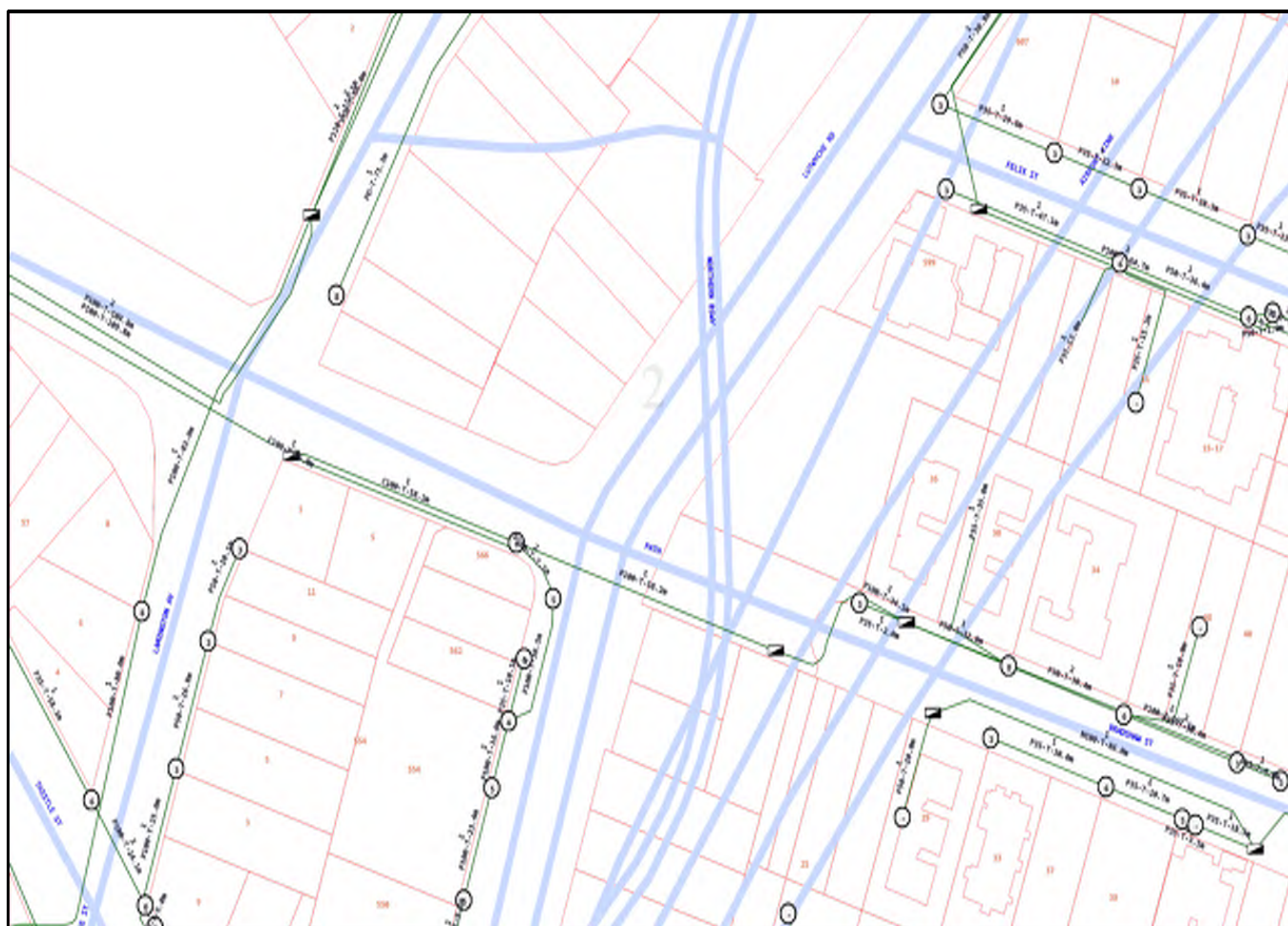




LEGEND

	Panel and the location
	Pit with size "5"
	Power Pit with size "2E". Valid PIT Size: e.g. 2E, 5E, 6E, 8E, 9E, E, null.
	Manhole
	Pillar
	Cable count of trench is 2. One "Other size" PVC conduit (PO) owned by Telstra (T), between pits of sizes, "5" and "9" are 25.0m apart. One 40mm PVC conduit (P40) owned by NBN, between pits of sizes, "5" and "9" are 20.0m apart.
	2 Direct buried cables between pits of sizes, "5" and "9" are 16.0m apart.
	Trench containing any INSERVICE/CONSTRUCTED (Copper/RF/Fibre) cables.
	Trench containing only DESIGNED/PLANNED (Copper/RF/Fibre/Power) cables.
	Trench containing any INSERVICE/CONSTRUCTED (Power) cables.
BROADWAY ST	Road and the street name "Broadway ST"
Scale	0 20 40 60 Meters 1:2000 1 cm equals 20 m 





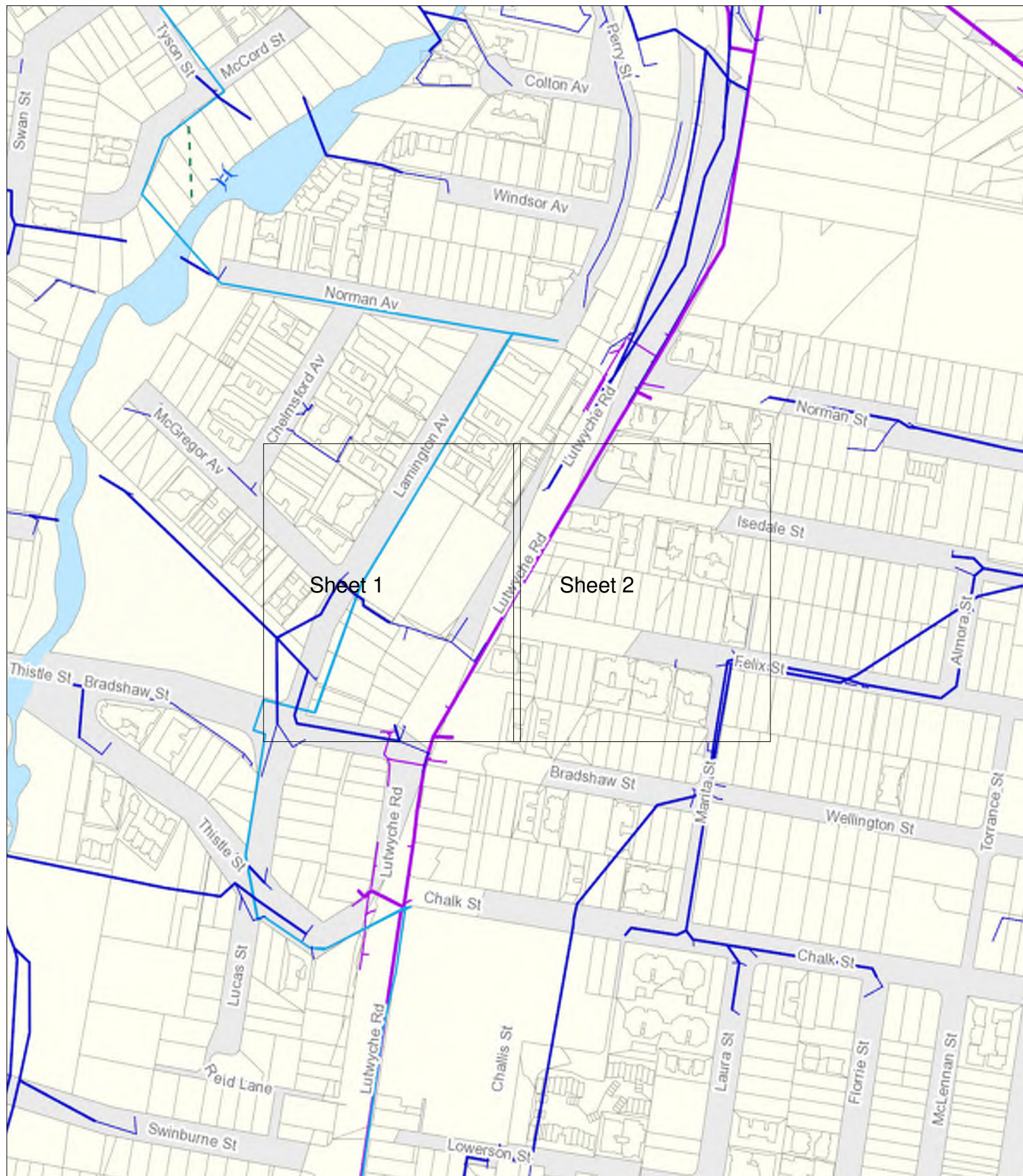
Emergency Contacts

You must immediately report any damage to **nbn™** network that you are/become aware of. Notification may be by telephone - 1800 626 329.

APPENDIX G

G.2 - Brisbane City Council
DIAL BEFORE YOU DIG





Map Sheet Overview

Sequence Number: 92968021

Disclaimer:

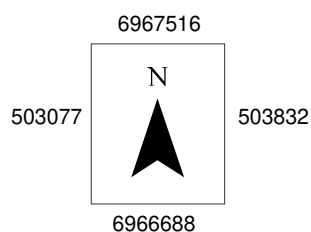
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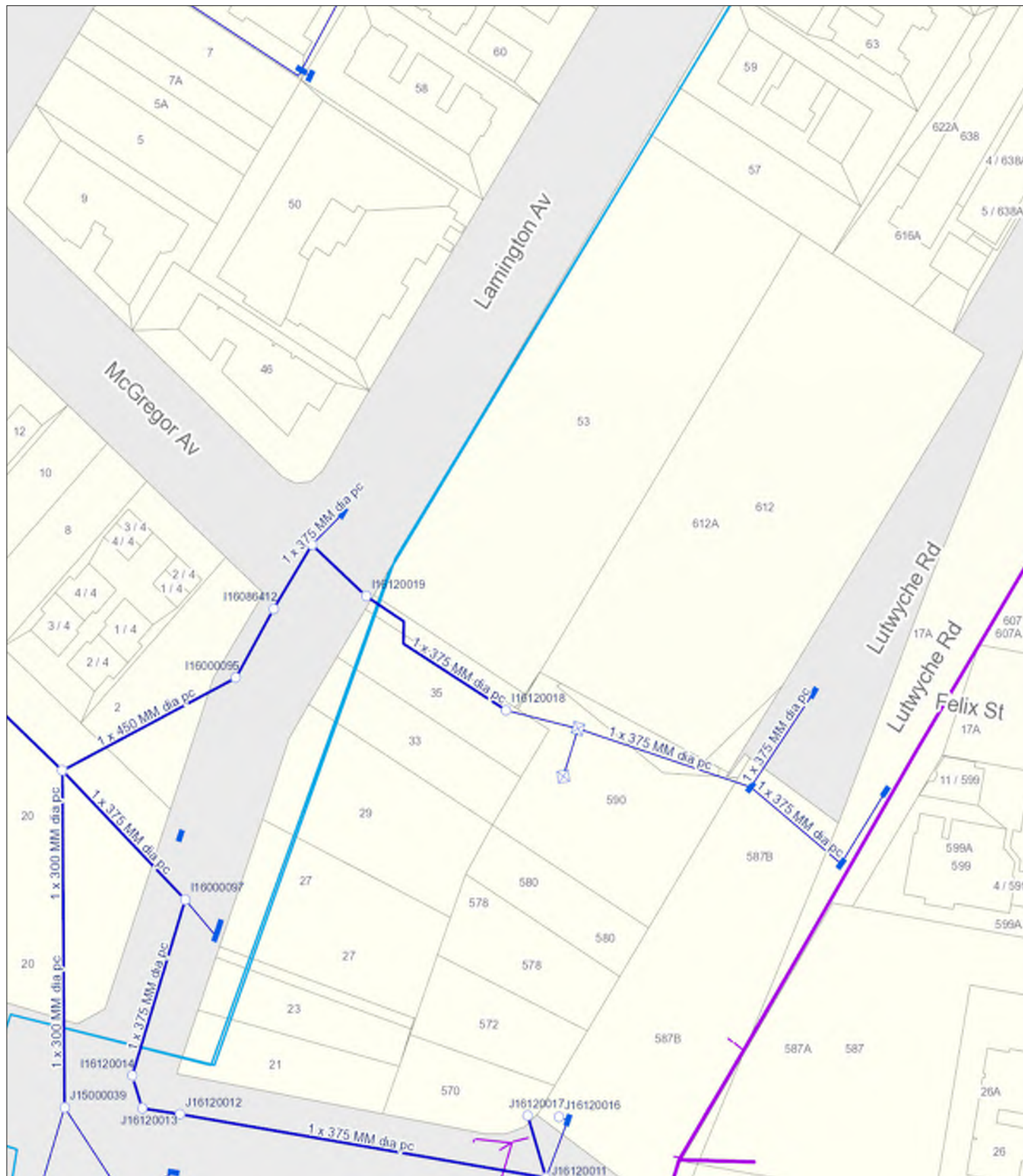
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BCC Stormwater and Cable Networks

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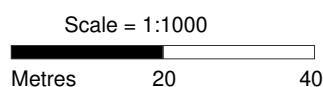
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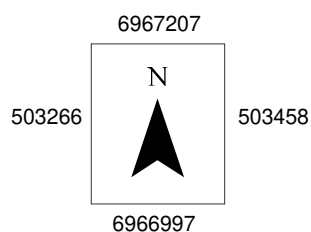
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Location:

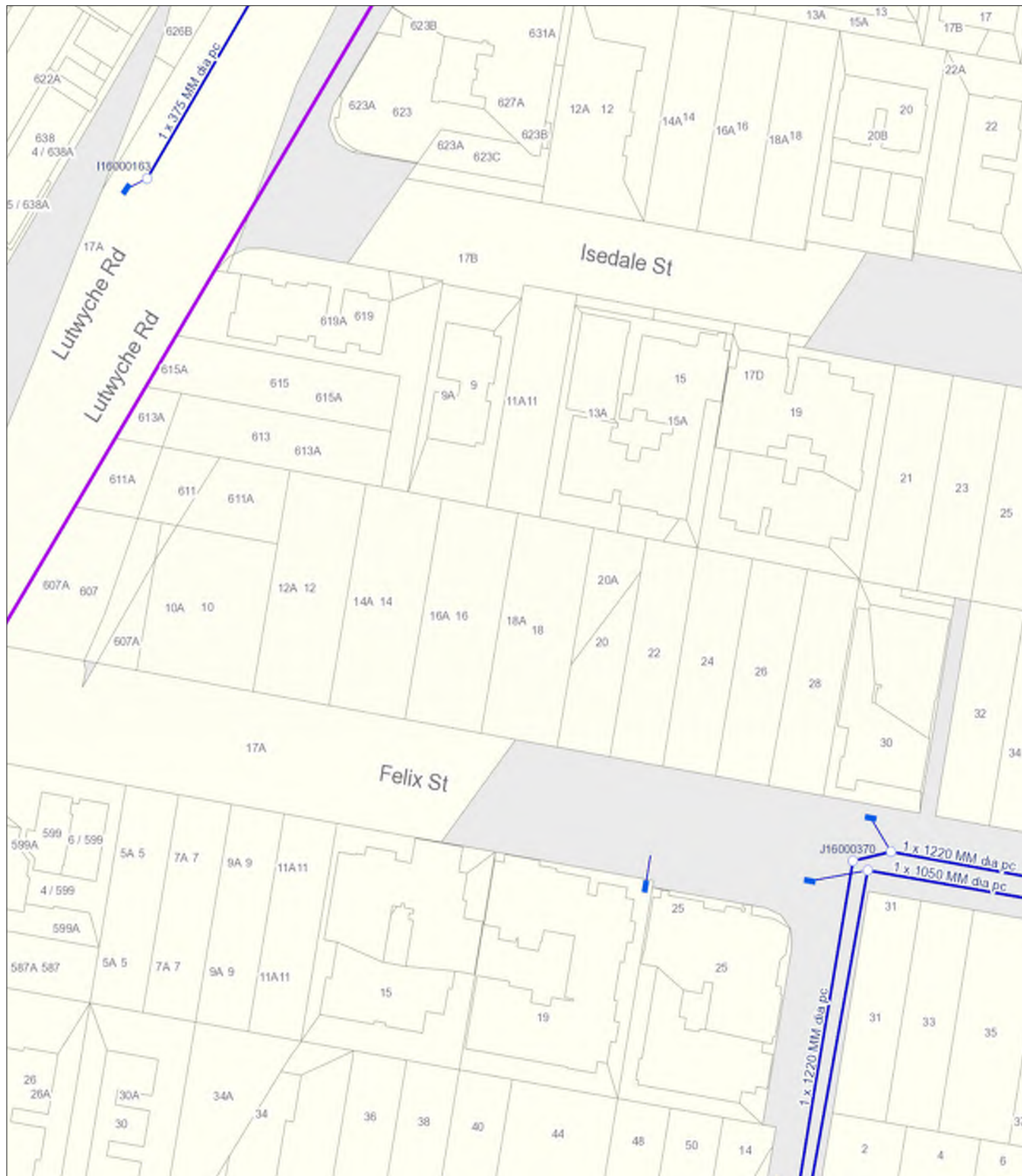


Sheet 1



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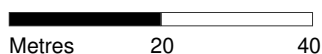
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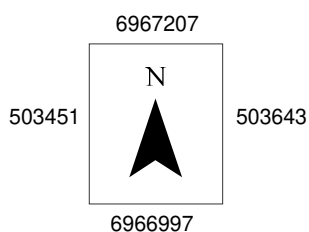
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Scale = 1:1000



Location:











Sheet 2







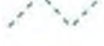


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Legend

Stormwater Network

	Stormwater Drain
	Stormwater Gully / Roofwater Connection
	Stormwater Maintenance Hole
	Stormwater Roofwater Pit
	Stormwater Gully Pit
	Stormwater Field Inlet
	Stormwater Quality Improvement Device
	Stormwater Culvert

BCC Cable Network

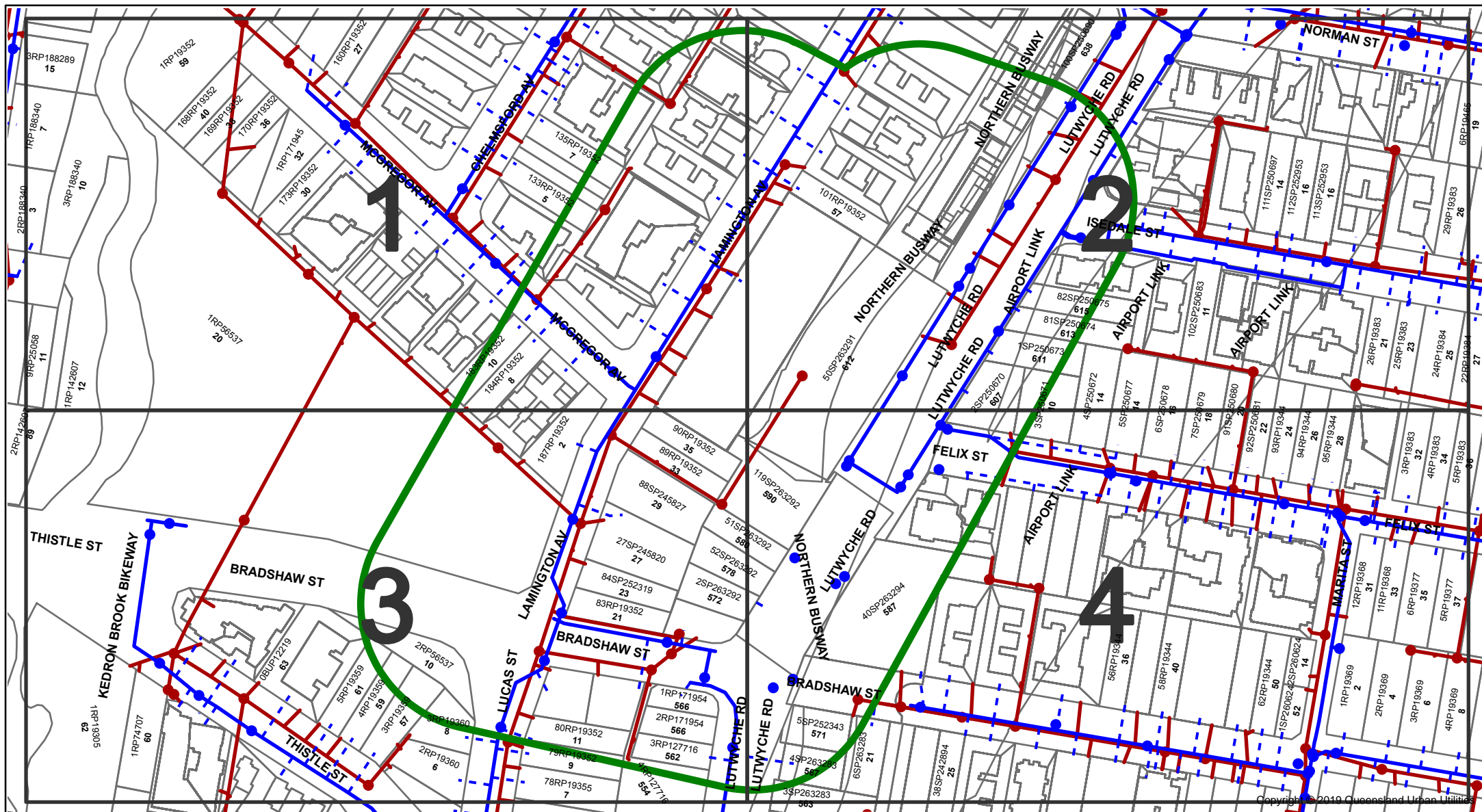
	Traffic System Cable
	Traffic Signal Ducting
	Traffic Light Conduit
	Fibre Optic Cable Location
	Flood Telemetry Conduit
	Parking Sensor Ducting
	Fibre Optic Pit Location

APPENDIX G

G.3 - Queensland Urban Utilities
DIAL BEFORE YOU DIG



Queensland Urban Utilities - Water & Sewer Infrastructure



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DBYD - Queensland Urban Utilities Water & Sewer Infrastructure

DBYD Reference No: 92968027

Date DBYD Ref Received: 9/12/2019 11:36:00 AM
Date DBYD Job to Commence: 10/12/2019 12:00:00 AM
Date DBYD Map Produced: 9/12/2019
This Map is valid for 30 days

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Sewer

- Infrastructure
- ◆ Major Infrastructure
- Network Pipelines
- Recycled Water Pipelines
- ▨ Network Structures

Water

- Infrastructure
- ◆ Major Infrastructure
- Network Pipelines
- - Water Service (Indicative only)
- ▨ Network Structures

N
Map Scale
1:2050

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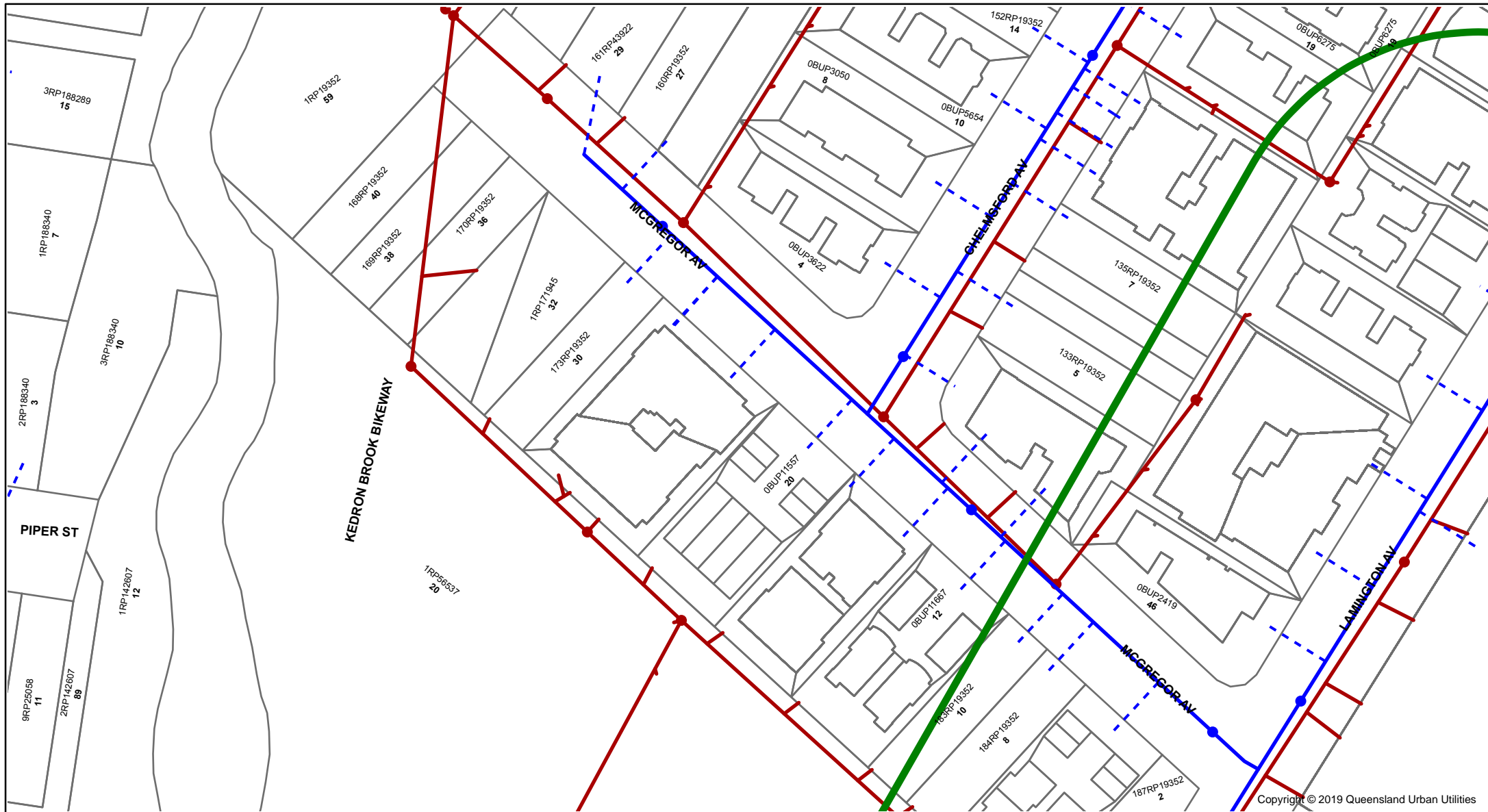
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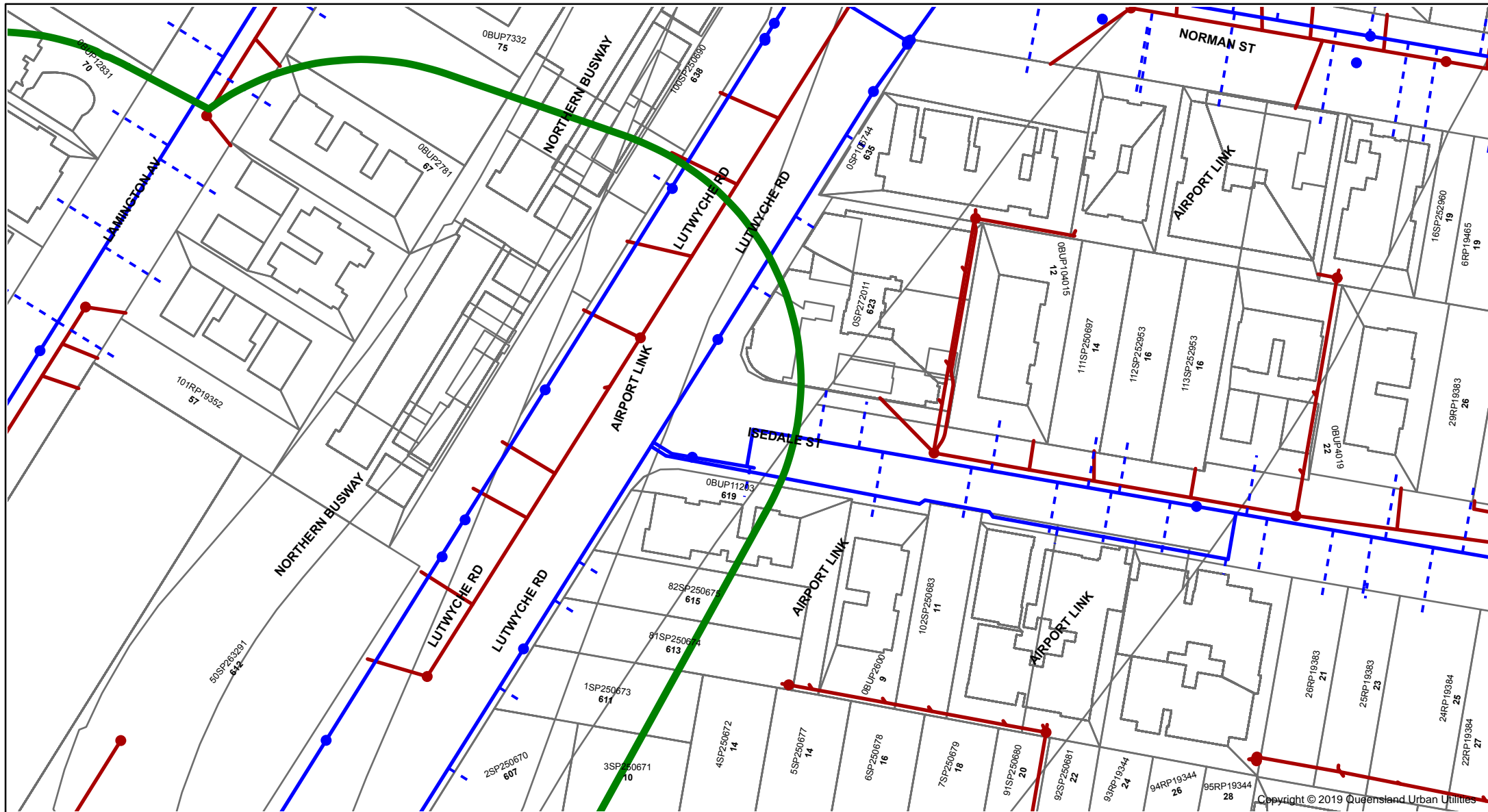
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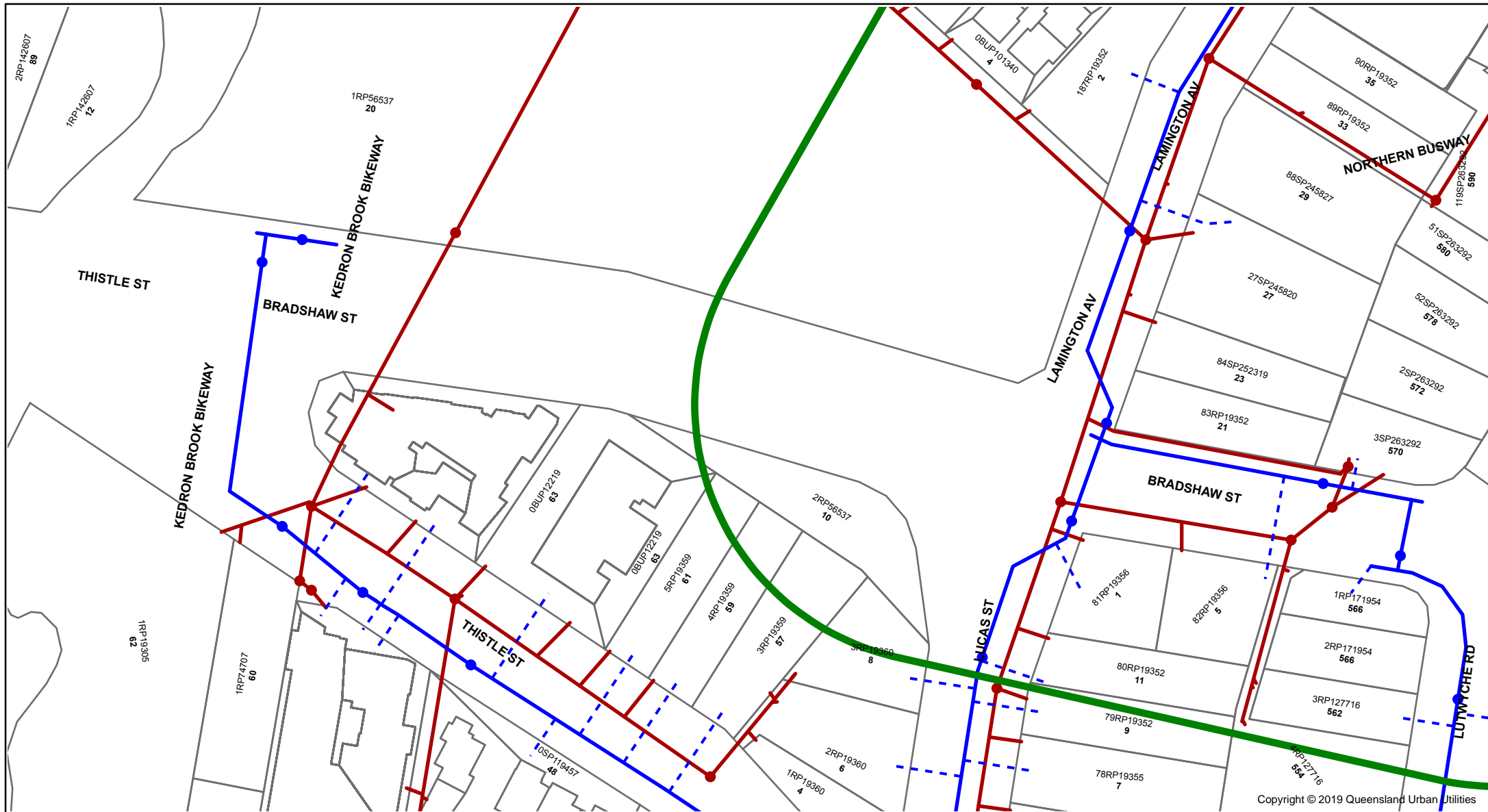
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