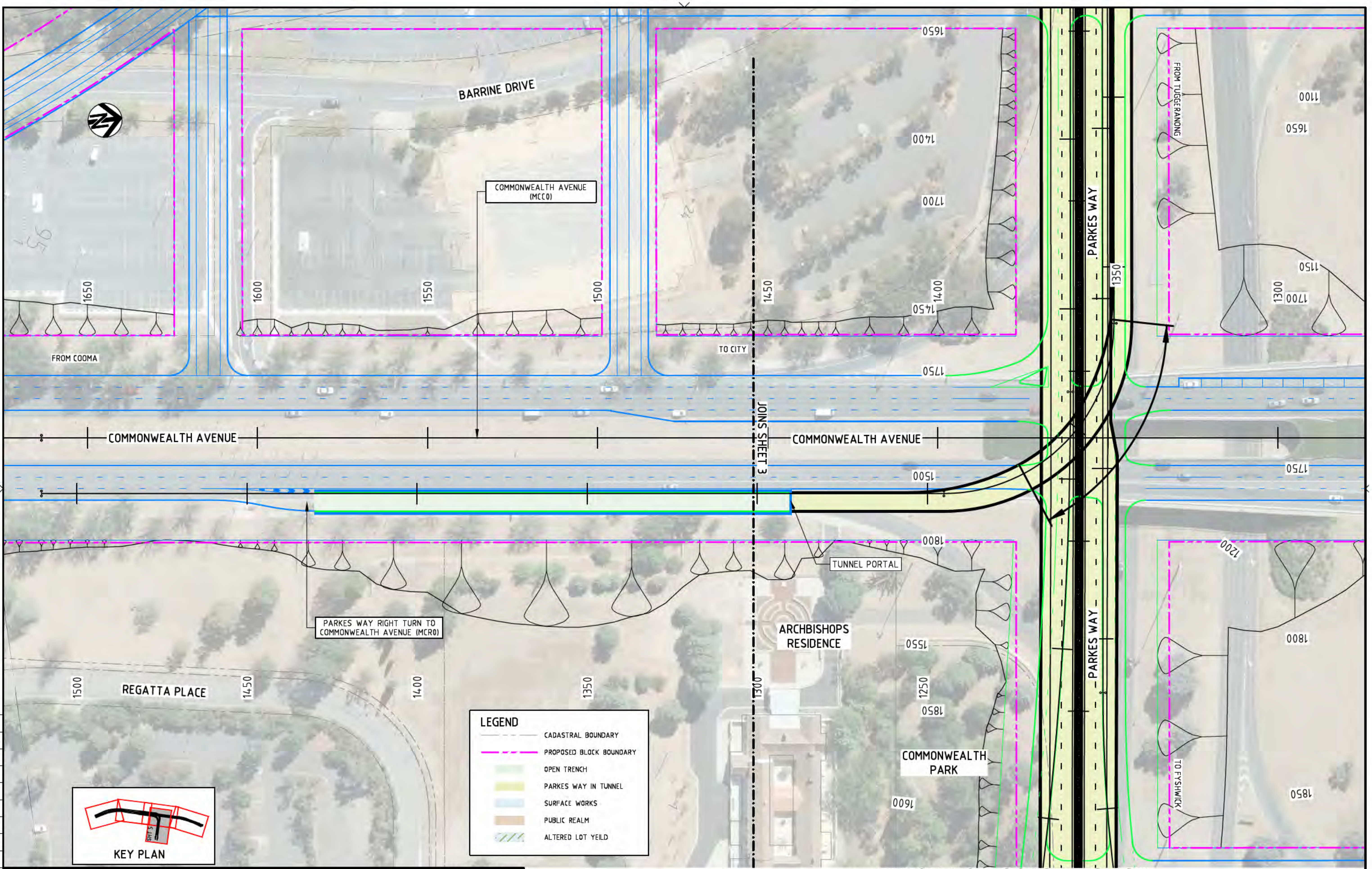

NOT FOR CONSTRUCTION

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PLOT DATE 11 Dec 2014
TIME 17:36:07

EXTERNAL REFERENCE FILES
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X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_FRAMES_CMWTH_500
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_MCHLN_PKSWY_500
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_FRAMES_PKSWY_50
X_PWFS_HATCH_V2C
X_PWFS_KEY_LOWER
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH
X_PWFS_DES_V2C_SR

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	G.BEAUMONT
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

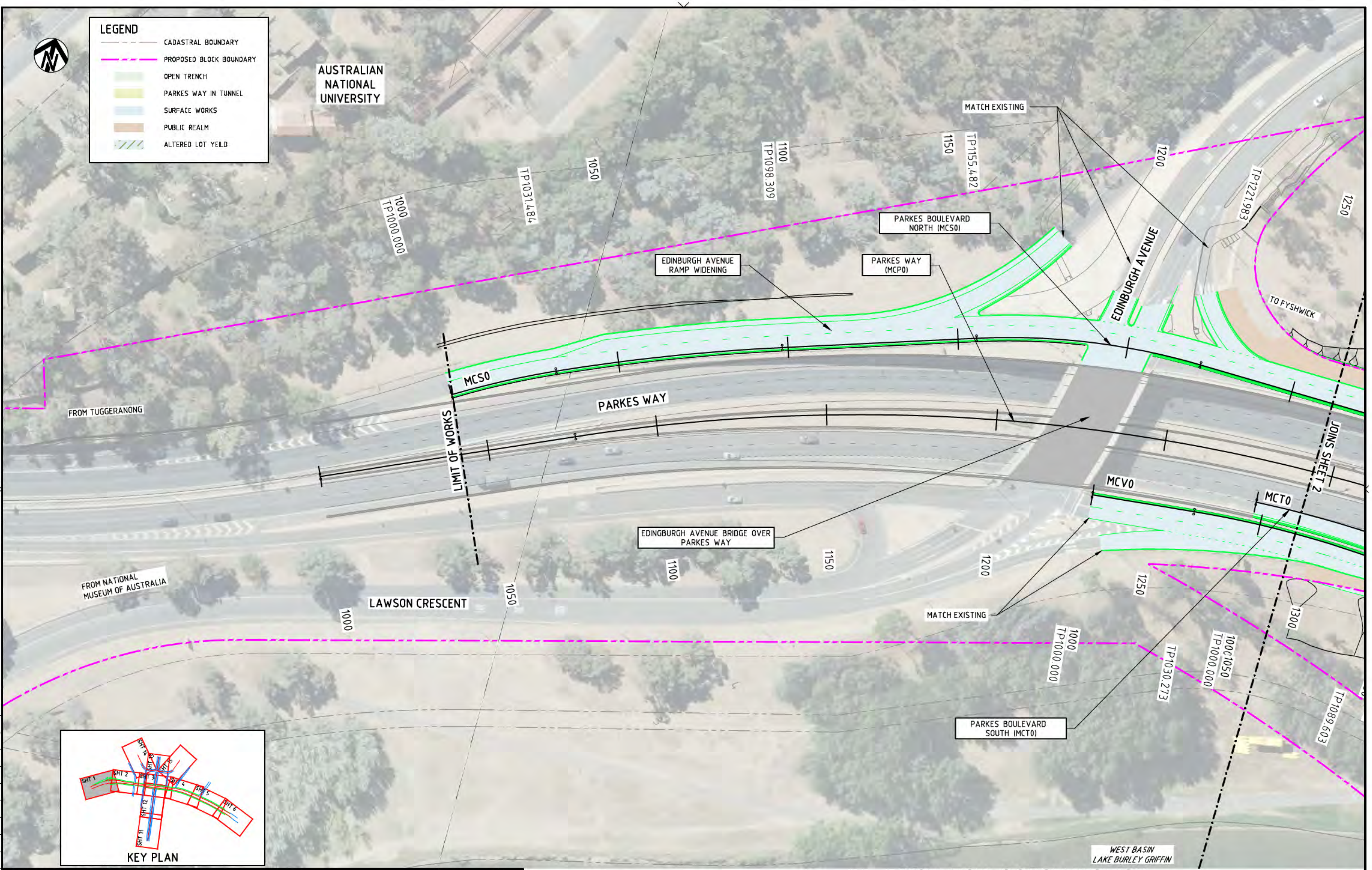
CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C

GENERAL ARRANGEMENT
PARKES WAY MAINLINE
SHEET 5 OF 5

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2115	02

150 mm ON ORIGINAL
A1



NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 11 Dec 2014
TIME 17:36:28

EXTERNAL REFERENCE FILES
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X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_MCHLN_PKSWY_S0
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_FRAMES_PKSWY_S0
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_204_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH
X_PWFS_CTRL_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
PARKES BOULEVARD
SHEET 1

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2121	02

150 mm ON ORIGINAL
A1
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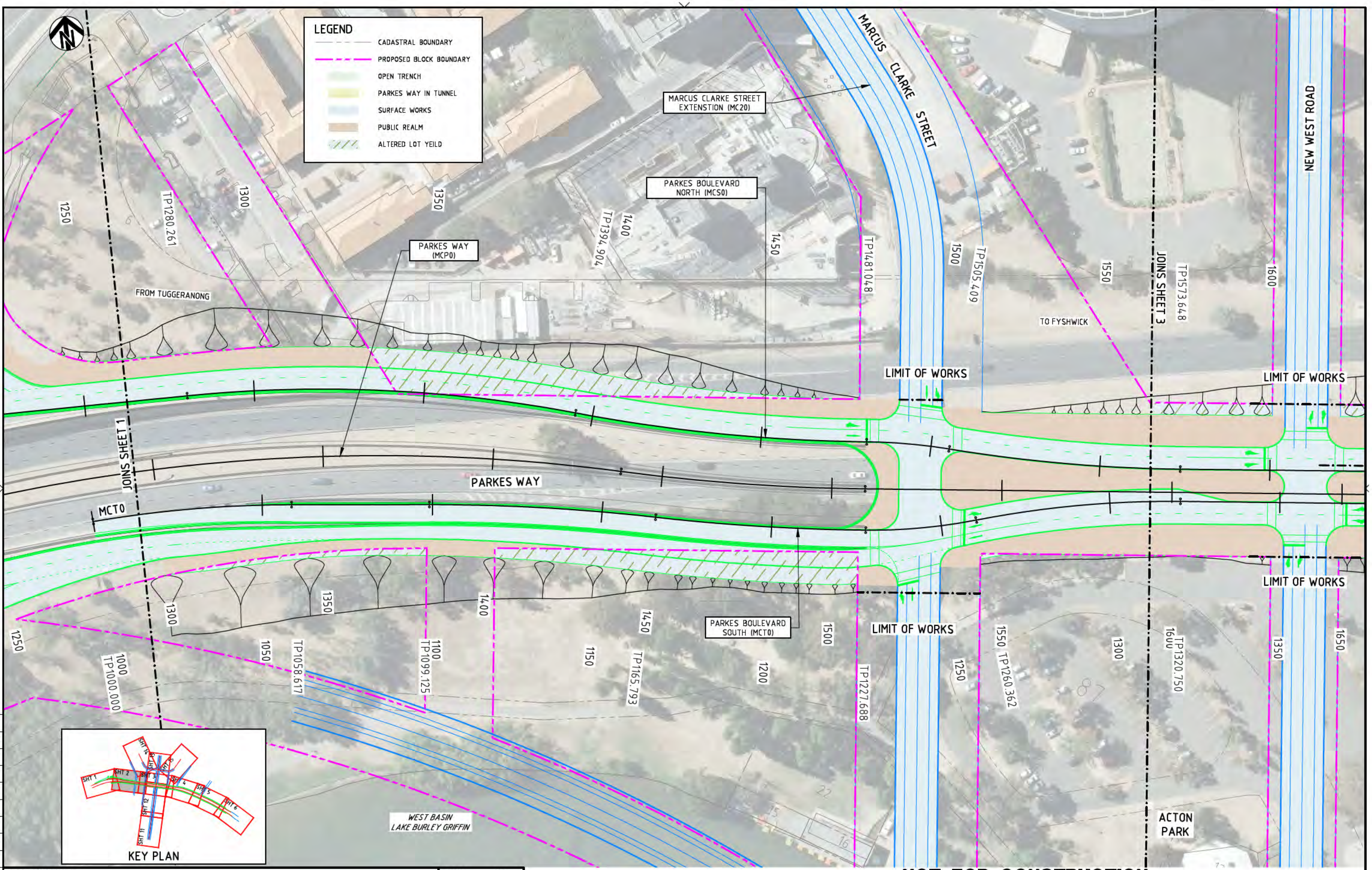

NOT FOR CONSTRUCTION

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PLOT DATE 11 Dec 2014
TIME 17:36:48

EXTERNAL REFERENCE FILES
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X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_MCHLN_PKSWY_500
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_FRAMES_PKSWY_50
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

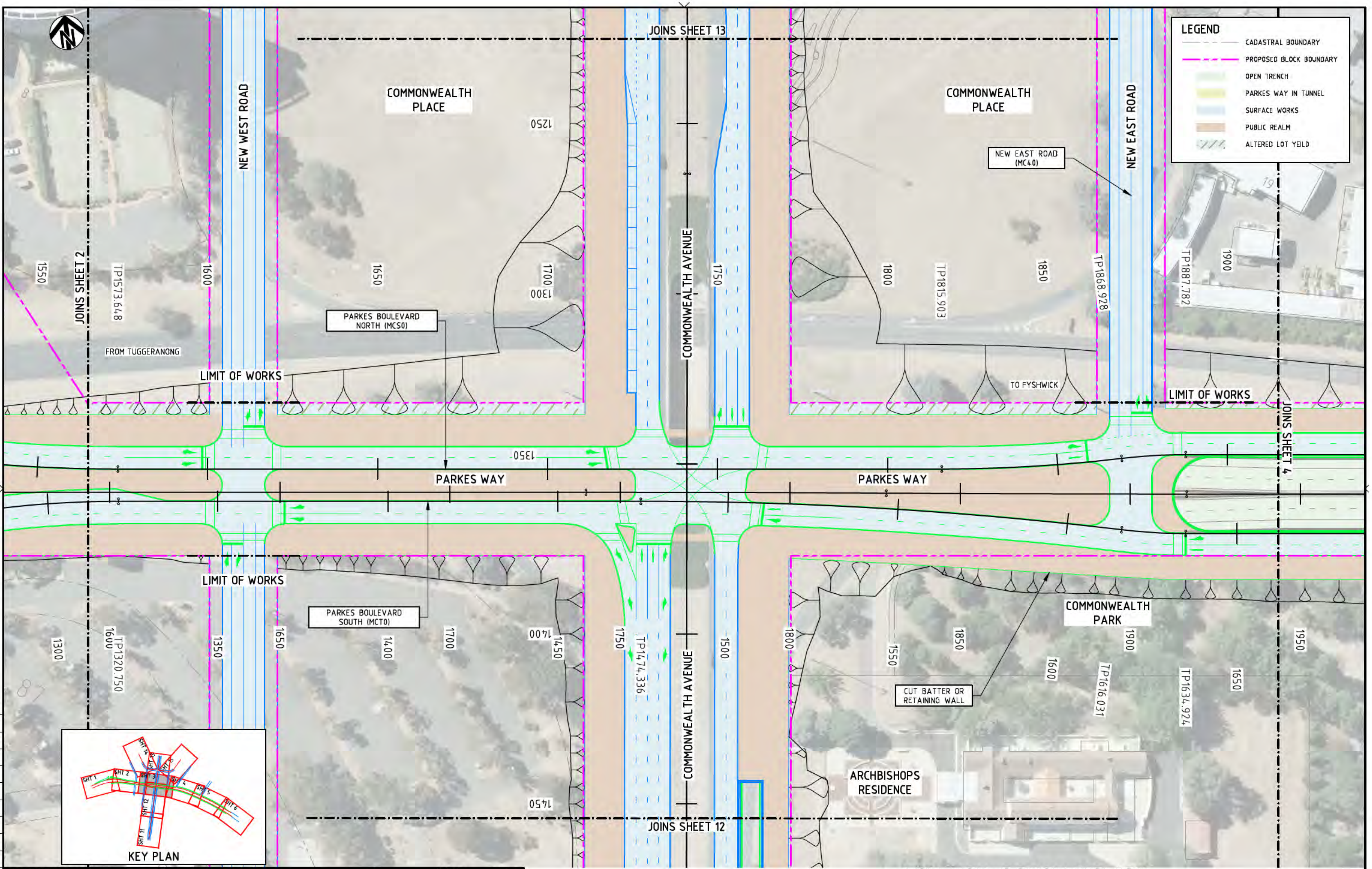
DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
PARKES BOULEVARD
SHEET 2

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2122	02

150 mm ON ORIGINAL
A1



NOT FOR CONSTRUCTION

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PLOT DATE	TIME
11 Dec 2014	17:37:07

EXTERNAL REFERENCE FILES
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X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_MCHLN_PKSWY_500
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_FRAMES_PKSWY_50
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_204_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

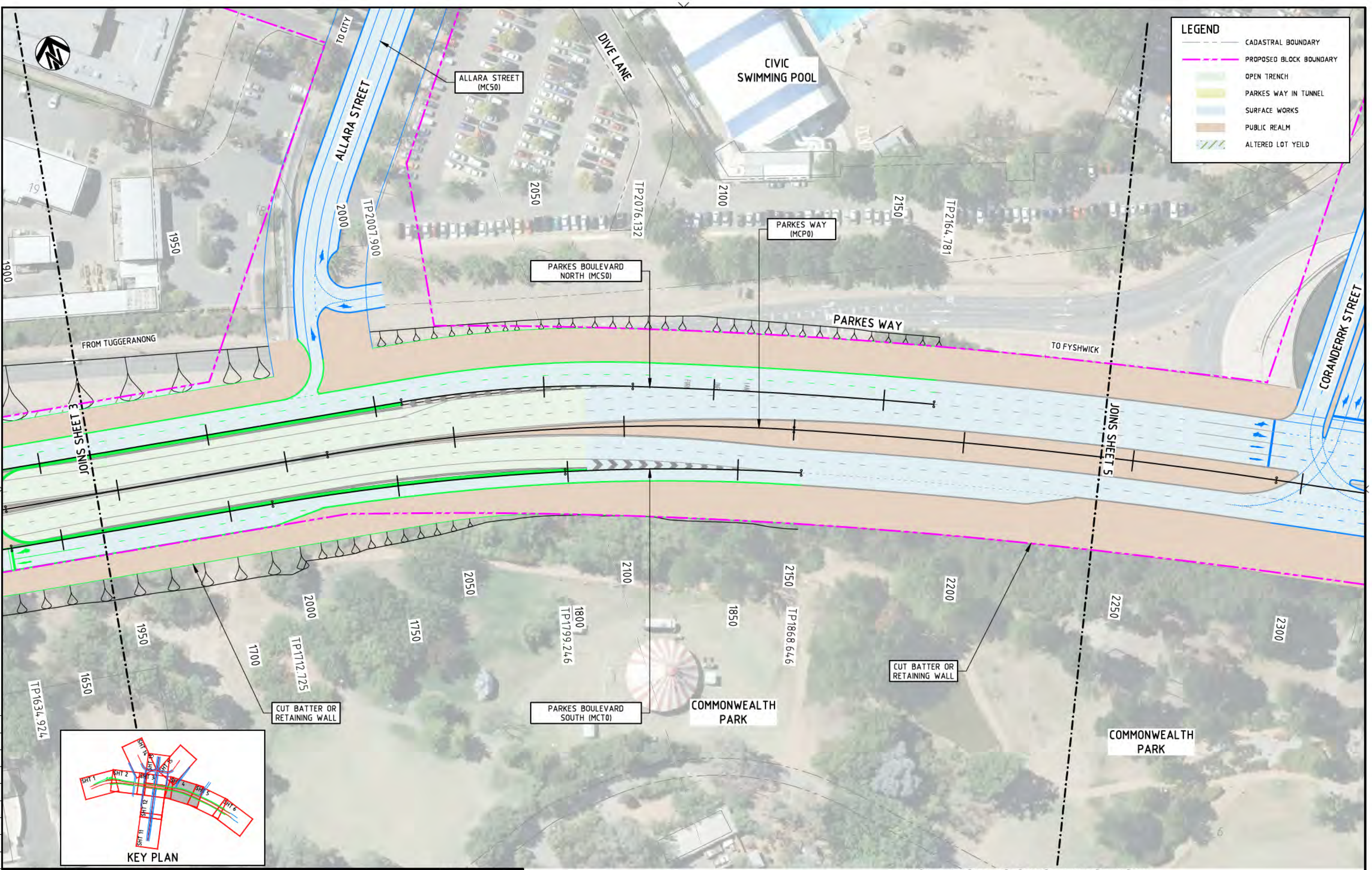
SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
PARKES BOULEVARD
SHEET 3

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2123	02



NOT FOR CONSTRUCTION

150 mm ON ORIGINAL
A1

DRAWING FILE LOCATION / NAME
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PLOT DATE 11 Dec 2014
TIME 17:37:29

EXTERNAL REFERENCE FILES
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X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_MCHLN_PKSWY_S0
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_FRAMES_PKSWY_S0
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_204_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	*C. DAWSON*
DRAFTING CHECK	*K. SIDRAK*
DESIGNER	*B. LEJANO*
DESIGN CHECK	*T. FERRIS*
PROJECT MANAGER	*B. DERRICK*
PROJECT DIRECTOR	*S. TILDSLEY*

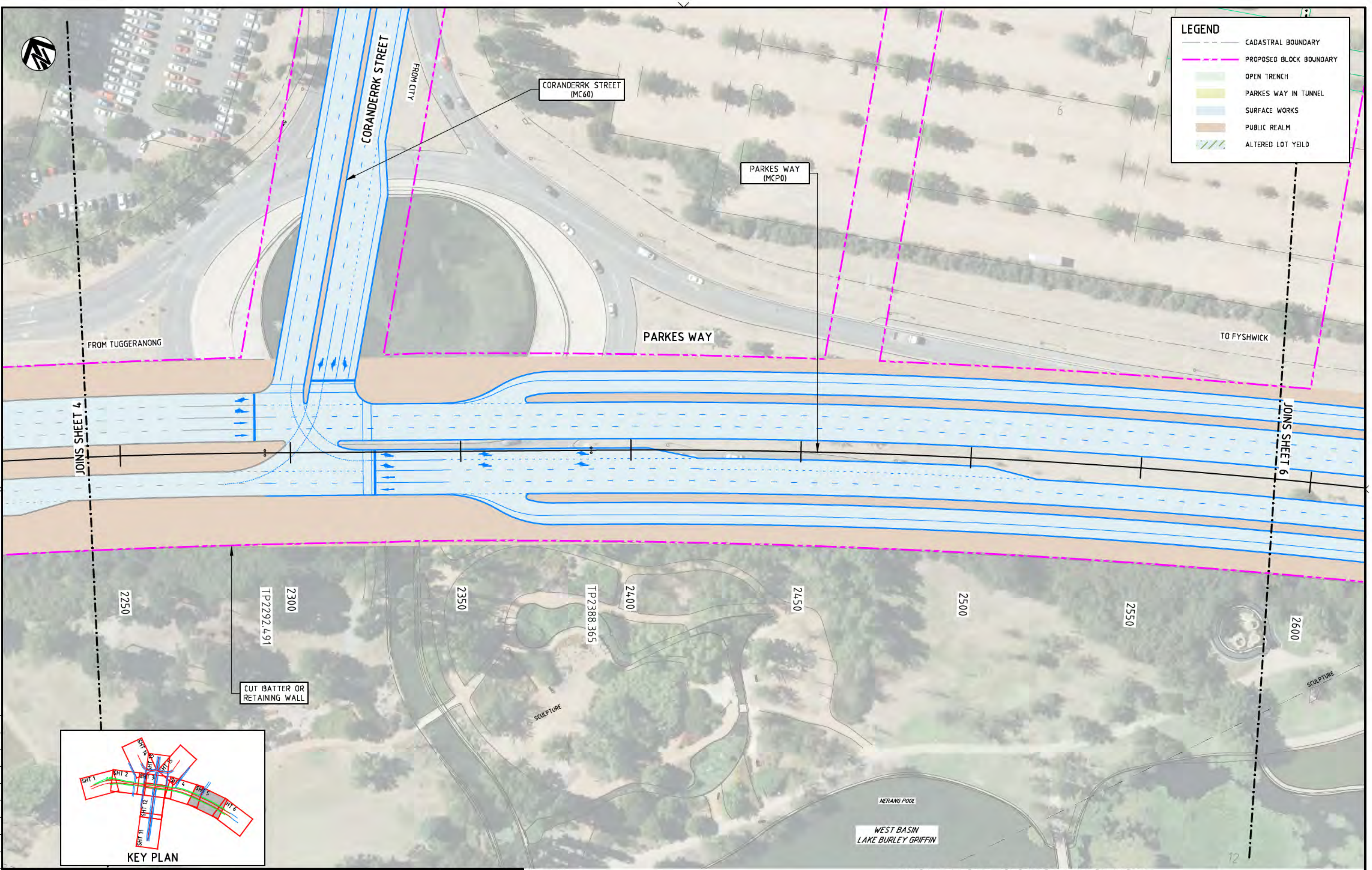
SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
PARKES BOULEVARD
SHEET 4

SCALE: AS SHOWN
PHASE: FEASIBILITY
PROJECT / DRAWING No.: 3002385-DRD-2124
REVISION: 02



150 mm ON ORIGINAL

A1

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 11 Dec 2014
TIME 17:37:50

EXTERNAL REFERENCE FILES
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X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_MCHLN_PKSWY_S0
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_FRAMES_PKSWY_S0
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
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X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

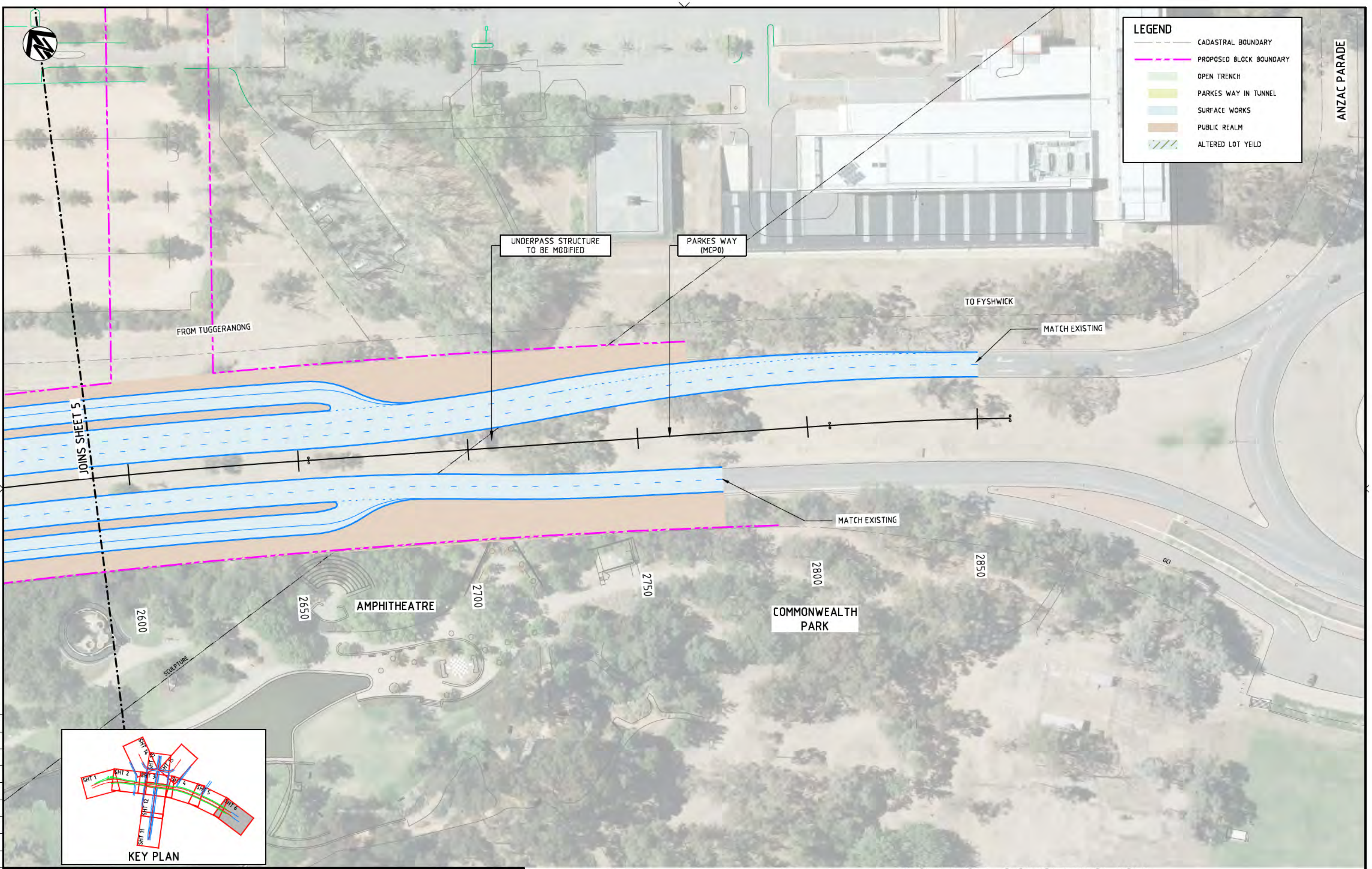
SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
PARKES BOULEVARD
SHEET 5

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2125	02



150 mm ON ORIGINAL

A1

NOT FOR CONSTRUCTION

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PLOT DATE 11 Dec 2014
TIME 17:38:12

EXTERNAL REFERENCE FILES
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X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_MCHLN_PKSWY_50
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_FRAMES_PKSWY_50
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

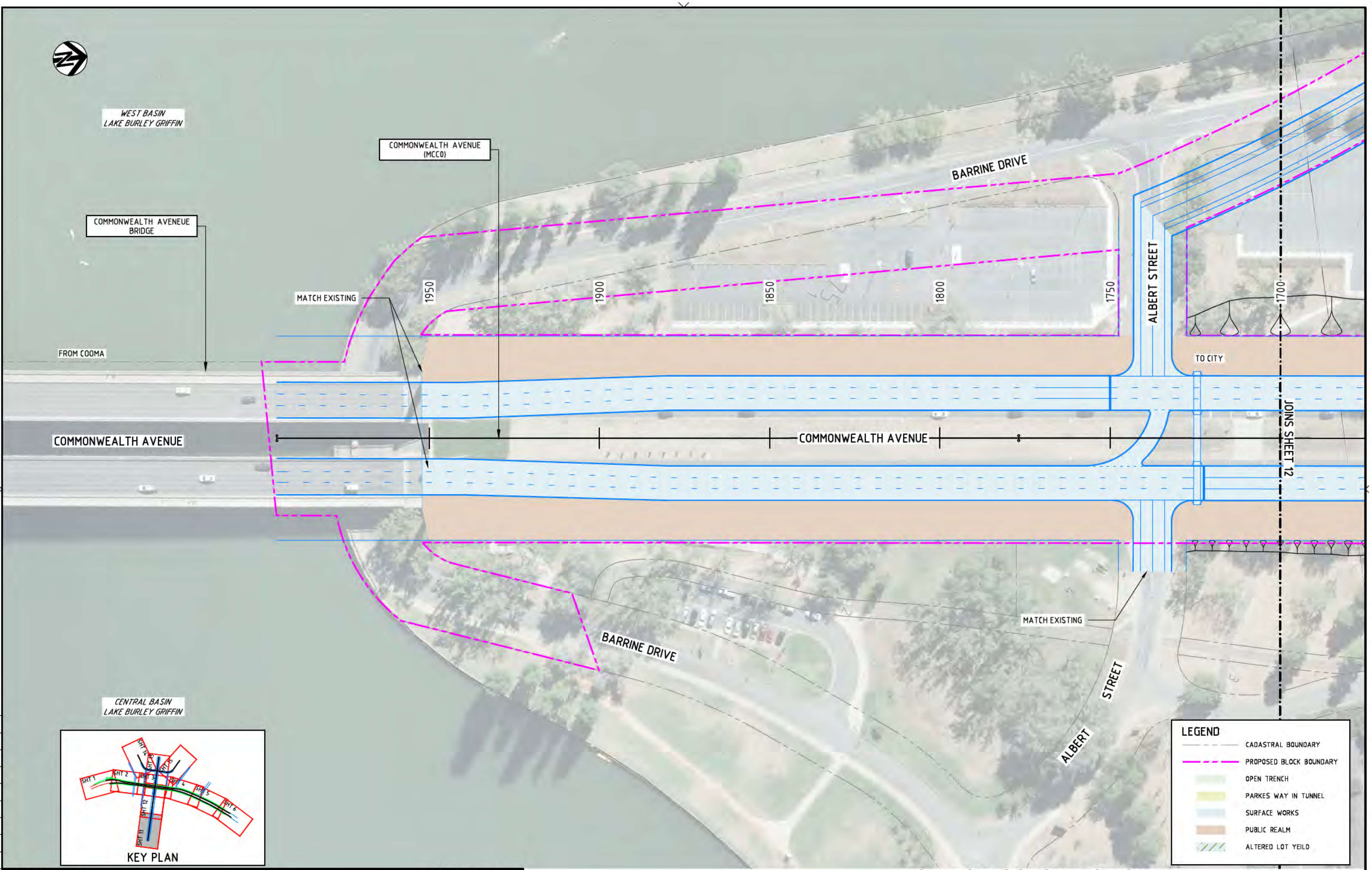
SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
PARKES BOULEVARD
SHEET 6

SCALE AS SHOWN
PHASE FEASIBILITY
PROJECT / DRAWING No. 3002385-DRD-2126
REVISION 02



NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 11 Dec 2014
TIME 17:38:36

EXTERNAL REFERENCE FILES
X_PWFS_CADAST
X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
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X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_MCHLN_CMWTH_500
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

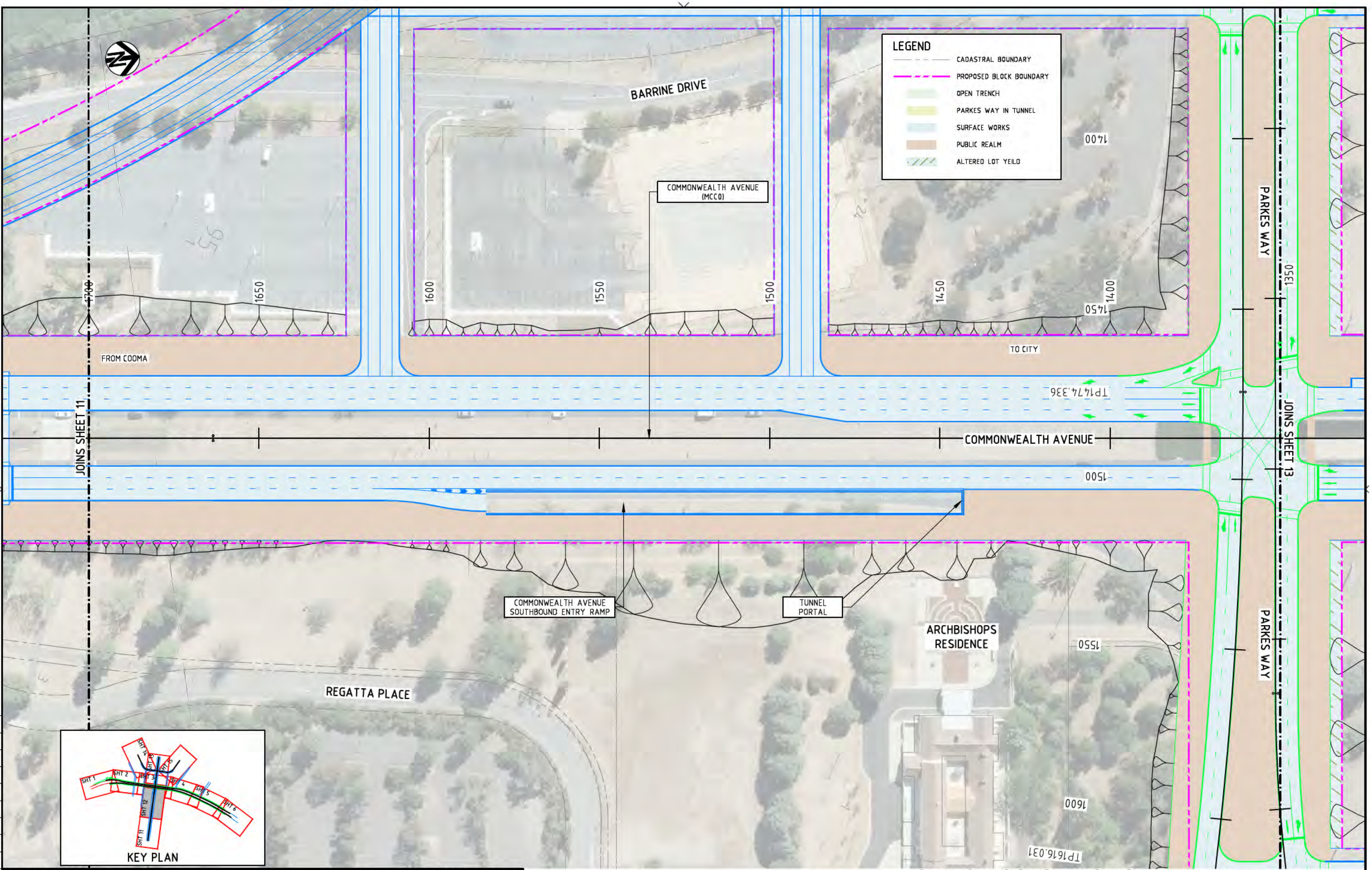
DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
COMMONWEALTH AVENUE
SHEET 11

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2131	02

150 mm ON ORIGINAL
A1



NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 11 Dec 2014 TIME 17:38:56

EXTERNAL REFERENCE FILES
X_PWFS_CADAST
X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH_500
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_MCHLN_CMWTH_500
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

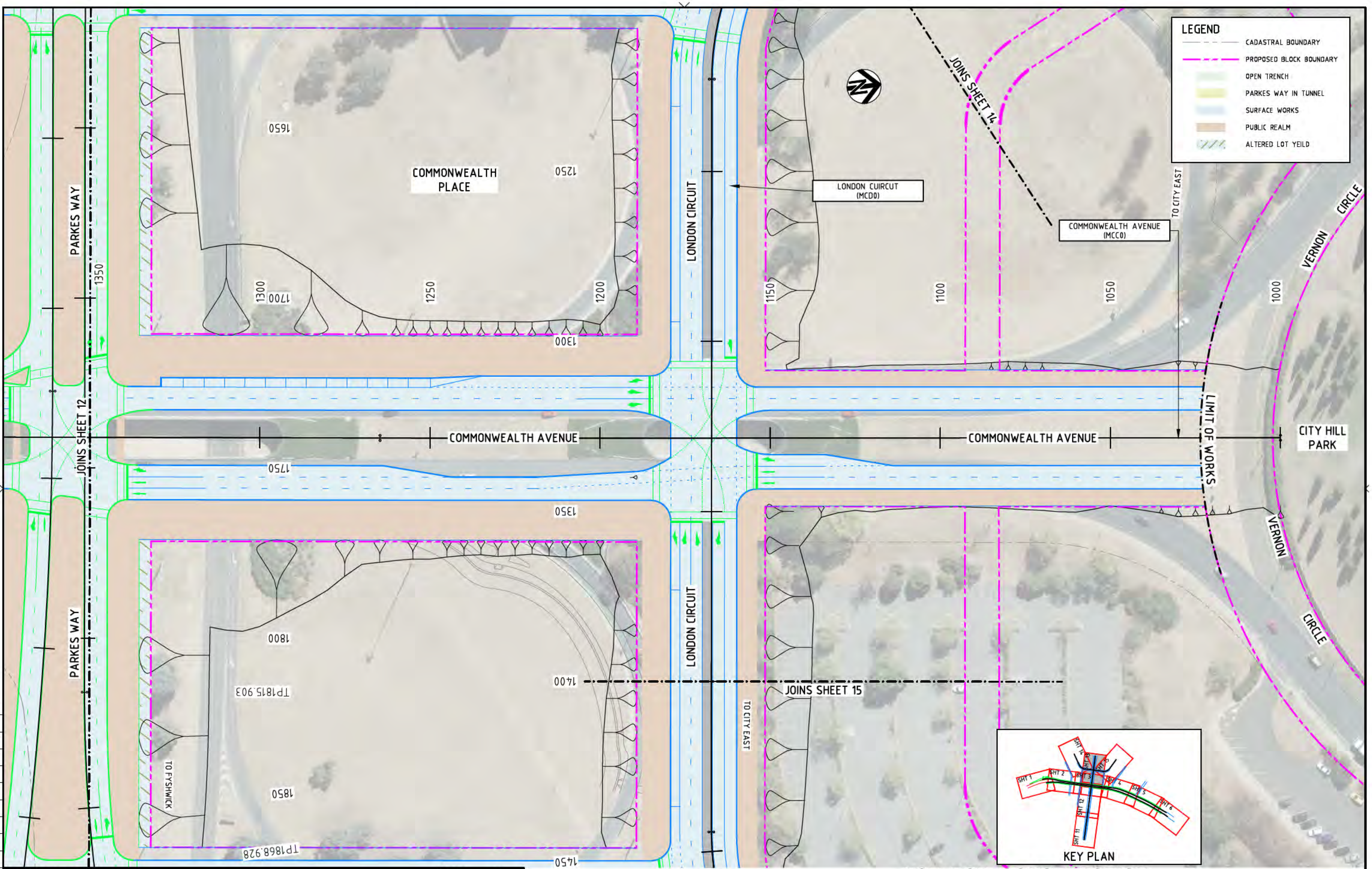
DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
COMMONWEALTH AVENUE
SHEET 12

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2132	02

A1 150 mm ON ORIGINAL



NOT FOR CONSTRUCTION

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PLOT DATE	TIME
11 Dec 2014	17:39:16

EXTERNAL REFERENCE FILES
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X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
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X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_MCHLN_CMWTH_500
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

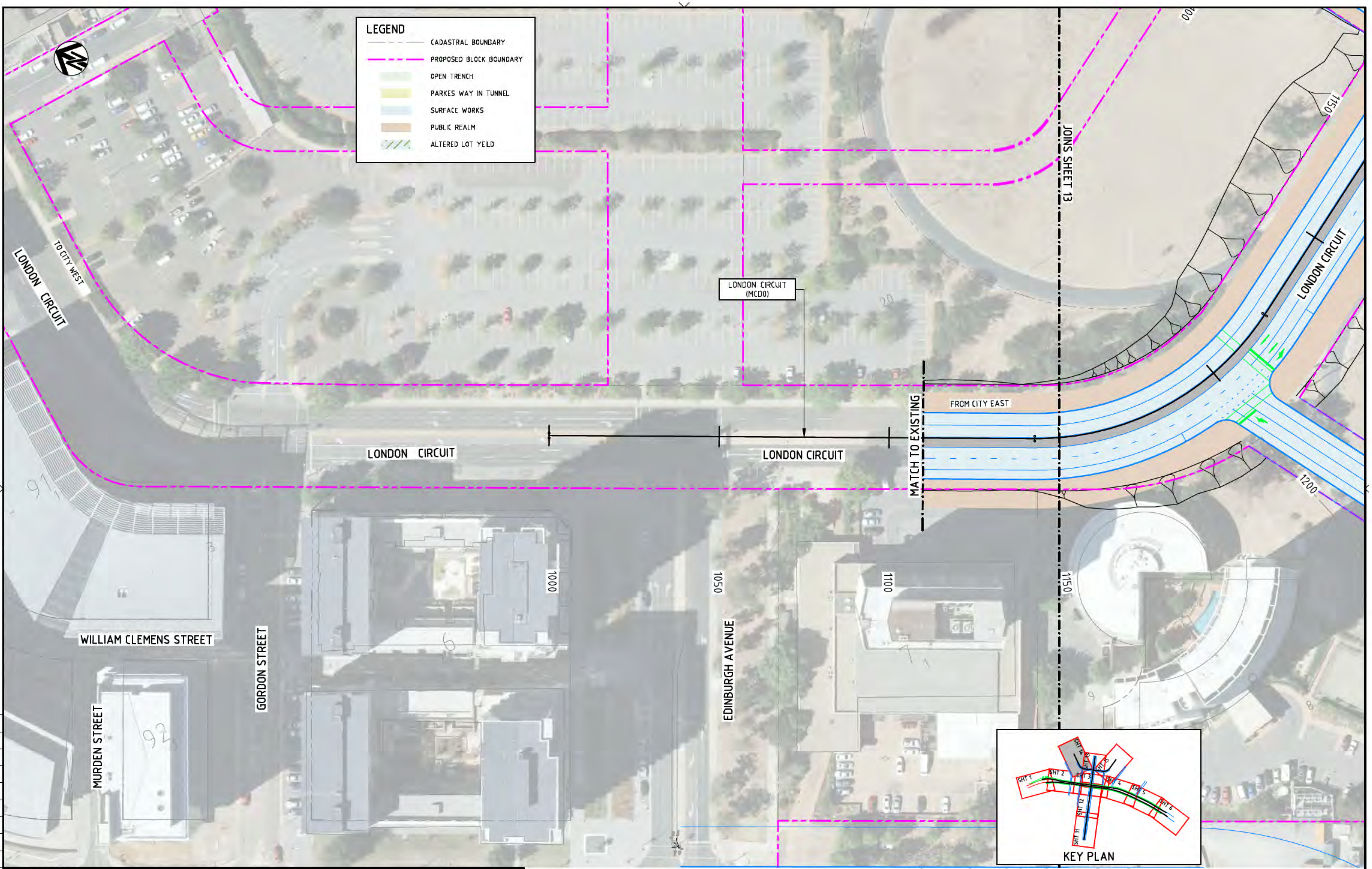
DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
COMMONWEALTH AVENUE
SHEET 13

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2133	02

150 mm ON ORIGINAL
A1



NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 11 Dec 2014
TIME 17:39:36

EXTERNAL REFERENCE FILES
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X_PWFS_DES_V2C
X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_MCHLN_CMWTH_500
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

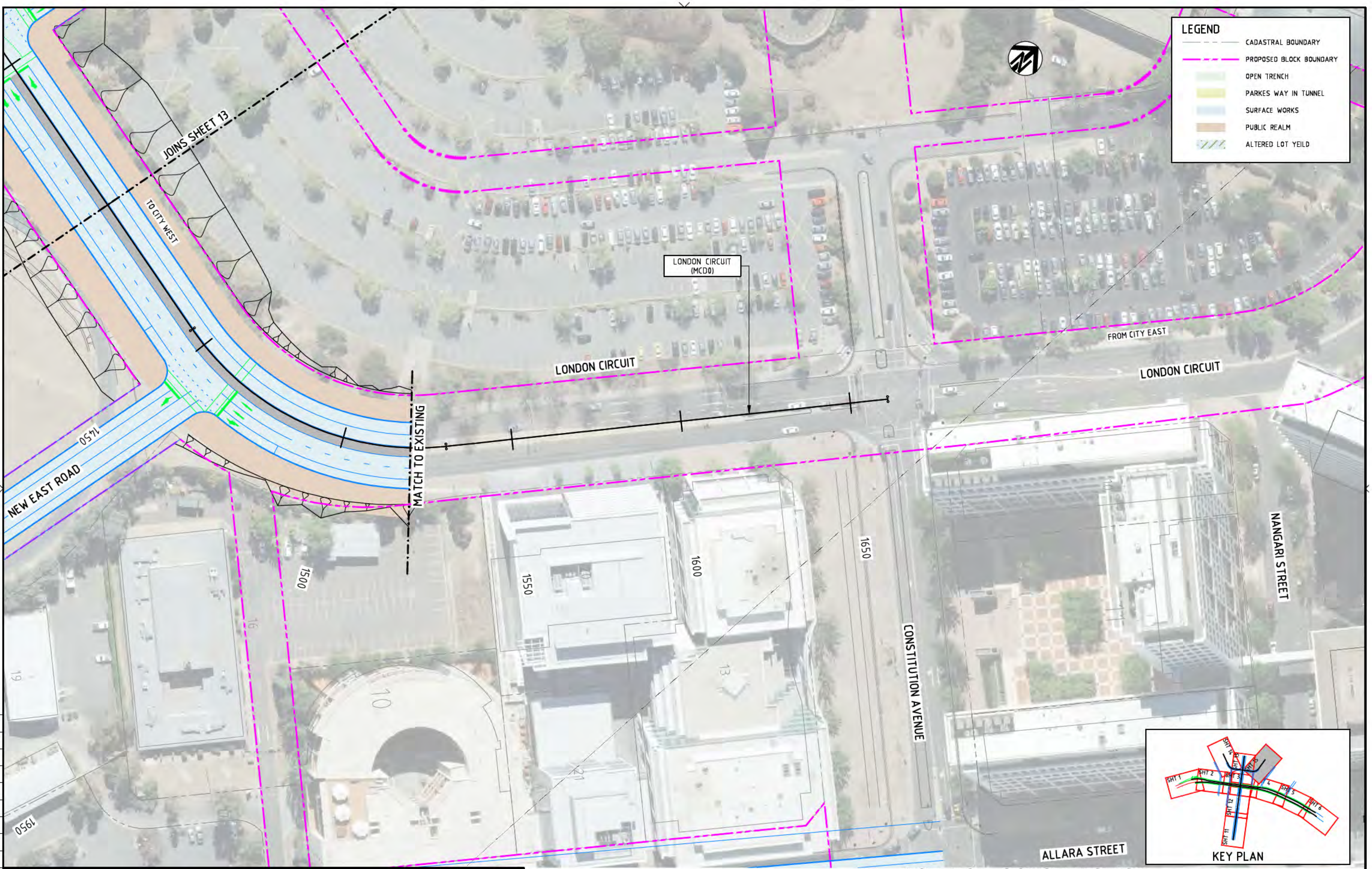
DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
GENERAL ARRANGEMENT
LONDON CIRCUIT
SHEET 14

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2134	02

150 mm ON ORIGINAL
A1



NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 11 Dec 2014
TIME 17:40:00

EXTERNAL REFERENCE FILES
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X_TCD_PWFS_EXG
X_PWFS_FRAMES_CMWTH
X_PWFS_CTRL_V2C_CMWTH
X_PWFS_DES_V2C_CAD
X_PWFS_CTRL_V2C_TRN
X_PWFS_CTRL_V2C_TUNL
X_PWFS_CTRL_V2C_SR
X_PWFS_DES_V2C_CMWTH
X_PWFS_ACT_A1
X_PWFS_IMAGES
X_PWFS_HATCH_V2C
X_TCD_205_XD
X_TCD_205_P
X_TCD_206_XD
X_TCD_234_XD
X_TCD_234_P
X_TCD_233_XD
X_TCD_233_P
X_PWFS_KEY_LOWER
X_PWFS_DES_V2C_SR
X_PWFS_KEY_ABOVE
X_PWFS_MCHLN_CMWTH_500
X_PWFS_BDRY
X_PWFS_LEG_GA_V2C
X_PWFS_DES_V2C_EDBH

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

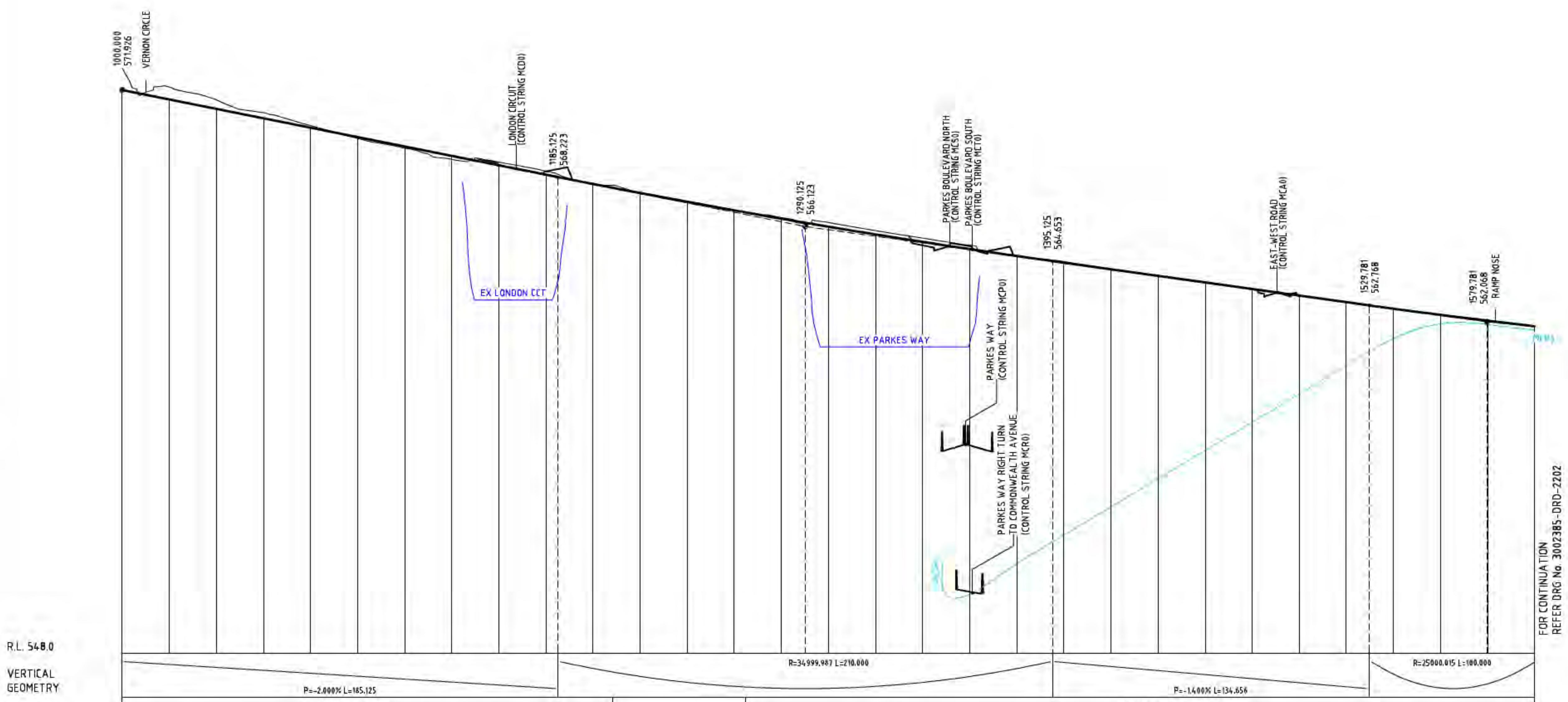
DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONDON CIRCUIT
COMMONWEALTH AVENUE SURFACE LEVEL
SHEET 15

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DRD-2135	02

150 mm ON ORIGINAL
A1



EXISTING LEVELS	572.857	572.050	571.500	570.958	570.407	569.865	569.443	568.976	568.862	568.470	567.941	567.571	567.210	566.822	566.500	566.288
DESIGN LEVELS	571.926	571.526	571.126	570.726	570.326	569.926	569.526	569.126	568.726	568.326	567.929	567.543	567.169	566.806	566.454	566.114
STATION	1000.000	1020.000	1040.000	1060.000	1080.000	1100.000	1120.000	1140.000	1160.000	1180.000	1200.000	1220.000	1240.000	1260.000	1280.000	1300.000

EXISTING LEVELS	565.945	565.629	565.325	564.852	564.627	564.316	564.029	563.764	563.472	563.179	562.917	562.628	562.385	562.141	561.888
DESIGN LEVELS	565.786	565.468	565.163	564.868	564.585	564.305	564.025	563.745	563.465	563.185	562.905	562.627	562.363	562.115	561.883
STATION	1320.000	1340.000	1360.000	1380.000	1400.000	1420.000	1440.000	1460.000	1480.000	1500.000	1520.000	1540.000	1560.000	1580.000	1600.000

VARIANT 2C - COMMONWEALTH AVENUE

(CONTROL LINE MCC0)

NOT FOR CONSTRUCTION

150 mm ON ORIGINAL

A1

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:16:30

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCC0_0

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

DESIGNER

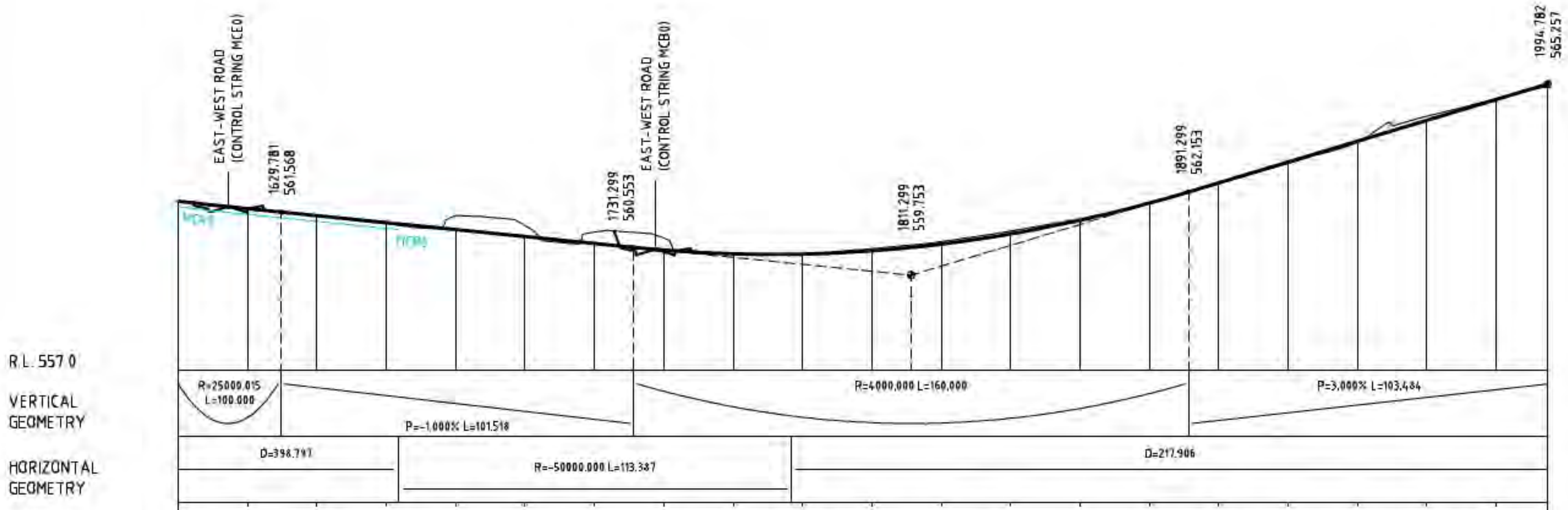
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT

ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
COMMONWEALTH AVENUE (MCC0)
SHEET 1 OF 2

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2201	01



EXISTING LEVELS	561.888	561.676	561.460	561.233	561.475	561.184	560.991	560.821	560.383	560.352	560.519	560.723	561.028	561.381	561.817	562.389	562.975	563.589	564.333	564.841	565.195
DESIGN LEVELS	561.883	561.668	561.466	561.266	561.066	560.866	560.666	560.475	560.369	560.362	560.456	560.649	560.943	561.336	561.830	562.414	563.014	563.614	564.214	564.814	565.257
STATION	1600.000	1620.000	1640.000	1660.000	1680.000	1700.000	1720.000	1740.000	1760.000	1780.000	1800.000	1820.000	1840.000	1860.000	1880.000	1900.000	1920.000	1940.000	1960.000	1980.000	1994.782

VARIANT 2C - COMMONWEALTH AVENUE

(CONTROL LINE MCC0)

NOT FOR CONSTRUCTION

A1 150 mm ON ORIGINAL 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:16:41

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCC0_0R

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

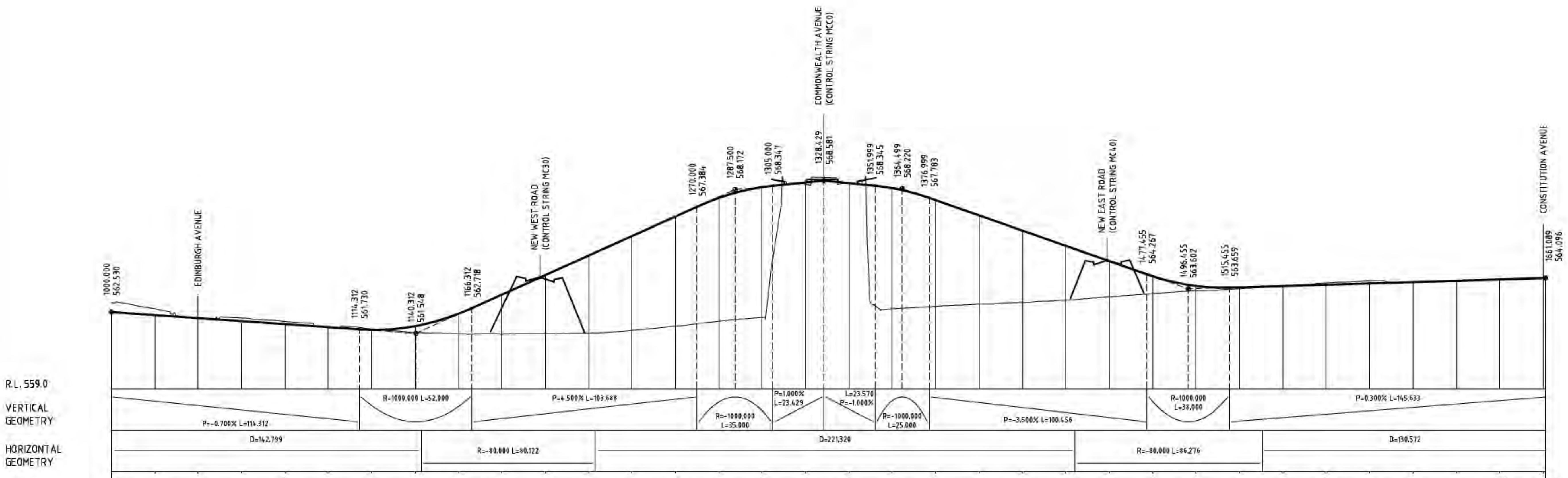
DESIGNER
SMEC AUSTRALIA PTY LTD

SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
COMMONWEALTH AVENUE (MCC0)
SHEET 2 OF 2

SCALE AS SHOWN
PHASE PRELIMINARY
PROJECT / DRAWING No. 3002385-DRD-2202
REVISION 01



EXISTING LEVELS	562.966	562.678	562.241	562.261	562.098	561.829	561.752	561.588	561.522	561.516	561.526	561.555
DESIGN LEVELS	562.530	562.390	562.250	562.110	561.970	561.830	561.707	561.880	562.454	563.334	564.234	565.134
STATION	1000.000	1020.000	1040.000	1060.000	1080.000	1100.000	1120.000	1140.000	1160.000	1180.000	1200.000	1220.000

EXISTING LEVELS	561.684	561.884	562.102	562.282	568.415	568.451	562.675	562.796	562.902	562.970	563.080	563.223
DESIGN LEVELS	566.034	566.934	567.784	568.284	568.497	568.465	568.233	567.678	566.978	566.278	565.578	564.878
STATION	1240.000	1260.000	1280.000	1300.000	1320.000	1340.000	1360.000	1380.000	1400.000	1420.000	1440.000	1460.000

EXISTING LEVELS	563.374	563.511	563.601	563.710	563.872	563.973	563.913	563.939	564.048	564.101	564.105
DESIGN LEVELS	564.181	563.732	563.673	563.733	563.793	563.853	563.913	563.973	564.033	564.093	564.096
STATION	1480.000	1500.000	1520.000	1540.000	1560.000	1580.000	1600.000	1620.000	1640.000	1660.000	1661.089

VARIANT 2C - LONDON CIRCUIT

(CONTROL LINE MCD0)

NOT FOR CONSTRUCTION

150 mm ON ORIGINAL

A1

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:16:52

EXTERNAL REFERENCE FILES
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X_PWFS_V2C_LS_MCD0_01

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

DESIGNER

SMEC AUSTRALIA PTY LTD
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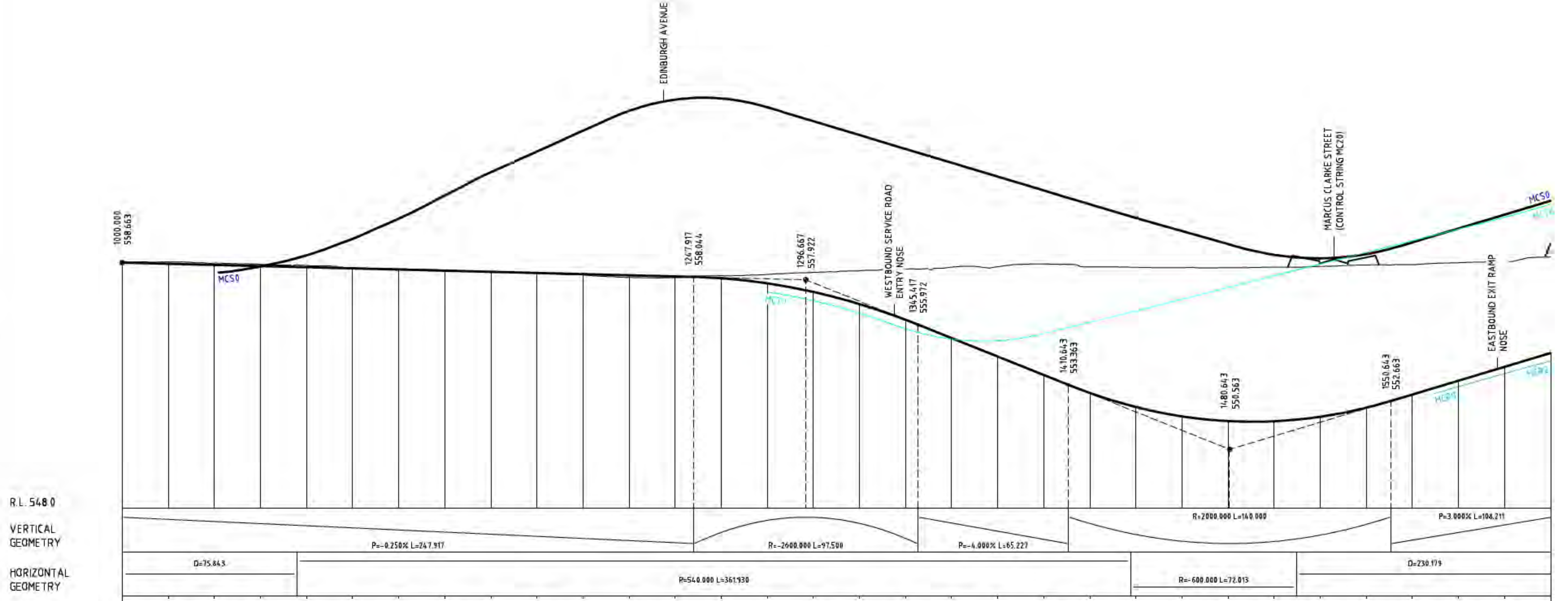
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
LONDON CIRCUIT (MCD0)
SHEET 1 OF 1

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2211	01



STATION	EXISTING LEVELS	DESIGN LEVELS
1000.000	558.685	558.663
1020.000	558.692	558.613
1040.000	558.651	558.563
1060.000	558.598	558.513
1080.000	558.538	558.463
1100.000	558.452	558.413
1120.000	558.399	558.363
1140.000	558.343	558.313
1160.000	558.260	558.263
1180.000	558.209	558.213
1200.000	558.136	558.163
1220.000	558.023	558.113
1240.000	558.013	558.063
1260.000	558.102	557.985
1280.000	558.155	557.765
1300.000	558.243	557.392
1320.000	558.311	556.864
1340.000	558.387	556.183
1360.000	558.470	555.388
1380.000	558.486	554.588
1400.000	558.606	553.788
1420.000	558.479	553.010
1440.000	558.461	552.404
1460.000	558.449	551.997
1480.000	558.445	551.791
1500.000	558.469	551.784
1520.000	558.495	551.978
1540.000	558.564	552.372
1560.000	558.584	552.943
1580.000	558.665	553.543
1600.000	558.708	554.143
1620.000	558.911	554.743

VARIANT 2C - PARKES WAY

(CONTROL LINE MCP0)

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:17:02

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCP0_01

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

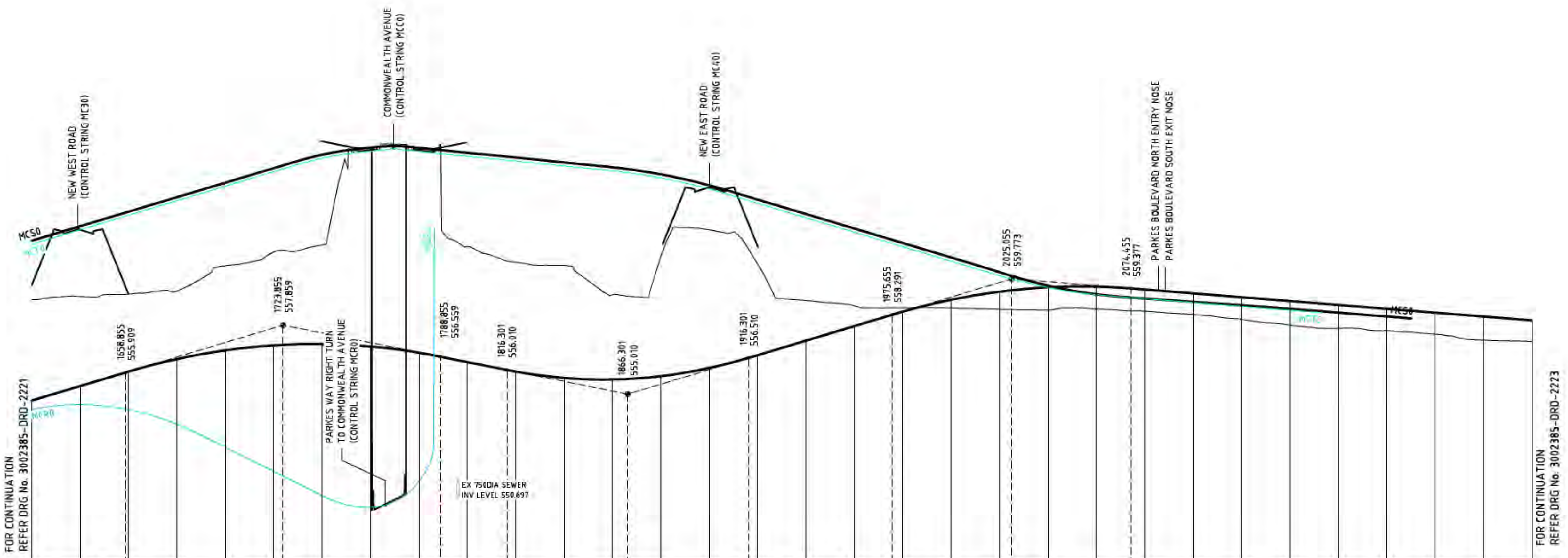
DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY (MCP0)
SHEET 1 OF 3

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2221	01

150 mm ON ORIGINAL
A1



R.L. 548.0

VERTICAL GEOMETRY: P=3.000% L=108.211 | R=-2600.000 L=130.000 | P=-2.000% L=27.446 | R=2000.000 L=100.000 | P=3.000% L=59.354 | R=-2600.000 L=98.800 | P=-0.800% L=271.947

HORIZONTAL GEOMETRY: D=230.179 | R=15000.000 L=88.317 | R=-15000.000 L=88.317 | D=95.799 | R=600.000 L=137.562 | R=1670.500 L=142.530

EXISTING LEVELS	558.911	559.038	559.139	559.267	560.313	560.877	561.174	565.138	565.130	561.095	560.464	560.321	559.118	560.703	561.801	560.389
DESIGN LEVELS	554.743	555.343	555.943	556.457	556.818	557.024	557.077	556.976	556.721	556.336	555.939	555.676	555.613	555.750	556.087	556.621
STATION	1620.000	1640.000	1660.000	1680.000	1700.000	1720.000	1740.000	1760.000	1780.000	1800.000	1820.000	1840.000	1860.000	1880.000	1900.000	1920.000

EXISTING LEVELS	558.878	558.658	558.574	558.566	558.516	558.478	558.526	558.436	558.299	558.102	557.865	557.732	557.633	557.483	557.242	557.186
DESIGN LEVELS	557.221	557.821	558.417	558.907	559.243	559.425	559.453	559.333	559.173	559.013	558.853	558.693	558.533	558.373	558.213	558.053
STATION	1940.000	1960.000	1980.000	2000.000	2020.000	2040.000	2060.000	2080.000	2100.000	2120.000	2140.000	2160.000	2180.000	2200.000	2220.000	2240.000

VARIANT 2C - PARKES WAY
(CONTROL LINE MCP0)

NOT FOR CONSTRUCTION

150 mm ON ORIGINAL 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
A1

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:17:13

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCP0_02

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

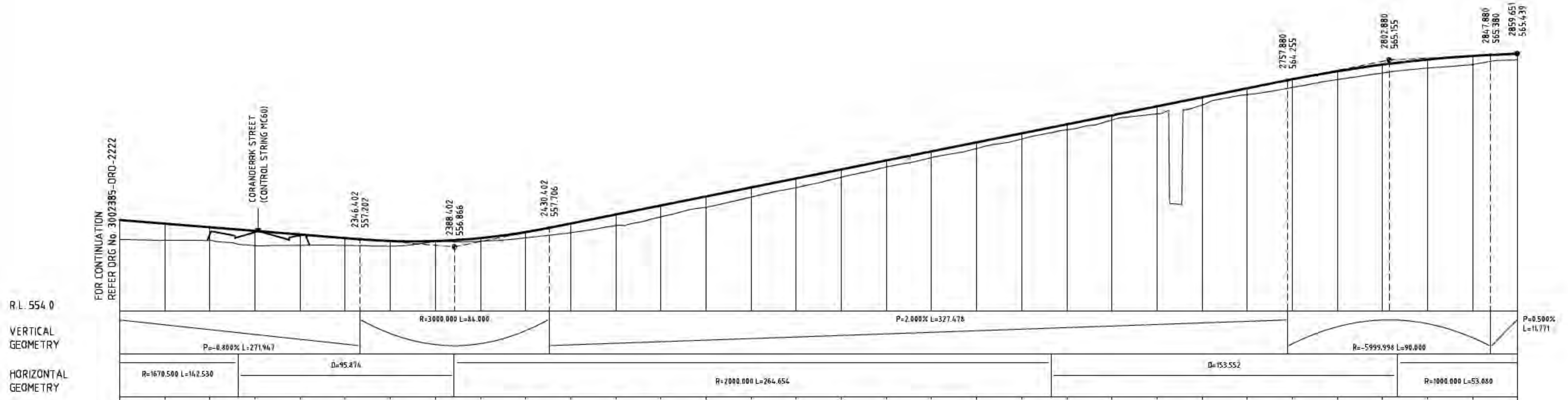
SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY (MCP0)
SHEET 2 OF 3

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2222	01



EXISTING LEVELS	557.186	557.152	557.153	556.917	556.930	556.923	556.897	557.112	557.112	557.262	557.492	557.806	558.194	558.620	559.072	559.482
DESIGN LEVELS	558.053	557.893	557.733	557.573	557.413	557.253	557.124	557.121	557.252	557.516	557.898	558.298	558.698	559.098	559.498	559.898
STATION	2240.000	2260.000	2280.000	2300.000	2320.000	2340.000	2360.000	2380.000	2400.000	2420.000	2440.000	2460.000	2480.000	2500.000	2520.000	2540.000

EXISTING LEVELS	559.953	560.410	560.823	561.229	561.648	562.058	562.493	562.764	563.157	563.617	563.935	564.285	564.574	564.797	564.955	565.173
DESIGN LEVELS	560.298	560.698	561.098	561.498	561.898	562.298	562.698	563.098	563.498	563.898	564.297	564.657	564.950	565.176	565.336	565.439
STATION	2560.000	2580.000	2600.000	2620.000	2640.000	2660.000	2680.000	2700.000	2720.000	2740.000	2760.000	2780.000	2800.000	2820.000	2840.000	2859.651

VARIANT 2C - PARKES WAY

(CONTROL LINE MCP0)

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:17:24

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCP0_08

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

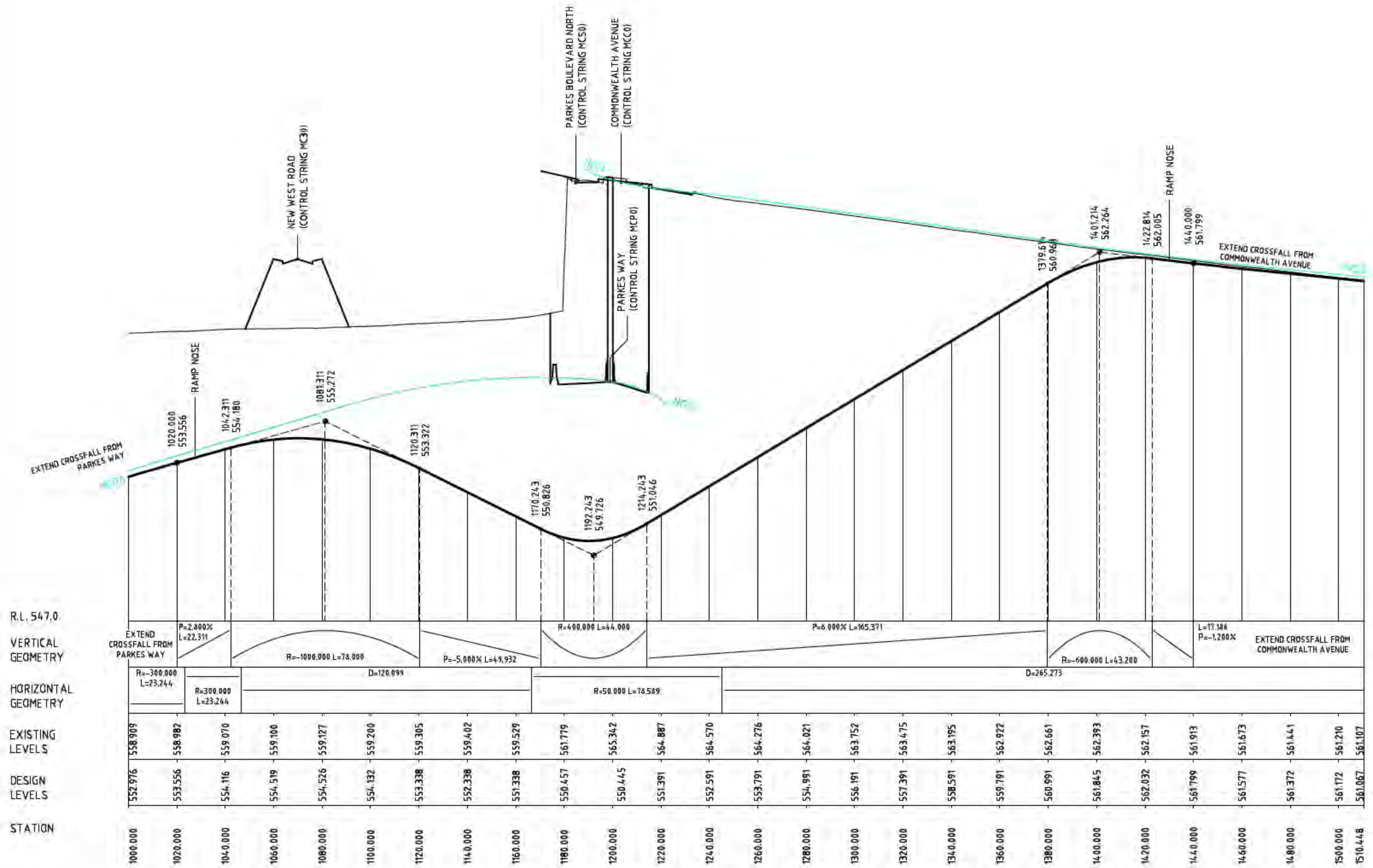
DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY (MCP0)
SHEET 3 OF 3

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2223	01

A1 150 mm ON ORIGINAL



STATION	1000.000	1020.000	1040.000	1060.000	1080.000	1100.000	1120.000	1140.000	1160.000	1180.000	1200.000	1220.000	1240.000
EXISTING LEVELS	558.909	558.982	559.070	559.100	559.127	559.200	559.305	559.402	559.529	561.779	565.342	564.887	564.570
DESIGN LEVELS	552.976	553.556	554.116	554.519	554.526	554.132	553.338	552.338	551.338	550.457	550.445	551.391	552.591

STATION	1260.000	1280.000	1300.000	1320.000	1340.000	1360.000	1380.000	1400.000	1420.000	1440.000	1460.000	1480.000	1500.000	1510.448
EXISTING LEVELS	564.276	564.021	563.752	563.475	563.195	562.922	562.661	562.393	562.157	561.913	561.673	561.441	561.210	561.107
DESIGN LEVELS	553.791	554.991	556.191	557.391	558.591	559.791	560.991	561.845	562.032	561.799	561.577	561.372	561.172	561.067

VARIANT 2C - PARKES WAY RIGHT TURN TO COMMONWEALTH AVENUE

(CONTROL LINE MCR0)

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
I:\3002385\CAD\DWG\12_RD_Long_Sections\3002385-DRD-2241_[01].dwg

PLOT DATE 25 Sep 2014
TIME 17:17:34

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCR0_01

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

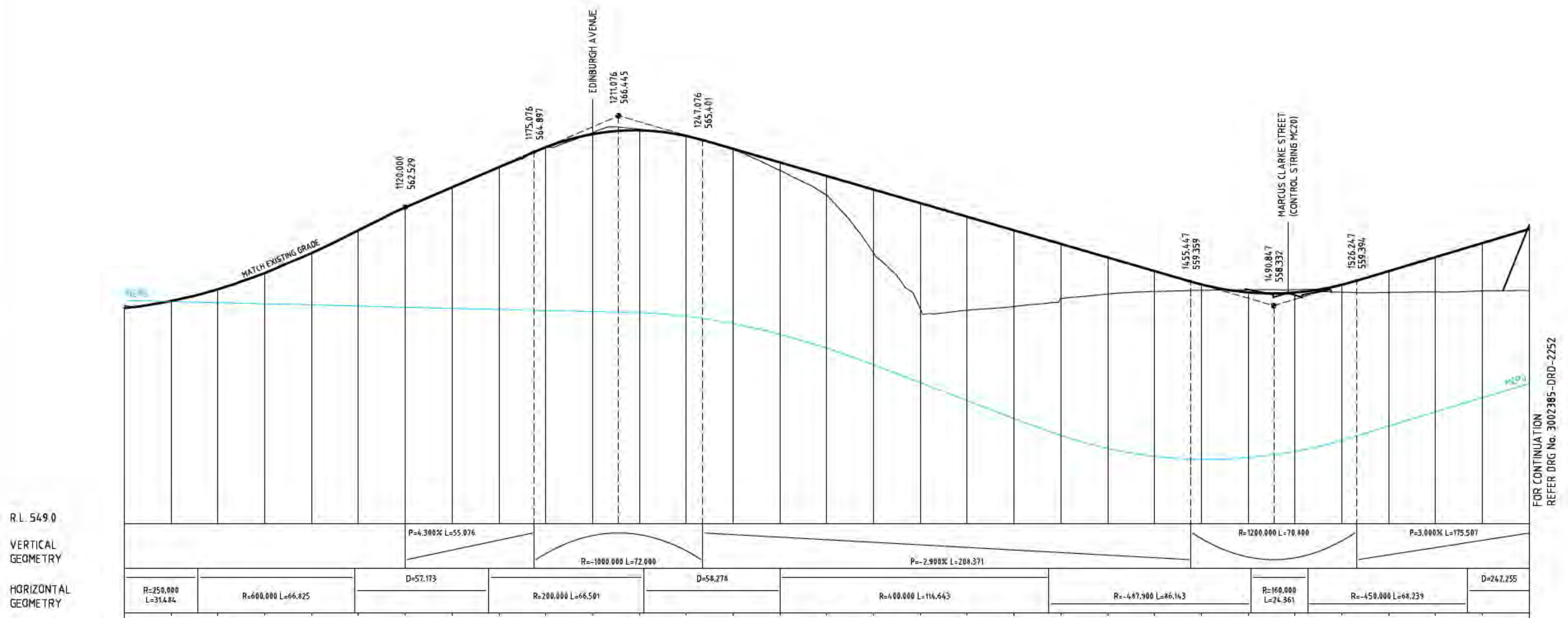
DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY RIGHT TURN RAMP TO
COMMONWEALTH AVENUE (MCR0) SHEET 1 OF 1

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2241	01

150 mm ON ORIGINAL
A1



EXISTING LEVELS	558.328	558.531	559.032	559.721	560.577	561.550	562.529	563.387	564.238	565.100	565.723	565.874	565.561	565.011	564.112	563.050
DESIGN LEVELS	558.233	558.532	559.032	559.721	560.582	561.550	562.529	563.389	564.249	565.097	565.658	565.820	565.581	565.027	564.447	563.867
STATION	1000.000	1020.000	1040.000	1060.000	1080.000	1100.000	1120.000	1140.000	1160.000	1180.000	1200.000	1220.000	1240.000	1260.000	1280.000	1300.000

EXISTING LEVELS	560.575	558.185	558.134	558.295	558.630	558.825	558.933	558.986	559.006	559.013	558.902	558.898	558.917	558.959	558.986
DESIGN LEVELS	563.287	562.707	562.127	561.547	560.967	560.387	559.807	559.235	558.898	558.894	559.223	559.807	560.407	561.007	561.607
STATION	1320.000	1340.000	1360.000	1380.000	1400.000	1420.000	1440.000	1460.000	1480.000	1500.000	1520.000	1540.000	1560.000	1580.000	1600.000

VARIANT 2C - SERVICE ROAD EASTBOUND

(CONTROL LINE MCS0)

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
I:\3002385\CAD\DWG\12_RD_Long_Sections\3002385-DRD-2251_[01].dwg

PLOT DATE 25 Sep 2014
TIME 17:17:45

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCS0_01

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C

LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY SERVICE ROAD EASTBOUND (MCS0)
SHEET 1 OF 2

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2251	01

A1
150 mm ON ORIGINAL
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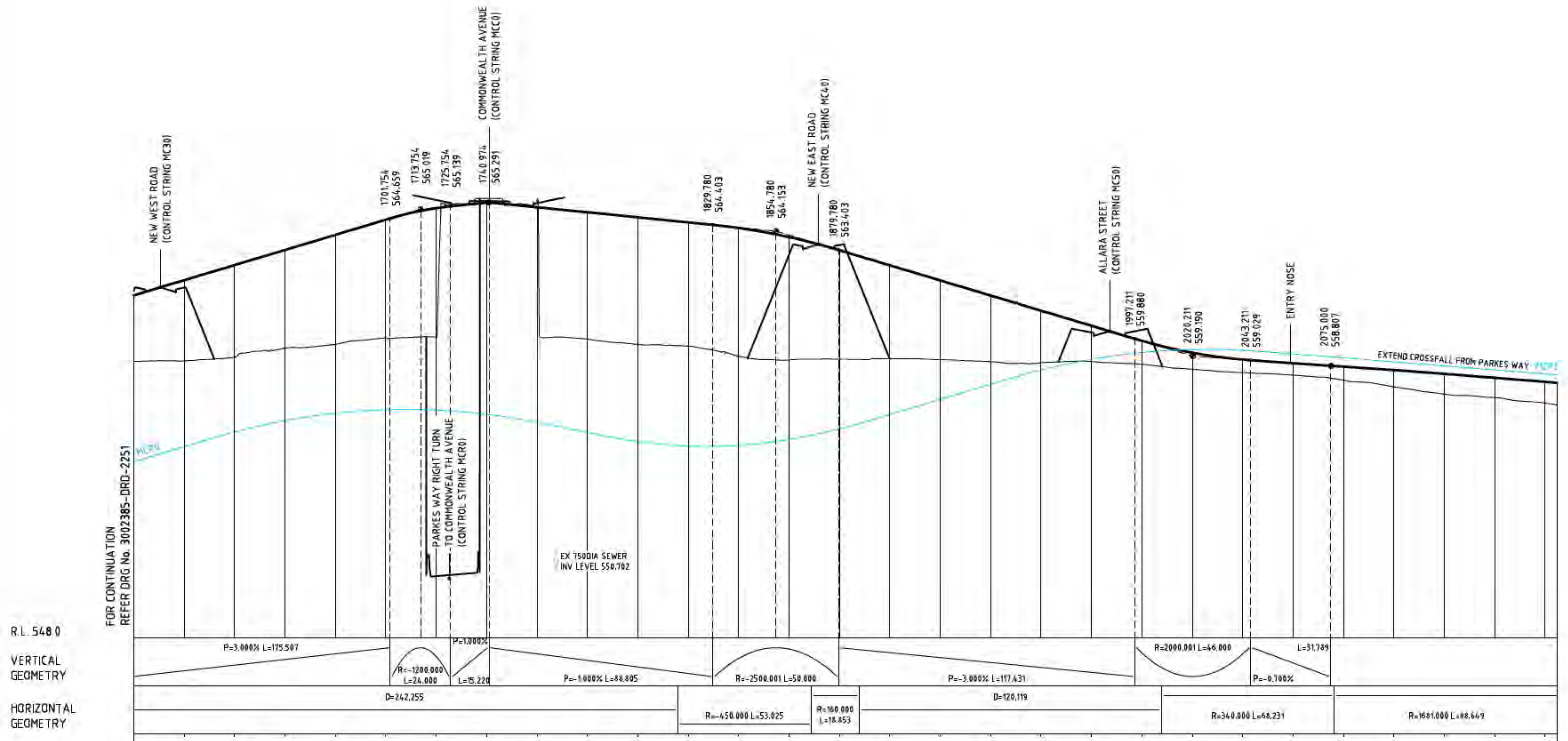

EXISTING LEVELS	558.986	559.007	559.149	559.511	559.659	559.917	559.953	565.446	565.427	559.867	559.654	559.590	559.185	559.043	559.068	559.089	559.051	558.976	558.926	558.979	558.868	558.672	558.543	558.440	558.239	557.975	557.685	557.546	557.331 557.254
DESIGN LEVELS	561.607	562.207	562.807	563.407	564.007	564.607	565.068	565.282	565.101	564.901	564.701	564.501	564.280	563.918	563.397	562.797	562.197	561.597	560.997	560.397	559.799	559.327	559.054	558.912	558.775	558.639	558.491	558.333	558.174 558.136
STATION	1600.000	1620.000	1640.000	1660.000	1680.000	1700.000	1720.000	1740.000	1760.000	1780.000	1800.000	1820.000	1840.000	1860.000	1880.000	1900.000	1920.000	1940.000	1960.000	1980.000	2000.000	2020.000	2040.000	2060.000	2080.000	2100.000	2120.000	2140.000	2160.000 2164.781

VARIANT 2C - SERVICE ROAD EASTBOUND

(CONTROL LINE MCS0)

150 mm ON ORIGINAL

A1

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:17:56

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCS0_02

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

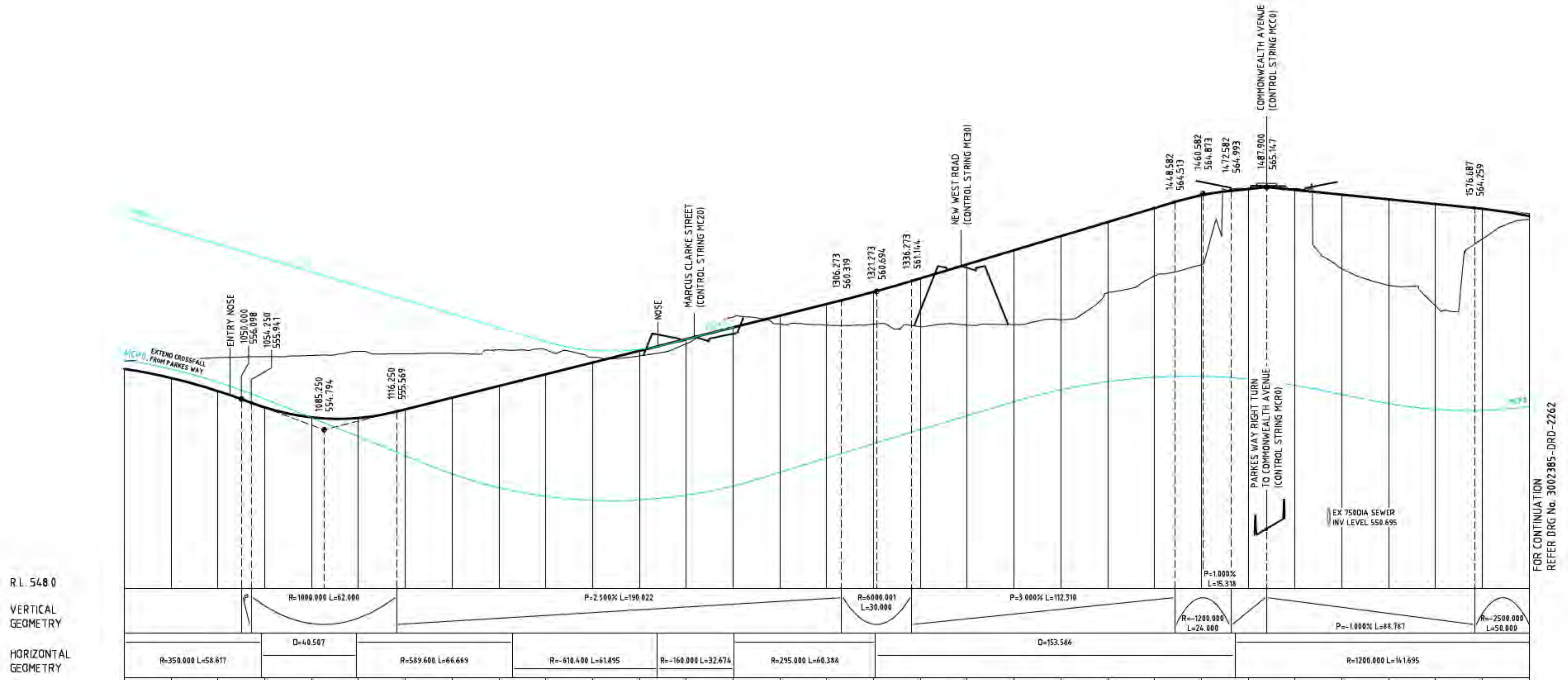
NOT FOR CONSTRUCTION

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY SERVICE ROAD EASTBOUND (MCS0)
SHEET 2 OF 2

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2252	01



EXISTING LEVELS	557.729	557.803	557.868	557.916	557.962	558.137	558.033	558.056	558.211	558.206	557.883	557.942	558.465	559.606	559.305	559.258
DESIGN LEVELS	557.388	557.001	556.442	555.744	555.319	555.294	555.662	556.162	556.662	557.162	557.662	558.162	558.662	559.162	559.662	560.162
STATION	1000.000	1020.000	1040.000	1060.000	1080.000	1100.000	1120.000	1140.000	1160.000	1180.000	1200.000	1220.000	1240.000	1260.000	1280.000	1300.000
SUPERELEVATION																

EXISTING LEVELS	559.297	559.190	559.255	559.277	559.484	560.638	561.357	561.831	565.081	565.089	561.663	560.959	560.078	562.940	563.775
DESIGN LEVELS	560.678	561.256	561.856	562.456	563.056	563.656	564.256	564.802	565.068	565.026	564.826	564.626	564.426	564.223	563.917
STATION	1320.000	1340.000	1360.000	1380.000	1400.000	1420.000	1440.000	1460.000	1480.000	1500.000	1520.000	1540.000	1560.000	1580.000	1600.000
SUPERELEVATION															

VARIANT 2C - SERVICE ROAD WESTBOUND

(CONTROL LINE MCT0)

NOT FOR CONSTRUCTION

150 mm ON ORIGINAL

A1

DRAWING FILE LOCATION / NAME
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PLOT DATE 25 Sep 2014
TIME 17:18:07

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCT0_01

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

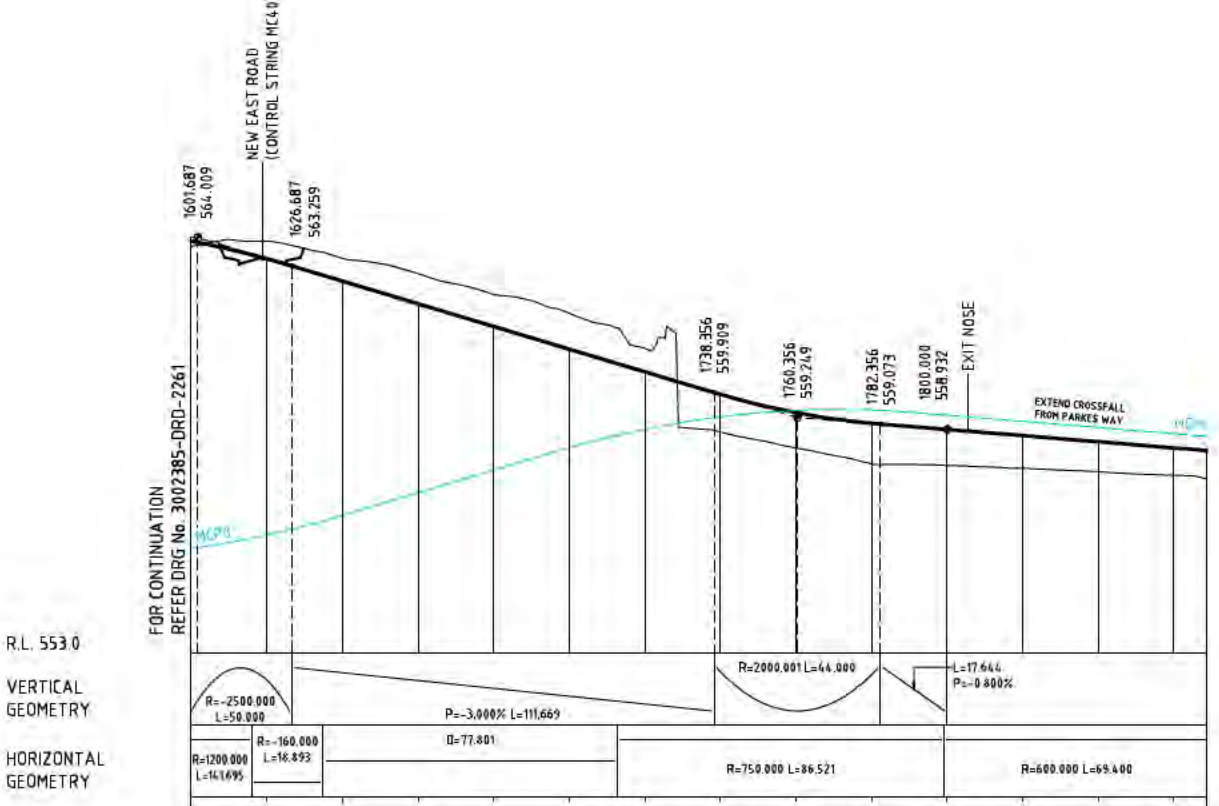
SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY SERVICE ROAD WESTBOUND (MCT0)
SHEET 1 OF 2

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2261	01



EXISTING LEVELS	563.775	563.918	563.462	563.058	562.495	562.007	561.081	558.863	558.443	558.015	557.983	557.905	557.811	557.720	557.620
DESIGN LEVELS	563.917	563.450	562.859	562.259	561.659	561.059	560.459	559.860	559.377	559.093	558.932	558.769	558.606	558.445	558.375
STATION	1600.000	1620.000	1640.000	1660.000	1680.000	1700.000	1720.000	1740.000	1760.000	1780.000	1800.000	1820.000	1840.000	1860.000	1868.646
SUPERELEVATION															

VARIANT 2C - SERVICE ROAD WESTBOUND

(CONTROL LINE MCT0)

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
I:\3002385\CAD\DWG\12__RD__Long__Sections\3002385-DRD-2262__[01].dwg

PLOT DATE 25 Sep 2014
TIME 17:18:19

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCT0_02

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

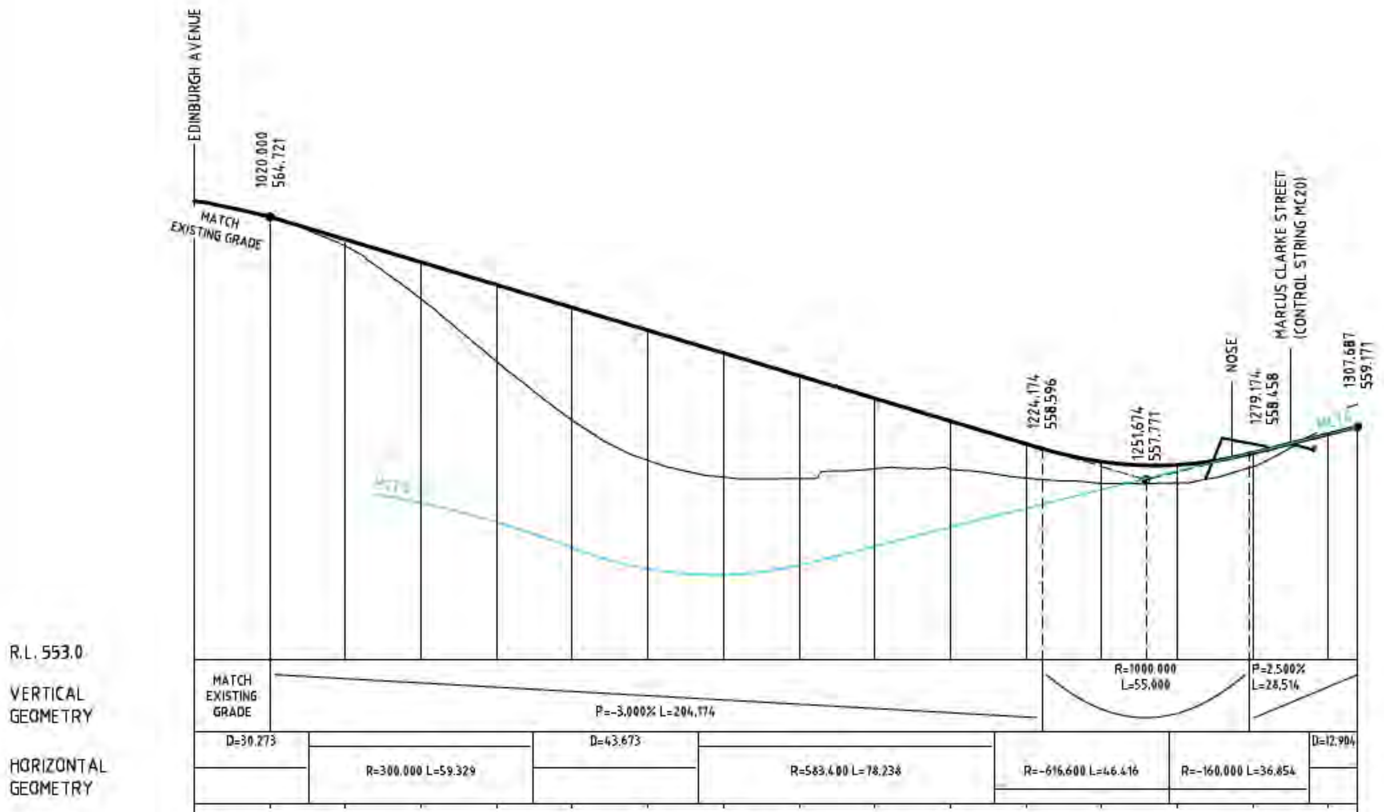
DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
PARKES WAY SERVICE ROAD WESTBOUND (MCT0)
SHEET 2 OF 2

SCALE AS SHOWN
PHASE PRELIMINARY
PROJECT / DRAWING No. 3002385-DRD-2262
REVISION 01

A1 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 150 mm ON ORIGINAL



STATION	EXISTING LEVELS	DESIGN LEVELS
1000.000	565.139	565.139
1020.000	564.721	564.721
1040.000	563.950	564.121
1060.000	562.546	563.521
1080.000	560.898	562.921
1100.000	559.338	562.321
1120.000	558.282	561.721
1140.000	557.836	561.121
1160.000	557.805	560.521
1180.000	558.062	559.921
1200.000	558.047	559.321
1220.000	557.814	558.721
1240.000	557.675	558.246
1260.000	557.688	558.163
1280.000	558.115	558.479
1300.000	559.192	558.979
1307.687	559.769	559.171

VARIANT 2C - ENTRY TO EDINBURGH AVENUE

(CONTROL LINE MCV0)

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
I:\3002385\CAD\DWG\12__RD__Long__Sections\3002385-DRD-2271__[01].dwg

PLOT DATE 25 Sep 2014
TIME 17:18:30

EXTERNAL REFERENCE FILES
X_PWFS_ACT_A1
X_PWFS_V2C_LS_MCV0_01

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	B. LEJANO
DESIGN CHECK	T. FERRIS
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
LONGITUDINAL SECTION - VARIANT 2C
ENTRY TO EDINBURGH AVENUE (MCV0)
SHEET 1 OF 1

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	PRELIMINARY	3002385-DRD-2271	01

A1 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 150 mm ON ORIGINAL

NOTE:

1. ALL PROPOSED UTILITY ALIGNMENTS ARE INDICATIVE ONLY. FINAL UTILITY ALIGNMENTS AND SHARED TRENCH REQUIREMENTS ARE TO BE AGREED WITH INDIVIDUAL ASSET OWNERS.
2. THE LOCATION OF EXISTING SERVICES DEPICTED ON THE DRAWINGS IS INDICATIVE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE VERIFICATION OF THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF THE WORK.

LEGEND

GENERAL

- CADASTRAL BOUNDARY
- PROJECT BOUNDARY

EXISTING - SEWER

- SEWER PIPE
- Ø150 SEWER PIPE
- Ø150 SEWER PIPE - ABANDONED
- Ø225 SEWER PIPE
- Ø225 SEWER PIPE - ABANDONED
- Ø300 SEWER PIPE
- Ø375 SEWER PIPE
- Ø375 SEWER PIPE - ABANDONED
- Ø450 SEWER PIPE
- Ø450 SEWER PIPE - ABANDONED
- Ø525 SEWER PIPE - ABANDONED
- Ø600 SEWER PIPE - ABANDONED
- Ø750 SEWER PIPE
- Ø750 SEWER PIPE - ABANDONED

EXISTING - WATER

- WATER PIPE / END CAP / MAN HOLE
- ØUNKNOWN WATER MAIN - ABANDONED
- Ø100 ACTEW WATER MAIN
- Ø100 ACTEW WATER MAIN - ABANDONED
- Ø150 ACTEW WATER MAIN
- Ø150 ACTEW WATER MAIN - ABANDONED
- Ø225 ACTEW WATER MAIN
- Ø225 ACTEW WATER MAIN - ABANDONED
- Ø300 ACTEW WATER MAIN
- Ø300 ACTEW WATER MAIN - ABANDONED
- Ø600 ACTEW WATER MAIN
- Ø600 ACTEW WATER MAIN - ABANDONED
- Ø675 ACTEW WATER MAIN
- Ø675 ACTEW WATER MAIN - ABANDONED

EXISTING - GAS

- GAS MAIN
- GAS MAIN - ABANDONED
- Ø50 GAS MAIN HIGH PRESSURE
- Ø100 GAS MAIN HIGH PRESSURE
- Ø100 GAS MAIN HIGH PRESSURE - RELOCATED
- Ø150 GAS MAIN HIGH PRESSURE
- Ø300 GAS MAIN HIGH PRESSURE
- Ø350 GAS MAIN HIGH PRESSURE
- Ø350 GAS MAIN HIGH PRESSURE - ABANDONED
- Ø450 GAS MAIN HIGH PRESSURE
- Ø450 GAS MAIN HIGH PRESSURE - ABANDONED

LEGEND

EXISTING - ELECTRICAL

- ELECTRICITY LOW VOLTAGE - UNDERGROUND
- ELECTRICITY LOW VOLTAGE - UNDERGROUND - ABANDONED
- ELECTRICITY LOW VOLTAGE - UNDERGROUND
- ELECTRICITY LOW VOLTAGE - OVERHEAD
- ELECTRICITY LOW VOLTAGE - UNDERGROUND - ABANDONED
- ELECTRICITY HIGH VOLTAGE - UNDERGROUND
- ELECTRICITY HIGH VOLTAGE - ABANDONED
- STREET LIGHT CABLE - OVERHEAD
- STREET LIGHT CABLE - ABANDONED
- ELECTRICAL PILLARS - SUBSTATION

EXISTING - COMMUNICATIONS

- TELECOMMUNICATIONS (AAPT)
- TELECOMMUNICATIONS (AAPT) - ABANDONED
- TELECOMMUNICATIONS (ICON)
- TELECOMMUNICATIONS (ICON) - ABANDONED
- TELECOMMUNICATIONS (NEXTGEN)
- TELECOMMUNICATIONS (OPTUS)
- TELECOMMUNICATIONS (TRANSACT)
- TELECOMMUNICATIONS (TRANSACT) - ABANDONED
- TELECOMMUNICATIONS (TELSTRA)
- TELECOMMUNICATIONS (TELSTRA)
- TELECOMMUNICATIONS CONDUIT
- TELECOMMUNICATIONS TELSTRA OPTICAL FIBRE
- TELECOMMUNICATIONS PIT

LEGEND

PROPOSED - SEWER

- Ø150 SEWER MAIN
- Ø375 SEWER MAIN
- Ø450 SEWER MAIN
- Ø525 SEWER MAIN
- Ø600 SEWER MAIN
- Ø750 SEWER MAIN

PROPOSED - WATER

- Ø225 WATER MAIN
- Ø300 WATER MAIN
- Ø375 WATER MAIN
- Ø600 WATER MAIN
- Ø675 WATER MAIN

PROPOSED - GAS

- Ø100 GAS MAIN HIGH PRESSURE
- Ø350 GAS MAIN HIGH PRESSURE
- Ø450 GAS MAIN HIGH PRESSURE

PROPOSED - ELECTRICAL

- ELECTRICITY HIGH VOLTAGE - UNDERGROUND
- ELECTRICITY HIGH VOLTAGE - OVERHEAD

PROPOSED - COMMUNICATIONS

- TELECOMMUNICATIONS (ICON/AAPT/TRANSACT)
- TELECOMMUNICATIONS (AAPT)
- TELECOMMUNICATIONS (ICON)
- TELECOMMUNICATIONS (NEXTGEN)
- TELECOMMUNICATIONS (OPTUS)
- TELECOMMUNICATIONS (TRANSACT)
- TELECOMMUNICATIONS (TELSTRA)

LEGEND

EXISTING STORMWATER

- STORMWATER PIPE/ MANHOLE/ SUMP
- STORMWATER PIPE (DISUSED)

PROPOSED STORMWATER

- STORMWATER PIPE
- STORMWATER PIPE (Ø600)
- STORMWATER PIPE (Ø900)
- STORMWATER PIPE (Ø1200)
- CULVERT RCBC
- INSPECTION PIT/ MANHOLE/ HEADWALL
- STORMWATER STRUCTURES
- PUMP STATION

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 12 Dec 2014
TIME 09:31:44

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REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICES PLAN
LEGEND AND NOTES

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2001	02

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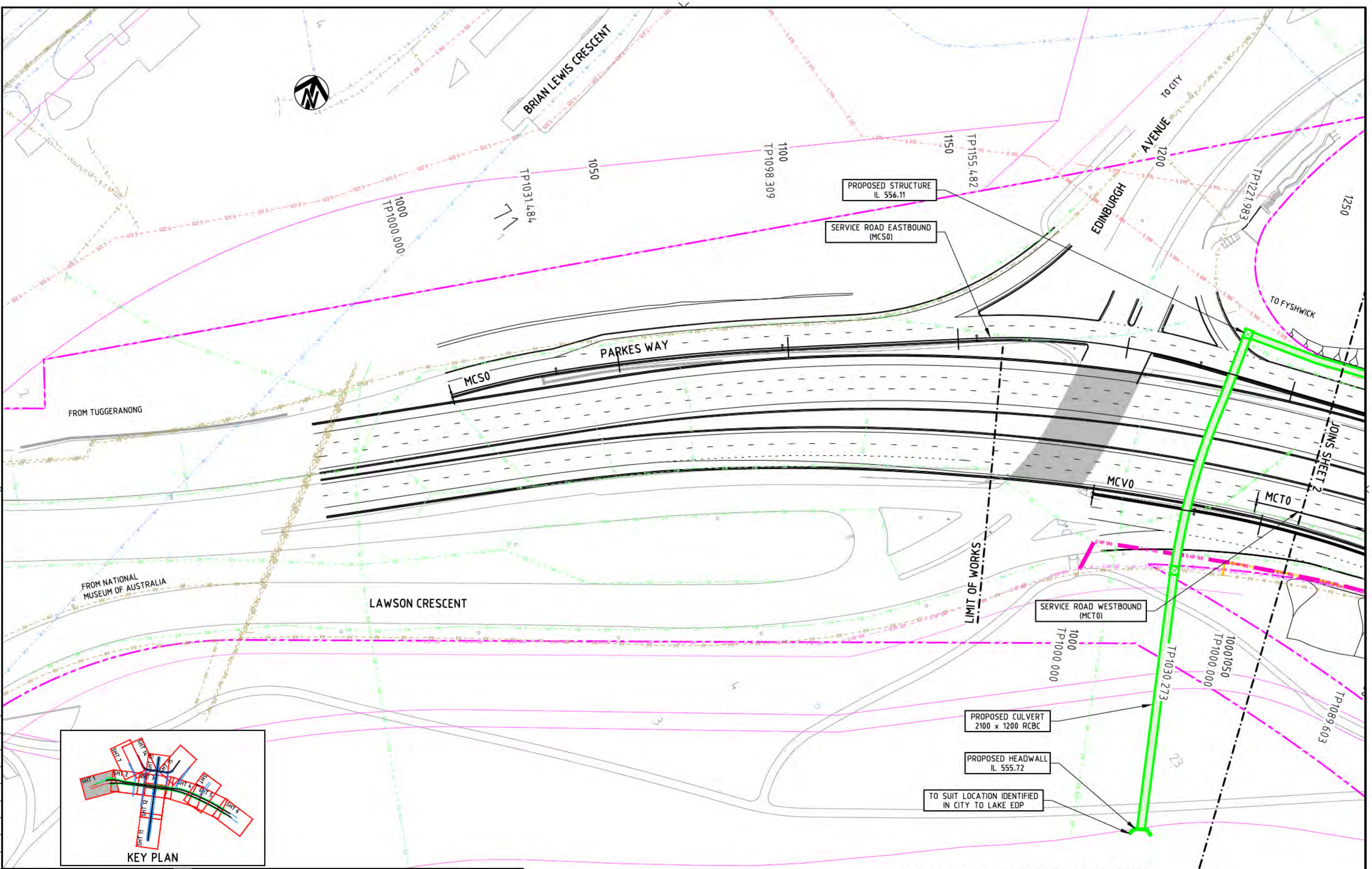

PROPOSED STRUCTURE
IL 556.11

SERVICE ROAD EASTBOUND
(MCS0)

SERVICE ROAD WESTBOUND
(MCT0)

PROPOSED CULVERT
2100 x 1200 RCBC

PROPOSED HEADWALL
IL 555.72

TO SUIT LOCATION IDENTIFIED
IN CITY TO LAKE EDP

NOT FOR CONSTRUCTION

150 mm ON ORIGINAL
A1

DRAWING FILE LOCATION / NAME
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PLOT DATE 12 Dec 2014
TIME 09:32:06

EXTERNAL REFERENCE FILES
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REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
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02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

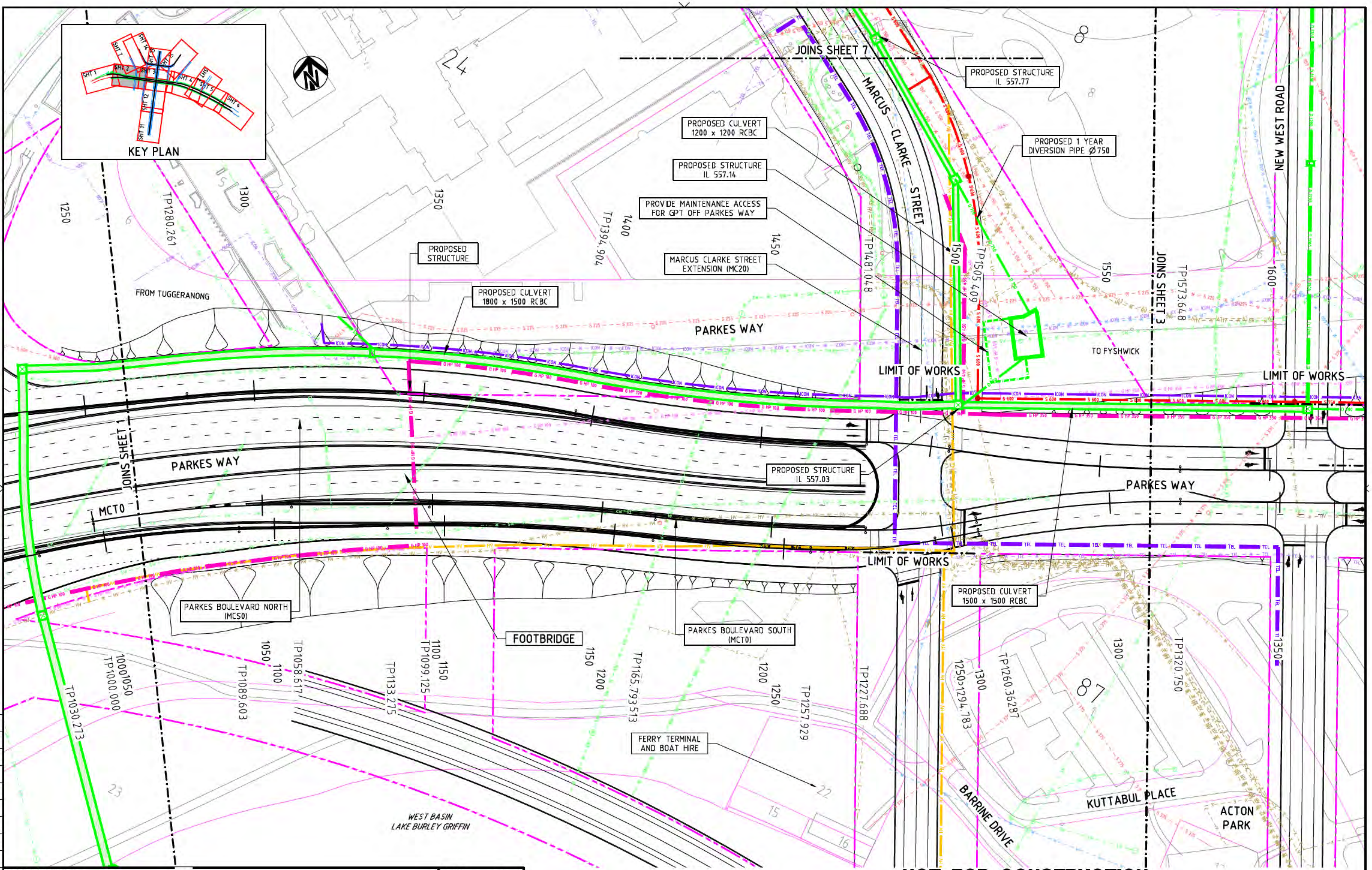
SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
PARKES WAY SURFACE BOULEVARD
SHEET 1

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2111	02



NOT FOR CONSTRUCTION

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PLOT DATE	TIME
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X_PWFS_V2C_DRN
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REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
PARKES WAY SURFACE BOULEVARD
SHEET 2

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2112	02

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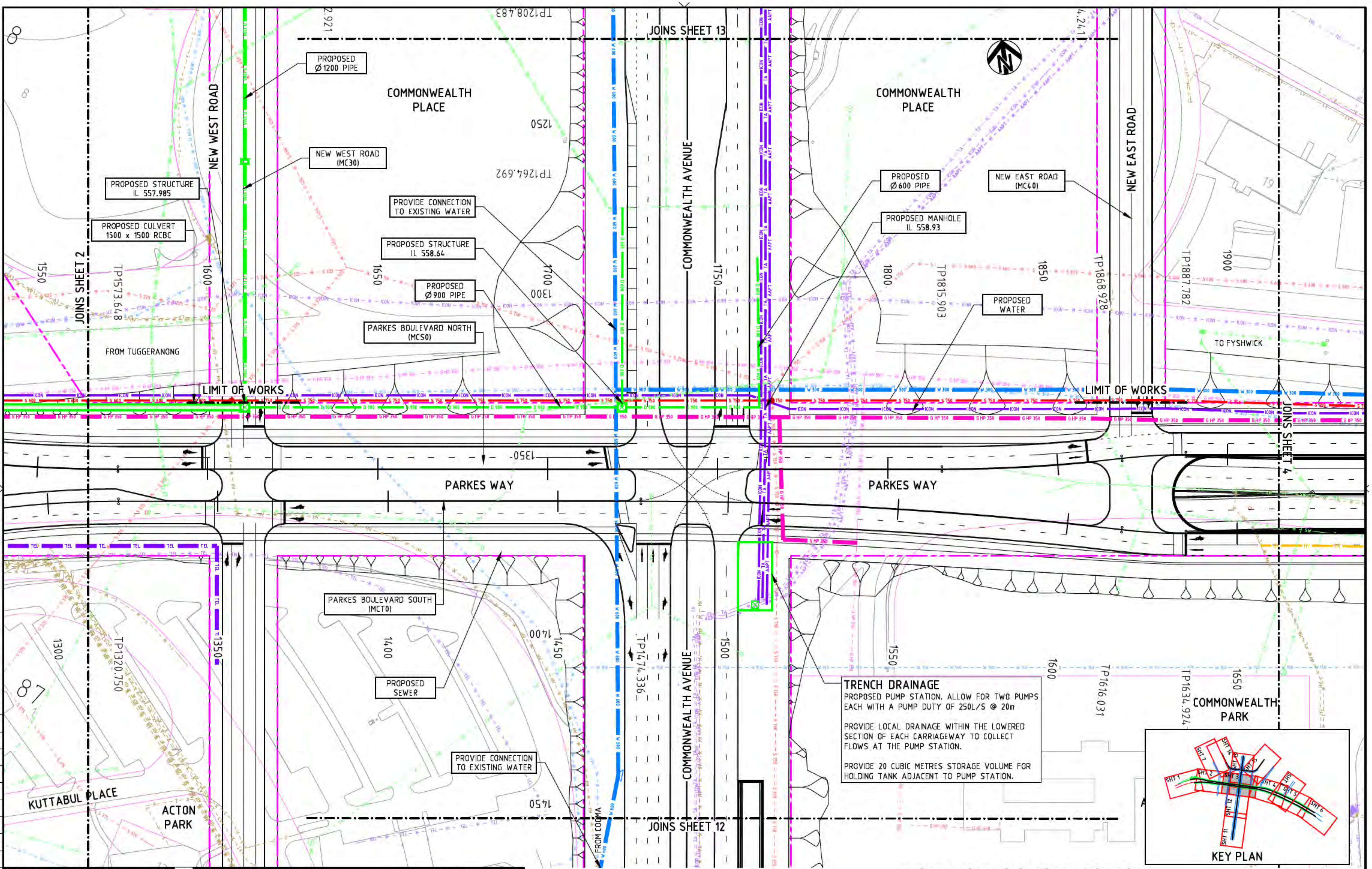

TRENCH DRAINAGE

PROPOSED PUMP STATION. ALLOW FOR TWO PUMPS EACH WITH A PUMP DUTY OF 250L/S @ 20m

PROVIDE LOCAL DRAINAGE WITHIN THE LOWERED SECTION OF EACH CARRIAGEWAY TO COLLECT FLOWS AT THE PUMP STATION.

PROVIDE 20 CUBIC METRES STORAGE VOLUME FOR HOLDING TANK ADJACENT TO PUMP STATION.

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 12 Dec 2014
TIME 09:33:06

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X_PWFS_UTILX_SW
X_PWFS_UTILX_SW_LCL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500
5 0 10 20

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
PARKES WAY SURFACE BOULEVARD
SHEET 3

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2113	02

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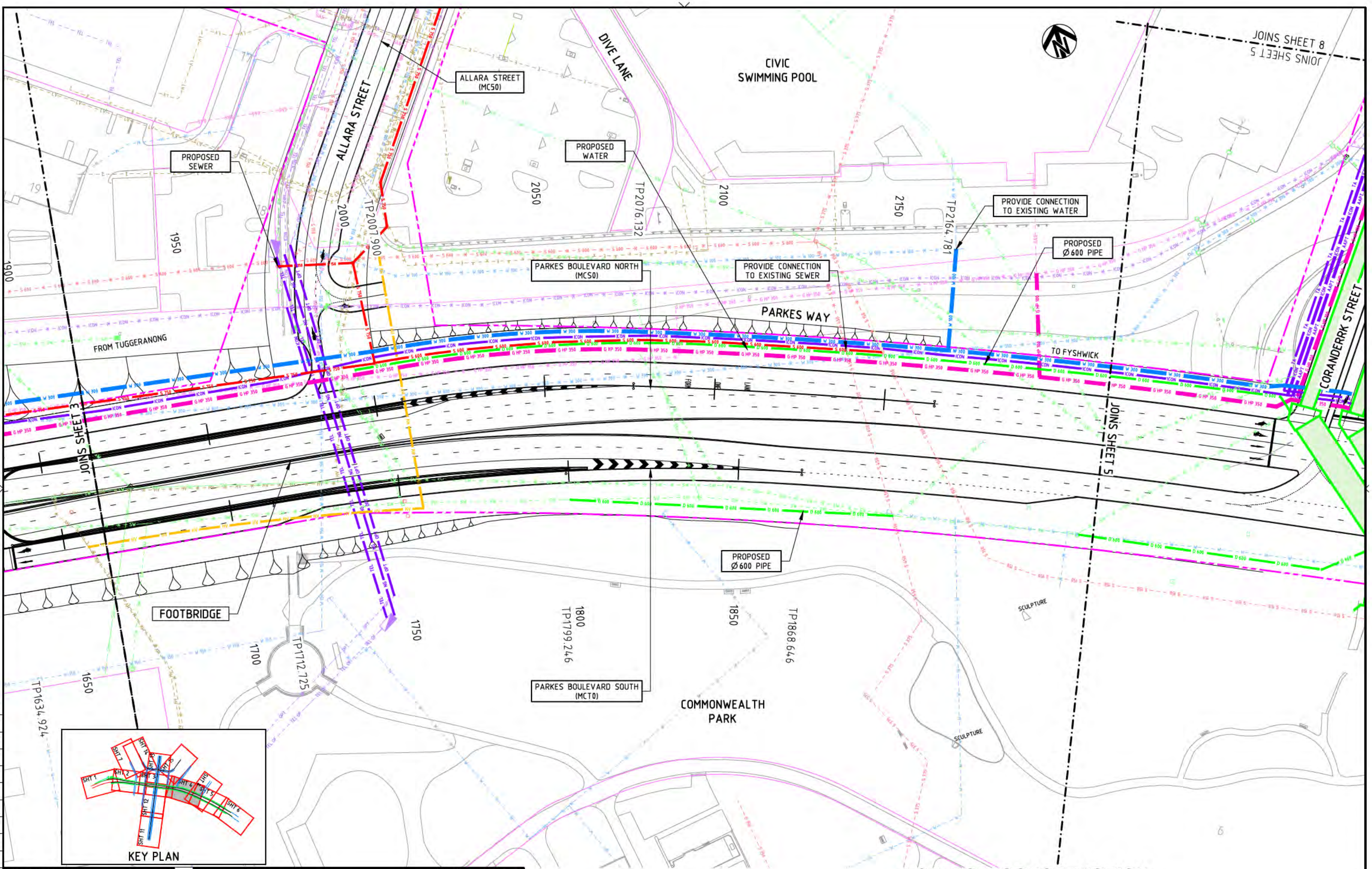

NOT FOR CONSTRUCTION

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PLOT DATE 12 Dec 2014
TIME 09:33:40

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X_PWFS_DES_V2C_TUNL
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X_PWFS_UTILX_SW_LCL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C

TRUNK UTILITIES SERVICE PLAN
PARKES WAY SURFACE BOULEVARD
SHEET 4

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2114	02

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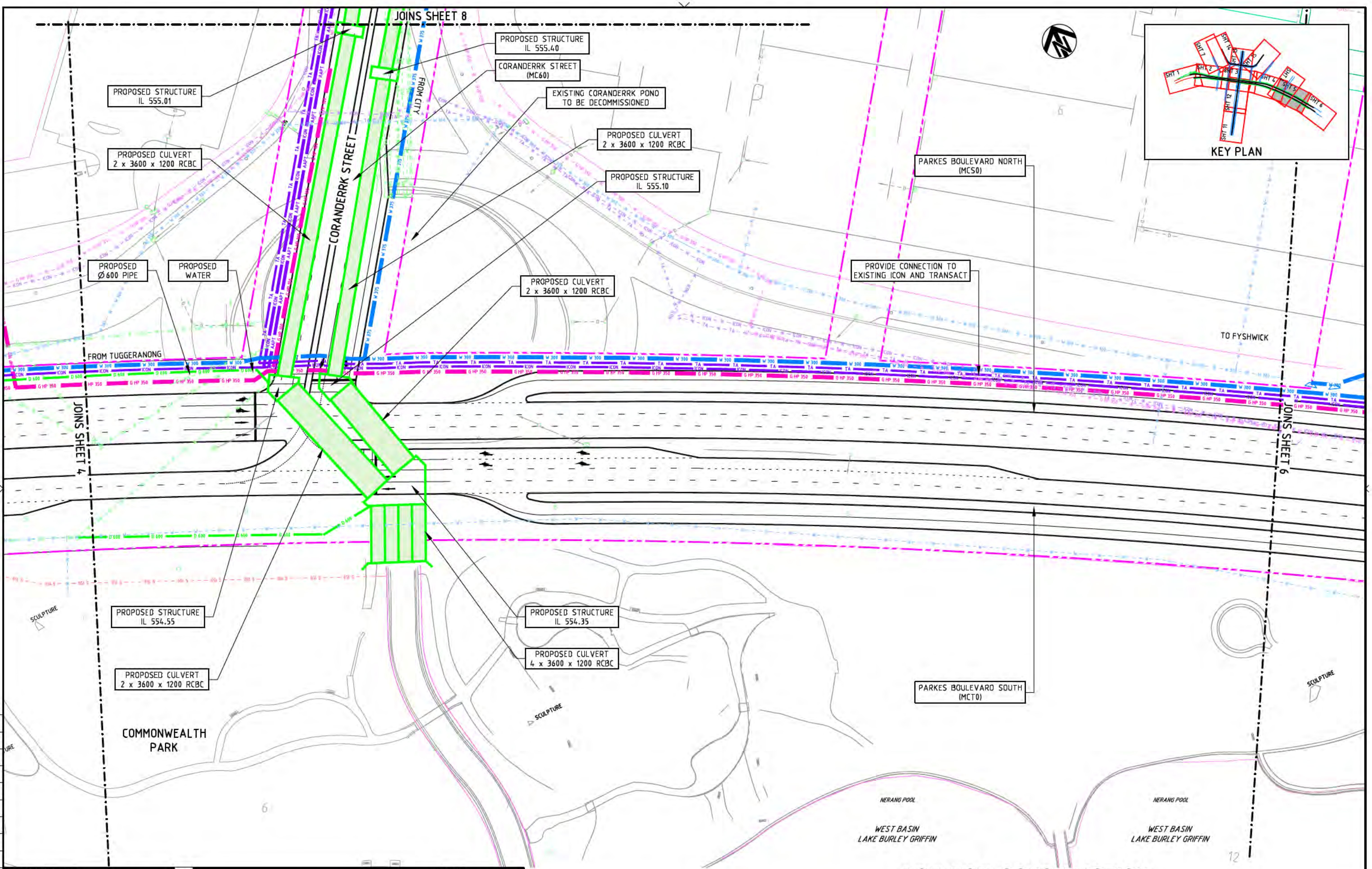

NOT FOR CONSTRUCTION

150 mm ON ORIGINAL
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PLOT DATE 12 Dec 2014
TIME 09:34:10

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X_PWFS_UTILX_SW
X_PWFS_UTILX_SW_LCL
X_PWFS_UTILX_SW_CAU
SUR

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

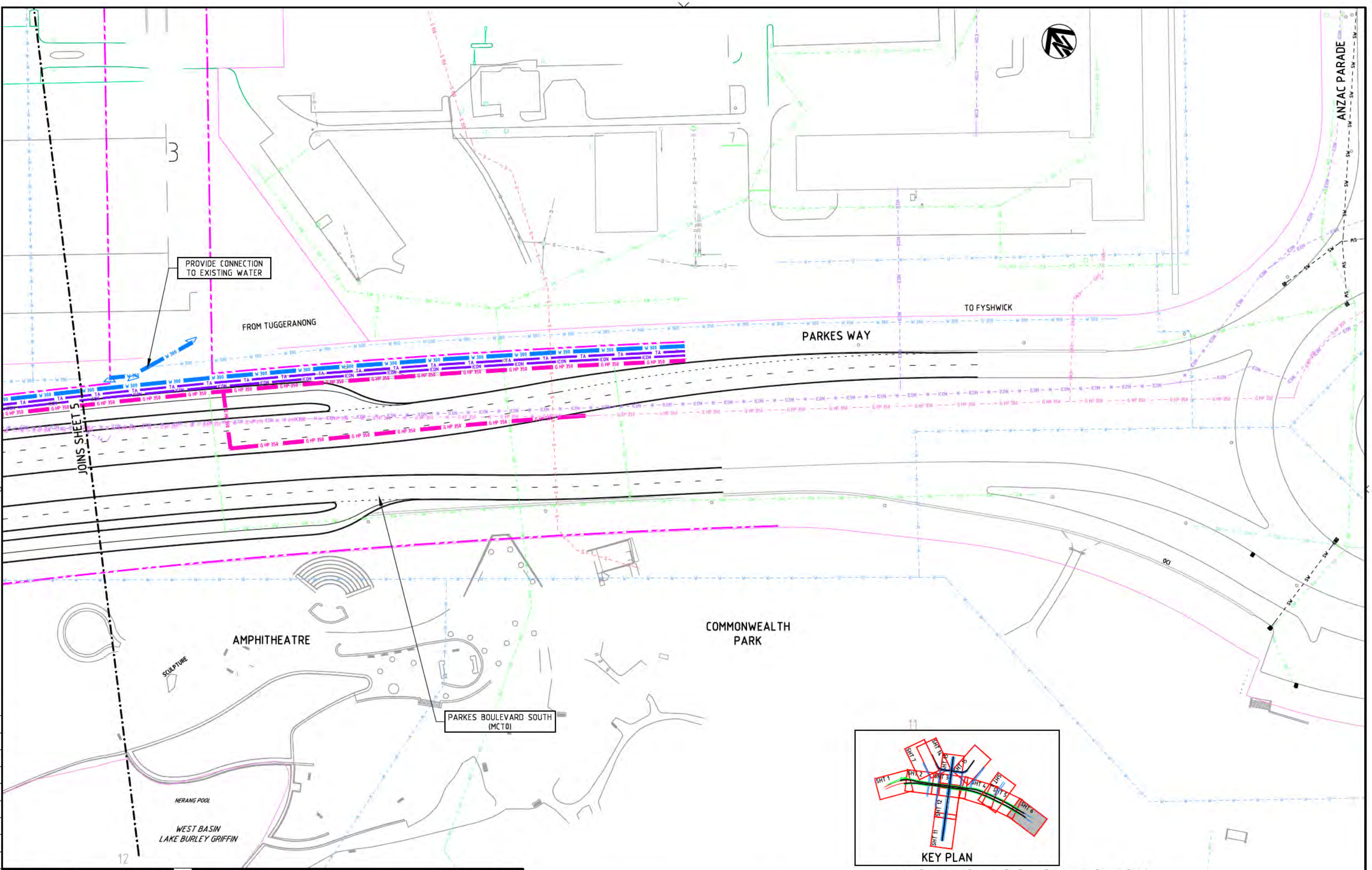
SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
PARKES WAY SURFACE BOULEVARD
SHEET 5

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2115	02



NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE 12 Dec 2014
TIME 09:34:39

EXTERNAL REFERENCE FILES
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X_PWFS_UTILX_SW
X_PWFS_UTILX_SW_LCL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C

TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 6

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2116	02

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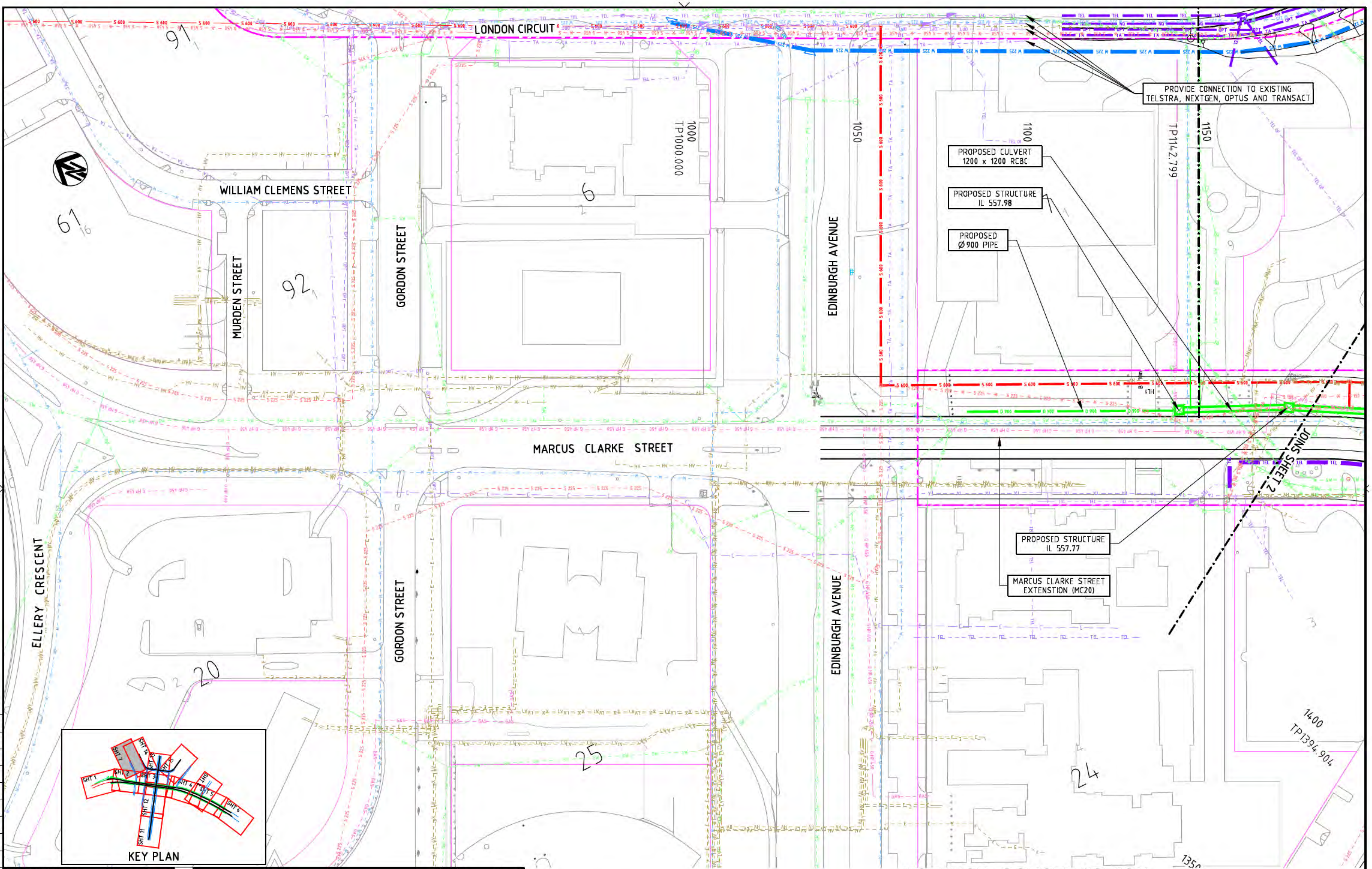

NOT FOR CONSTRUCTION

DRAWING FILE LOCATION / NAME
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PLOT DATE	TIME
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EXTERNAL REFERENCE FILES
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X_PWFS_UTILX_SW_LCL

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
PARKES WAY SURFACE BOULEVARD
SHEET 7

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2117	02

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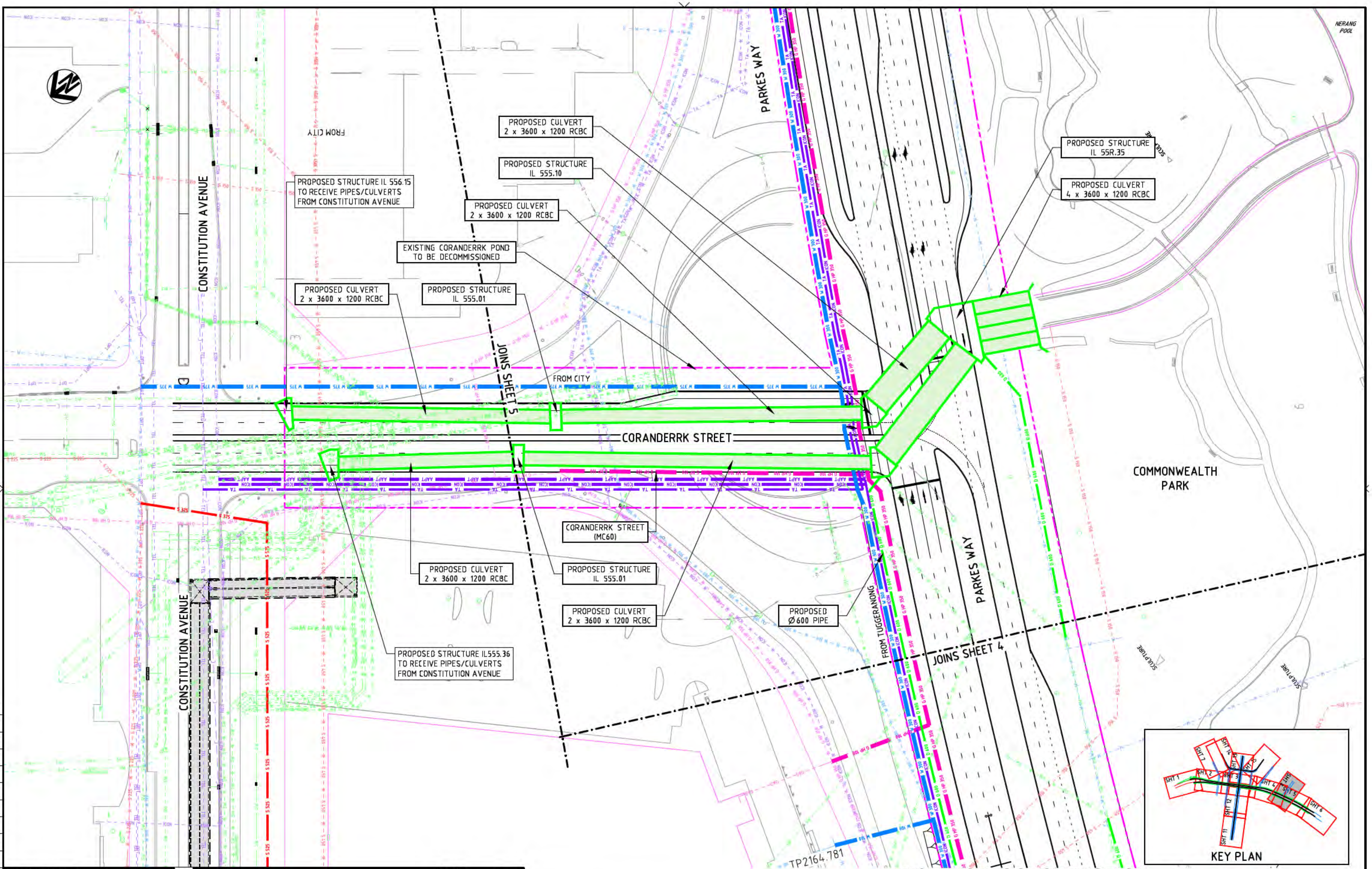

NOT FOR CONSTRUCTION

150 mm ON ORIGINAL

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PLOT DATE	TIME
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REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

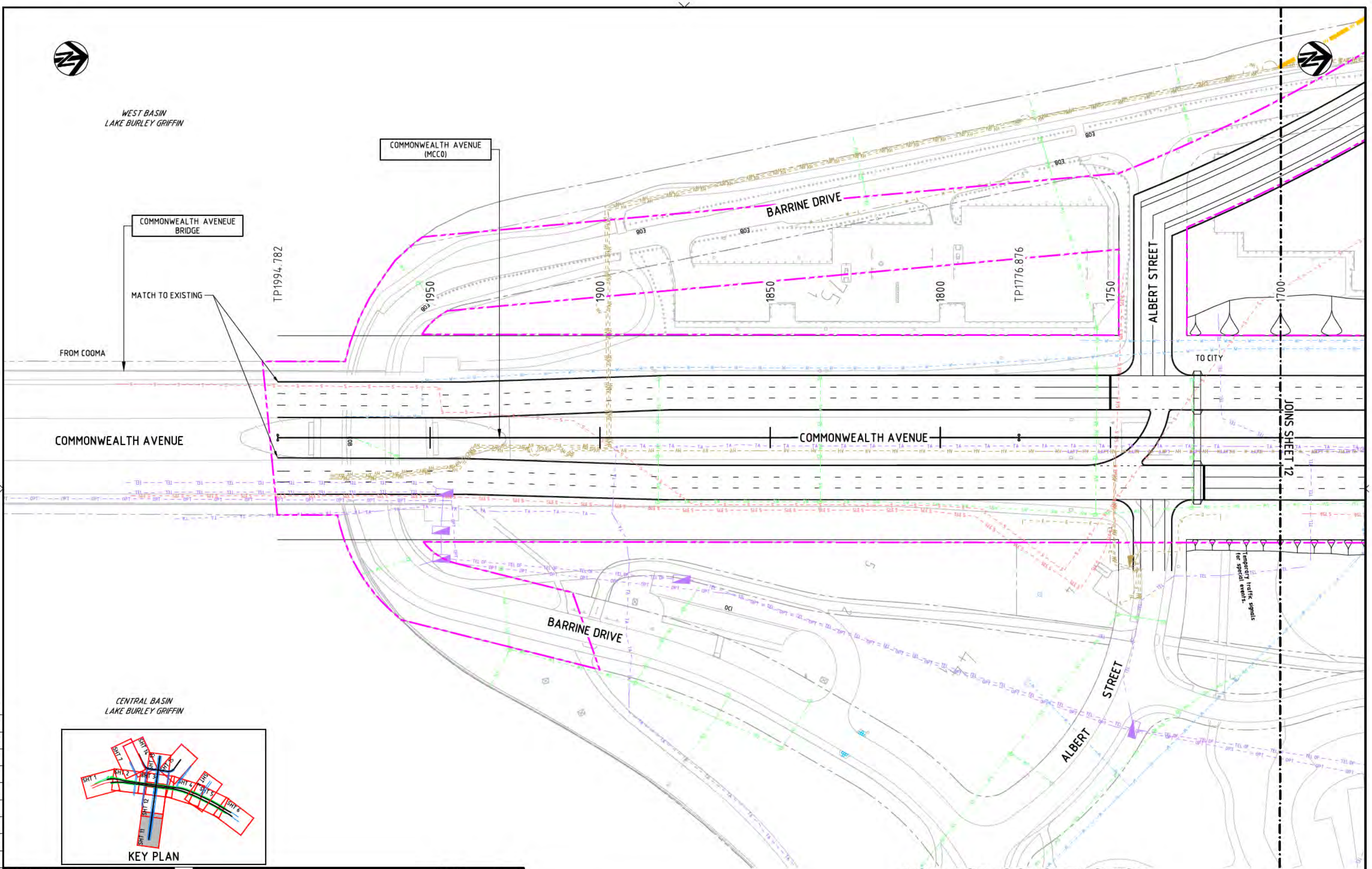
DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C

TRUNK UTILITIES SERVICE PLAN
PARKES WAY SURFACE BOULEVARD
SHEET 8

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2118	02



NOT FOR CONSTRUCTION

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PLOT DATE 12 Dec 2014
TIME 09:36:07

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REV	CAD No	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01		25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02		11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
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SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
COMMONWEALTH AVENUE SURFACE LEVEL
SHEET 11

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2121	02

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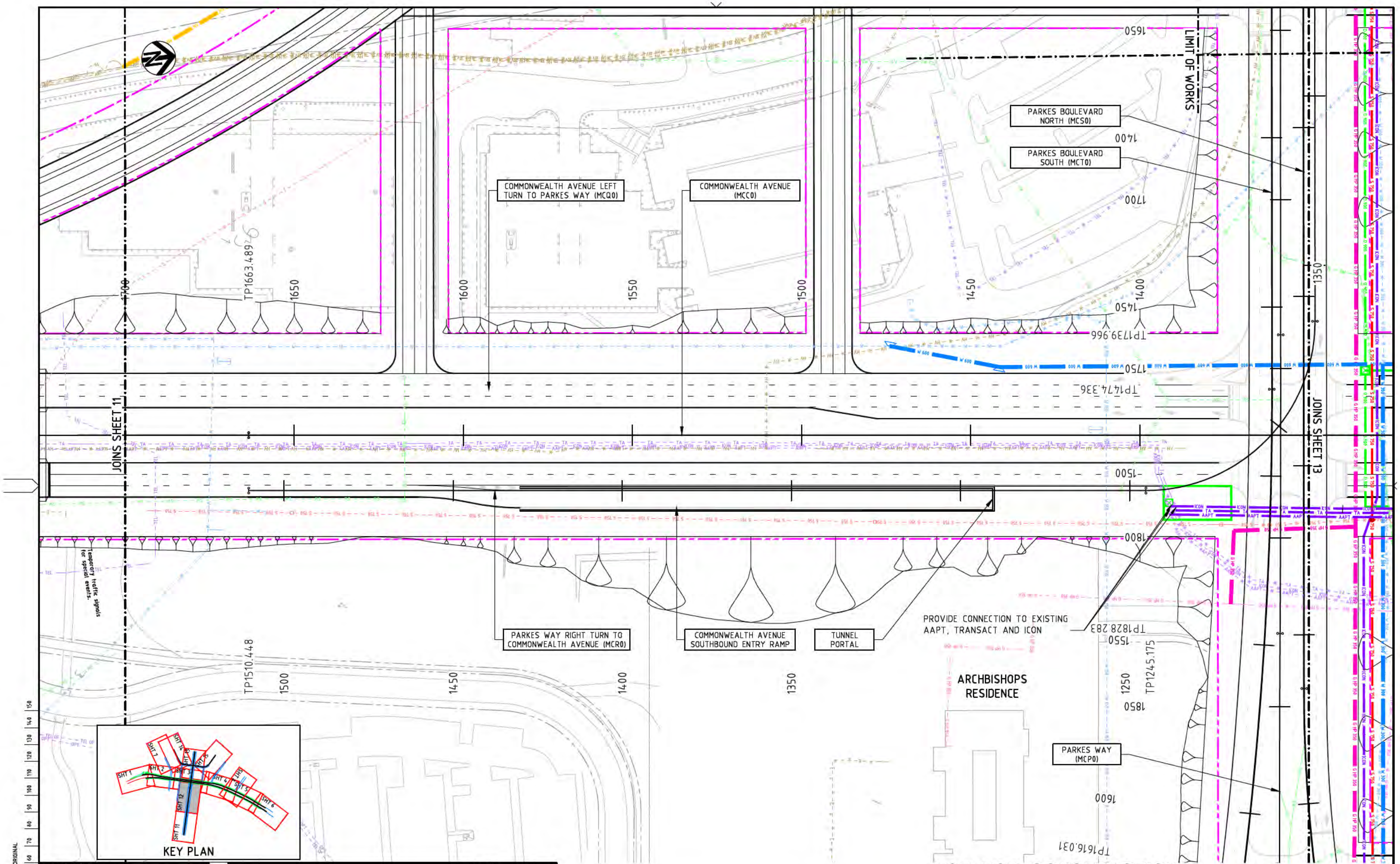

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PLOT DATE 12 Dec 2014
TIME 09:36:36

150 mm ON ORIGINAL
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EXTERNAL REFERENCE FILES
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X_PWFS_V2C_DRN

REV	SURV CAD NO	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01		25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02		11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC
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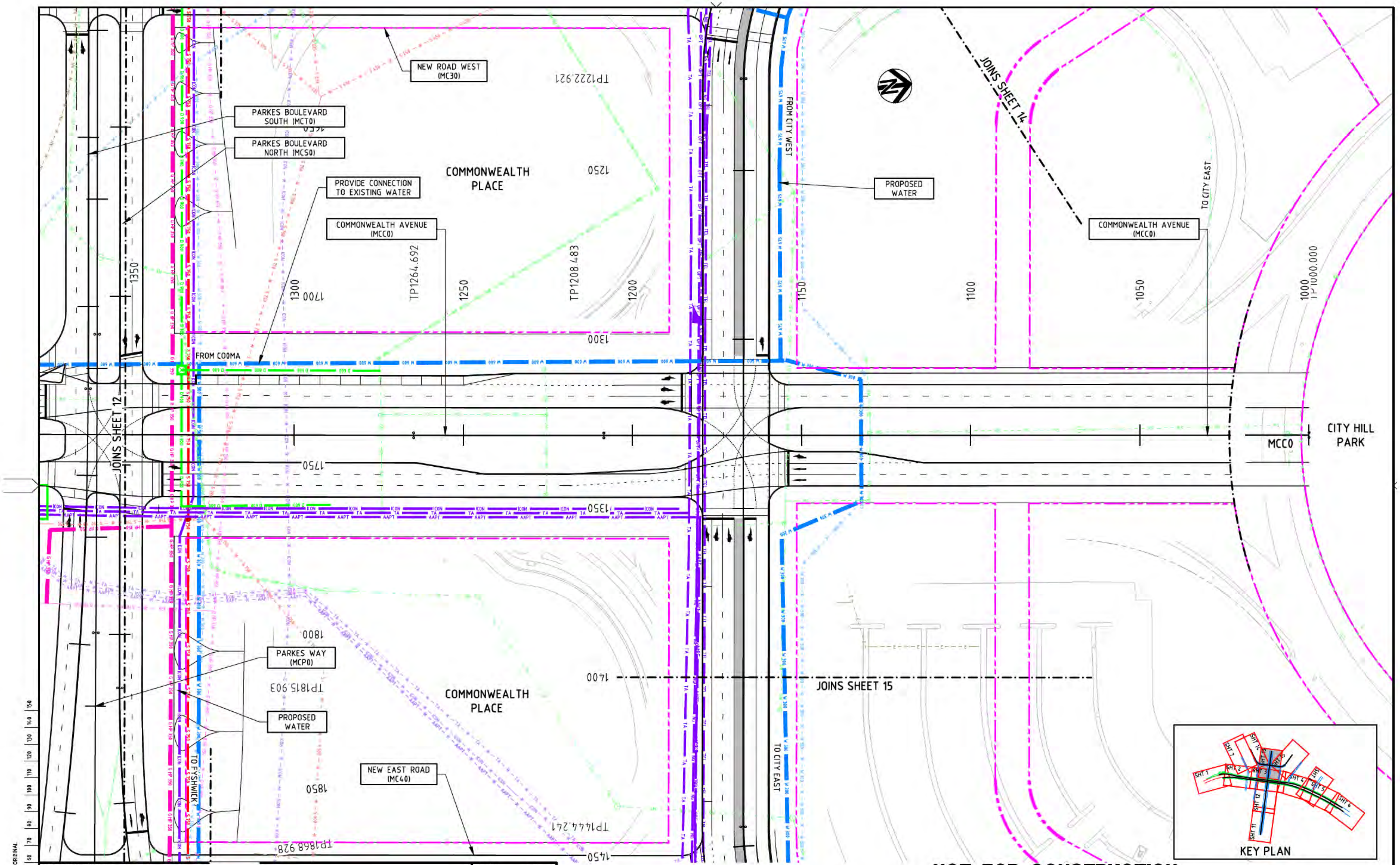
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C

TRUNK UTILITIES SERVICE PLAN
COMMONWEALTH AVENUE SURFACE LEVEL
SHEET 12

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2122	02



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PLOT DATE 12 Dec 2014
TIME 09:37:09

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REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

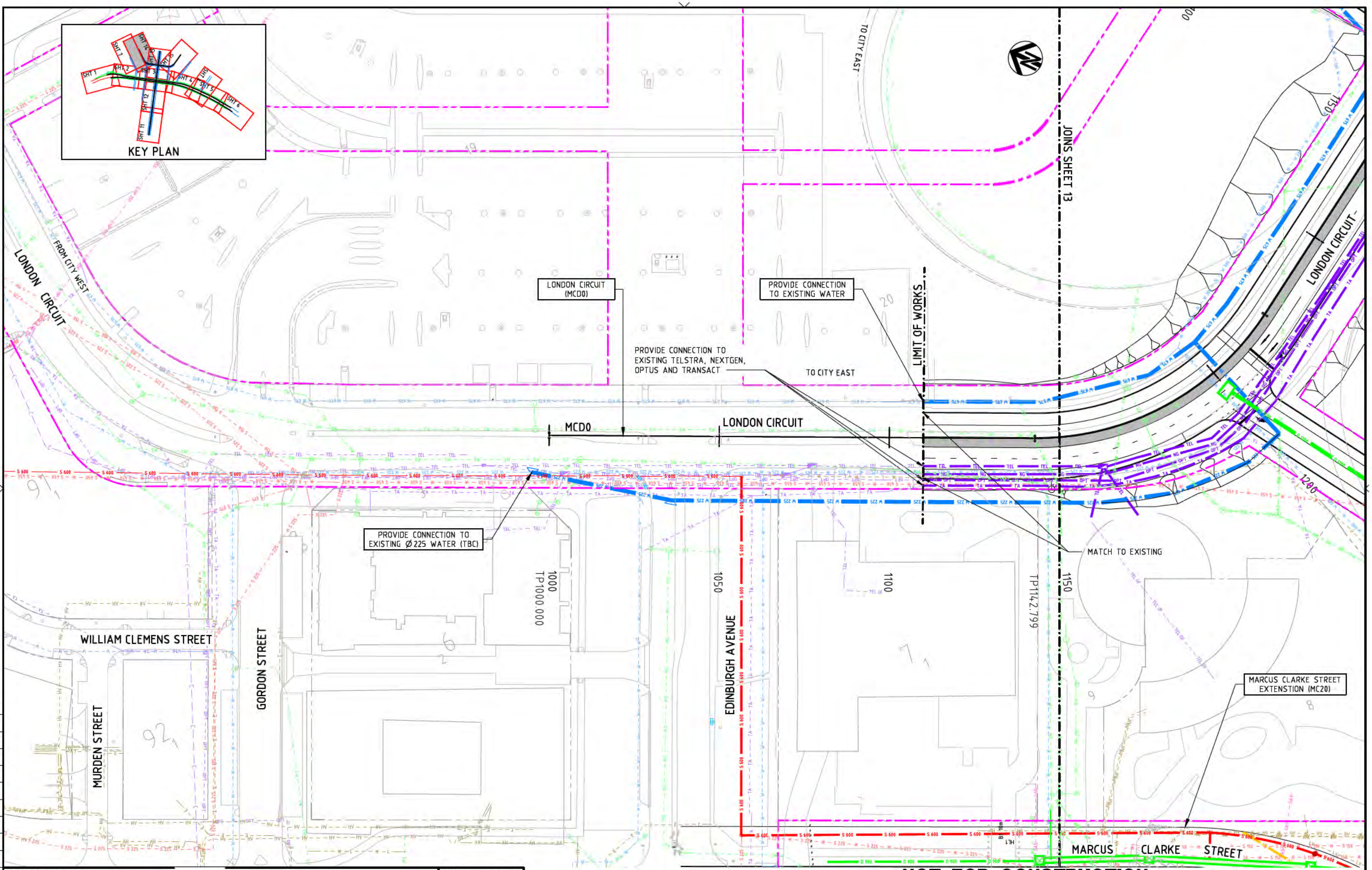
DESIGNER
SMEC
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C

TRUNK UTILITIES SERVICE PLAN
COMMONWEALTH AVENUE SURFACE LEVEL
SHEET 13

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2123	02



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PLOT DATE: 12 Dec 2014
TIME: 09:37:40

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REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
01	25.09.2014	FEASIBILITY STUDY ISSUE	WVR 201	DT
02	11.12.2014	FEASIBILITY STUDY RE-ISSUE	WVR 202	DT

TITLE	NAME
DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

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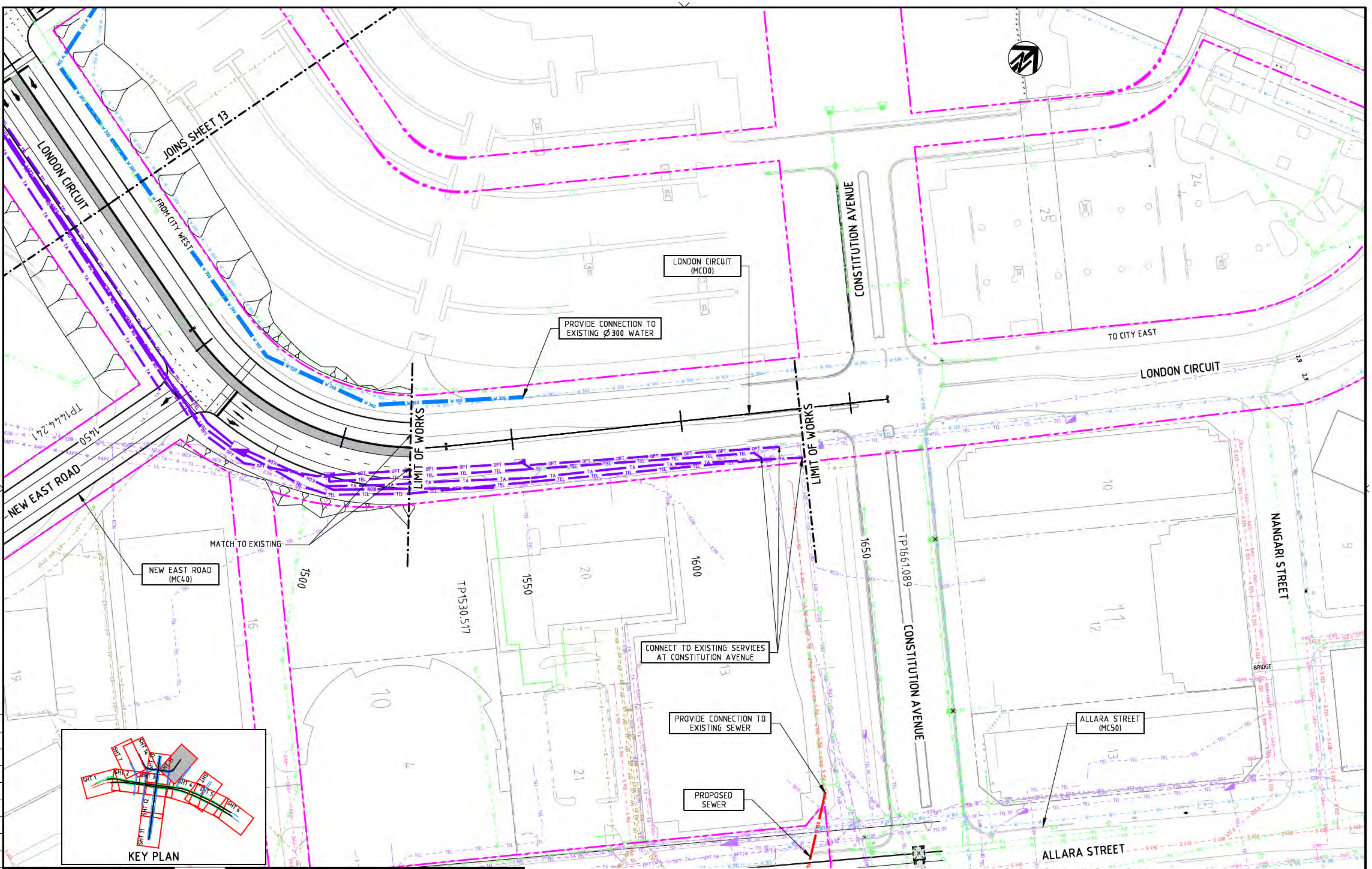
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
COMMONWEALTH AVENUE SURFACE LEVEL
SHEET 14

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2124	02



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PLOT DATE 12 Dec 2014
TIME 09:38:10

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DRAFTER	C. DAWSON
DRAFTING CHECK	K. SIDRAK
DESIGNER	M. DOWNES
DESIGN CHECK	A. BORELAND
PROJECT MANAGER	B. DERRICK
PROJECT DIRECTOR	S. TILDSLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:500 5 0 10 20

DESIGNER
SMEC AUSTRALIA PTY LTD
© ABN 47 065 475 149
SUITE 2, LEVEL 1, 243 NORTHBOURNE AVENUE
LYNEHAM ACT 2602 AUSTRALIA
PH (02) 6234 1900 FAX (02) 6234 1966
SMEC PROJECT No 3002385

CLIENT
ACT Government
Territory and Municipal Services

PROJECT TITLE
RE-ENGINEERING PARKES WAY
FEASIBILITY STUDY - VARIANT 2C
TRUNK UTILITIES SERVICE PLAN
COMMONWEALTH AVENUE SURFACE LEVEL
SHEET 15

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS SHOWN	FEASIBILITY	3002385-DUT-2125	02

Drawing Transmittal Advice

SMEC

Suite 2, Level 1
243 Northbourne Av
Lyneham, ACT 2602
Ph: 02 6234 1900
Fax: 02 6234 1966

Project **RE-ENGINERRING PARKES WAY FEASIBILITY STUDY AND FEASIBILITY STUDY VARIANT 2C**		Project Number **3002385**
Distribution ACT Procurement Solutions	**Method** By Hand	**Copies** 3
Reason for issue Review and Comment	**Document Type** Print	**Date** 12/12/2014
Phase Feasibility Study	**Size** a3	**Issued By** [redacted]

Please sign and return as confirmation of receipt
Signature.....

Comment: **WVR 003** - FEASIBILTY STUDY ISSUE
Comment: **WVR 202** - FEASIBILTY STUDY VARIANT 2C ISSUE

Document Title	Document No.	Revision
FEASIBILITY STUDY DESIGN		
GENERAL		
COVER SHEET FEASIBILITY STUDY DRAFT	3002385-DGE-0001	03
TYPICAL CROSS SECTIONS		
TYPICAL CROSS SECTIONS SHEET 1	3002385-DGE-0031	03
TYPICAL CROSS SECTIONS SHEET 2	3002385-DGE-0032	03
TYPICAL CROSS SECTIONS SHEET 3	3002385-DGE-0033	03
TYPICAL CROSS SECTIONS SHEET 4	3002385-DGE-0034	03
TYPICAL CROSS SECTIONS SHEET 5	3002385-DGE-0035	03
ROADS - GENERAL ARRANGEMENT PLANS		
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GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 3 OF 5	3002385-DRD-0113	03
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 4 OF 5	3002385-DRD-0114	03
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 5 OF 5	3002385-DRD-0115	03
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GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 5	3002385-DRD-0125	03
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GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 11	3002385-DRD-0131	03
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VARIANT 2C		
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VARIANT 2C - TYPICAL CROSS SECTIONS		
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TYPICAL CROSS SECTIONS SHEET 2	3002385-DGE-2032	02
TYPICAL CROSS SECTIONS SHEET 3	3002385-DGE-2033	02
TYPICAL CROSS SECTIONS SHEET 4	3002385-DGE-2034	02
TYPICAL CROSS SECTIONS SHEET 5	3002385-DGE-2035	02
TYPICAL CROSS SECTIONS SHEET 6	3002385-DGE-2036	02
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GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 1 OF 5	3002385-DRD-2111	02
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 2 OF 5	3002385-DRD-2112	02
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 3 OF 5	3002385-DRD-2113	02
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GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 1	3002385-DRD-2121	02
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 2	3002385-DRD-2122	02
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GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 5	3002385-DRD-2125	02
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VARIANT 2C - SERVICE RELOCATIONS		
TRUNK UTILITIES SERVICES PLAN LEGEND AND NOTES	3002385-DUT-2001	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 1	3002385-DUT-2111	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 2	3002385-DUT-2112	02
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TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 4	3002385-DUT-2114	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 5	3002385-DUT-2115	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 6	3002385-DUT-2116	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 7	3002385-DUT-2117	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 8	3002385-DUT-2118	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 11	3002385-DUT-2121	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 12	3002385-DUT-2122	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 13	3002385-DUT-2123	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 14	3002385-DUT-2124	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 15	3002385-DUT-2125	02
VARIANT 2C - CONSTRUCTION STAGING PLANS		
STAGING PLANS - VARIANT 2C STAGE 1C SHEET 1 OF 1	3002385-DCS-2116	02
STAGING PLANS - VARIANT 2C STAGE 4 SHEET 2 OF 5	3002385-DCS-2412	02
STAGING PLANS - VARIANT 2C STAGE 4B SHEET 1 OF 1	3002385-DCS-2416	01
STAGING PLANS - VARIANT 2C STAGE 5 SHEET 4 OF 4	3002385-DCS-2514	02
TOTAL NUMBER OF SHEETS =	**64**	

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Ph: 02 6234 1900
Fax: 02 6234 1966

Project
RE-ENGINERRING PARKES WAY
FEASIBILITY STUDY AND
FEASIBILITY STUDY VARIANT 2C

Project Number
3002385

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Feasibility Study	a3	[redacted]

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Document Title	Document No.	Revision
FEASIBILITY STUDY DESIGN		
GENERAL		
COVER SHEET FEASIBILITY STUDY DRAFT	3002385-DGE-0001	03
INDEX		
LOCALITY PLAN	3002385-DGE-0011	02
DRAWING INDEX SHEET 1	3002385-DGE-0021	02
	3002385-DGE-0022	02
TYPICAL CROSS SECTIONS		
TYPICAL CROSS SECTIONS SHEET 1	3002385-DGE-0031	03
TYPICAL CROSS SECTIONS SHEET 2	3002385-DGE-0032	03
TYPICAL CROSS SECTIONS SHEET 3	3002385-DGE-0033	03
TYPICAL CROSS SECTIONS SHEET 4	3002385-DGE-0034	03
TYPICAL CROSS SECTIONS SHEET 5	3002385-DGE-0035	03
ROADS - GENERAL ARRANGEMENT PLANS		
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 1 OF 5	3002385-DRD-0111	03
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 2 OF 5	3002385-DRD-0112	03
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 3 OF 5	3002385-DRD-0113	03
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 4 OF 5	3002385-DRD-0114	03
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 5 OF 5	3002385-DRD-0115	03
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 1	3002385-DRD-0121	03
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 2	3002385-DRD-0122	03
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 3	3002385-DRD-0123	03
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 4	3002385-DRD-0124	03
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 5	3002385-DRD-0125	03
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 6	3002385-DRD-0126	03
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 11	3002385-DRD-0131	03
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 12	3002385-DRD-0132	03
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 13	3002385-DRD-0133	03
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 14	3002385-DRD-0134	03
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 15	3002385-DRD-0135	03
LONGITUDINAL SECTIONS		
LONGITUDINAL SECTION COMMONWEALTH AVENUE (MCC0) SHEET 1 OF 2	3002385-DRD-0201	02
LONGITUDINAL SECTION COMMONWEALTH AVENUE (MCC0) SHEET 2 OF 2	3002385-DRD-0202	02
LONGITUDINAL SECTION LONDON CIRCUIT (MCD0) SHEET 1 OF 1	3002385-DRD-0211	02
LONGITUDINAL SECTION PARKES WAY (MCP0) SHEET 1 OF 3	3002385-DRD-0221	02
LONGITUDINAL SECTION PARKES WAY (MCP0) SHEET 2 OF 3	3002385-DRD-0222	02
LONGITUDINAL SECTION PARKES WAY (MCP0) SHEET 3 OF 3	3002385-DRD-0223	02
LONGITUDINAL SECTION - COMMONWEALTH AVENUE LEFT TURN TO PARKES WAY (MCQ0) SHEET 1 OF 1	3002385-DRD-0231	02
LONGITUDINAL SECTION - COMMONWEALTH AVENUE RIGHT TURN RAMP TO PARKES WAY (MCR0) SHEET 1 OF 1	3002385-DRD-0241	02
LONGITUDINAL SECTION PARKES BOULEVARD - NORTH (MCS0) SHEET 1 OF 3	3002385-DRD-0251	02
LONGITUDINAL SECTION PARKES BOULEVARD - NORTH (MCS0) SHEET 2 OF 3	3002385-DRD-0252	02
LONGITUDINAL SECTION PARKES BOULEVARD - NORTH (MCS0) SHEET 3 OF 3	3002385-DRD-0253	02
LONGITUDINAL SECTION PARKES BOULEVARD - SOUTH (MCT0) SHEET 1 OF 3	3002385-DRD-0261	02
LONGITUDINAL SECTION PARKES BOULEVARD - SOUTH (MCT0) SHEET 2 OF 3	3002385-DRD-0262	02
LONGITUDINAL SECTION PARKES BOULEVARD - SOUTH (MCT0) SHEET 3 OF 3	3002385-DRD-0263	02
LONGITUDINAL SECTION EAST-WEST ROAD (MCA0) SHEET 1 OF 1	3002385-DRD-0271	02
LONGITUDINAL SECTION EAST-WEST ROAD (MCB0) SHEET 1 OF 1	3002385-DRD-0275	02
LONGITUDINAL SECTION EAST-WEST ROAD (MCE0) SHEET 1 OF 1	3002385-DRD-0281	02
LONGITUDINAL SECTION MARCUS CLARKE STREET EXTENSION (MC20) SHEET 1 OF 1	3002385-DRD-0291	02
LONGITUDINAL SECTION NEW WEST ROAD (MC30) SHEET 1 OF 1	3002385-DRD-0295	02
LONGITUDINAL SECTION NEW EAST ROAD (MC40) SHEET 1 OF 1	3002385-DRD-0301	02
LONGITUDINAL SECTION ALLARA STREET (MC50) SHEET 1 OF 1	3002385-DRD-0305	02
LONGITUDINAL SECTION CORANDERRK STREET (MC60) SHEET 1 OF 1	3002385-DRD-0311	02
STORMWATER DRAINAGE		
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 1	3002385-DDD-0111	02
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 2	3002385-DDD-0112	02
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 3	3002385-DDD-0113	02

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Document Title	Document No.	Revision
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 4	3002385-DDD-0114	02
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 5	3002385-DDD-0115	02
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 6	3002385-DDD-0116	02
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 7	3002385-DDD-0117	02
TRUNK STORMWATER DRAINAGE PLAN PARKES BOULEVARD SHEET 8	3002385-DDD-0118	02
SERVICE RELOCATION - COMMUNICATIONS		
TRUNK UTILITIES SERVICES PLAN LEGEND AND NOTES	3002385-DUT-0001	02
COMMUNICATIONS SERVICE PLAN PARKES BOULEVARD SHEET 1	3002385-DUC-0111	02
COMMUNICATIONS SERVICE PLAN PARKES BOULEVARD SHEET 2	3002385-DUC-0112	02
COMMUNICATIONS SERVICE PLAN PARKES BOULEVARD SHEET 3	3002385-DUC-0113	02
COMMUNICATIONS SERVICE PLAN PARKES BOULEVARD SHEET 4	3002385-DUC-0114	02
COMMUNICATIONS SERVICE PLAN PARKES BOULEVARD SHEET 5	3002385-DUC-0115	02
COMMUNICATIONS SERVICE PLAN PARKES BOULEVARD SHEET 6	3002385-DUC-0116	02
COMMUNICATIONS SERVICE PLAN COMMONWEALTH AVENUE SHEET 11	3002385-DUC-0121	02
COMMUNICATIONS SERVICE PLAN COMMONWEALTH AVENUE SHEET 12	3002385-DUC-0122	02
COMMUNICATIONS SERVICE PLAN COMMONWEALTH AVENUE SHEET 13	3002385-DUC-0123	02
COMMUNICATIONS SERVICE PLAN COMMONWEALTH AVENUE SHEET 14	3002385-DUC-0124	02
COMMUNICATIONS SERVICE PLAN COMMONWEALTH AVENUE SHEET 15	3002385-DUC-0125	02
SERVICE RELOCATION - ELECTRICITY AND GAS		
ELECTRICITY AND GAS SERVICE PLAN PARKES BOULEVARD SHEET 1	3002385-DUE-0111	02
ELECTRICITY AND GAS SERVICE PLAN PARKES BOULEVARD SHEET 2	3002385-DUE-0112	02
ELECTRICITY AND GAS SERVICE PLAN PARKES BOULEVARD SHEET 3	3002385-DUE-0113	02
ELECTRICITY AND GAS SERVICE PLAN PARKES BOULEVARD SHEET 4	3002385-DUE-0114	02
ELECTRICITY AND GAS SERVICE PLAN PARKES BOULEVARD SHEET 5	3002385-DUE-0115	02
ELECTRICITY AND GAS SERVICE PLAN PARKES BOULEVARD SHEET 6	3002385-DUE-0116	02
ELECTRICITY AND GAS SERVICE PLAN COMMONWEALTH AVENUE SHEET 11	3002385-DUE-0121	02
ELECTRICITY AND GAS SERVICE PLAN COMMONWEALTH AVENUE SHEET 12	3002385-DUE-0122	02
ELECTRICITY AND GAS SERVICE PLAN COMMONWEALTH AVENUE SHEET 13	3002385-DUE-0123	02
ELECTRICITY AND GAS SERVICE PLAN COMMONWEALTH AVENUE SHEET 14	3002385-DUE-0124	02
ELECTRICITY AND GAS SERVICE PLAN COMMONWEALTH AVENUE SHEET 15	3002385-DUE-0125	02
SERVICE RELOCATION - WATER AND SEWER		
WATER AND SEWER SERVICE PLAN PARKES BOULEVARD SHEET 1	3002385-DWS-0111	02
WATER AND SEWER SERVICE PLAN PARKES BOULEVARD SHEET 2	3002385-DWS-0112	02
WATER AND SEWER SERVICE PLAN PARKES BOULEVARD SHEET 3	3002385-DWS-0113	02
WATER AND SEWER SERVICE PLAN PARKES BOULEVARD SHEET 4	3002385-DWS-0114	02
WATER AND SEWER SERVICE PLAN PARKES BOULEVARD SHEET 5	3002385-DWS-0115	02
WATER AND SEWER SERVICE PLAN PARKES BOULEVARD SHEET 6	3002385-DWS-0116	02
WATER AND SEWER SERVICE PLAN COMMONWEALTH AVENUE SHEET 11	3002385-DWS-0121	02
WATER AND SEWER SERVICE PLAN COMMONWEALTH AVENUE SHEET 12	3002385-DWS-0122	02
WATER AND SEWER SERVICE PLAN COMMONWEALTH AVENUE SHEET 13	3002385-DWS-0123	02
WATER AND SEWER SERVICE PLAN COMMONWEALTH AVENUE SHEET 14	3002385-DWS-0124	02
WATER AND SEWER SERVICE PLAN COMMONWEALTH AVENUE SHEET 15	3002385-DWS-0125	02
SEWER MAIN LONGITUDINAL SECTION SEWER LINE - SE A1 SHEET 1	3002385-DWS-0131	02
SEWER MAIN LONGITUDINAL SECTION SEWER LINE - SE E1 SHEET 1	3002385-DWS-0132	02
CONSTRUCTION STAGING PLANS		
STAGING PLANS STAGE 1A SHEET 1 OF 4	3002385-DCS-0111	02
STAGING PLANS STAGE 1A SHEET 2 OF 4	3002385-DCS-0112	02
STAGING PLANS STAGE 1A SHEET 3 OF 4	3002385-DCS-0113	02
STAGING PLANS STAGE 1A SHEET 4 OF 4	3002385-DCS-0114	02
STAGING PLANS STAGE 1B SHEET 1 OF 1	3002385-DCS-0115	02
STAGING PLANS STAGE 1C SHEET 1 OF 1	3002385-DCS-0116	02
STAGING PLANS STAGE 2 SHEET 1 OF 4	3002385-DCS-0211	02
STAGING PLANS STAGE 2 SHEET 2 OF 4	3002385-DCS-0212	02
STAGING PLANS STAGE 2 SHEET 3 OF 4	3002385-DCS-0213	02
STAGING PLANS STAGE 2 SHEET 4 OF 4	3002385-DCS-0214	02
STAGING PLANS STAGE 3 SHEET 1 OF 4	3002385-DCS-0311	02
STAGING PLANS STAGE 3 SHEET 2 OF 4	3002385-DCS-0312	02
STAGING PLANS STAGE 3 SHEET 3 OF 4	3002385-DCS-0313	02
STAGING PLANS STAGE 3 SHEET 4 OF 4	3002385-DCS-0314	02
STAGING PLANS STAGE 4 SHEET 1 OF 5	3002385-DCS-0411	02
STAGING PLANS STAGE 4 SHEET 2 OF 5	3002385-DCS-0412	02
STAGING PLANS STAGE 4 SHEET 3 OF 5	3002385-DCS-0413	02
STAGING PLANS STAGE 4 SHEET 4 OF 5	3002385-DCS-0414	02
STAGING PLANS STAGE 4 SHEET 5 OF 5	3002385-DCS-0415	02

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Lyneham, ACT 2602
Ph: 02 6234 1900
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Document Title	Document No.	Revision
STAGING PLANS STAGE 5 SHEET 1 OF 4	3002385-DCS-0511	02
STAGING PLANS STAGE 5 SHEET 2 OF 4	3002385-DCS-0512	02
STAGING PLANS STAGE 5 SHEET 3 OF 4	3002385-DCS-0513	02
STAGING PLANS STAGE 5 SHEET 4 OF 4	3002385-DCS-0514	02
STAGING PLANS STAGE 6 SHEET 1 OF 4	3002385-DCS-0611	02
STAGING PLANS STAGE 6 SHEET 2 OF 4	3002385-DCS-0612	02
STAGING PLANS STAGE 6 SHEET 3 OF 4	3002385-DCS-0613	02
STAGING PLANS STAGE 6 SHEET 4 OF 4	3002385-DCS-0614	02
VARIANT 2C		
VARIANT 2C - GENERAL		
COVER SHEET FEASIBILITY STUDY - VARIANT 2 DRAFT	3002385-DGE-2001	02
VARIANT 2C - INDEX		
LOCALITY PLAN	3002385-DGE-2011	02
DRAWING INDEX SHEET 1	3002385-DGE-2021	02
VARIANT 2C - TYPICAL CROSS SECTIONS		
TYPICAL CROSS SECTIONS SHEET 1	3002385-DGE-2031	02
TYPICAL CROSS SECTIONS SHEET 2	3002385-DGE-2032	02
TYPICAL CROSS SECTIONS SHEET 3	3002385-DGE-2033	02
TYPICAL CROSS SECTIONS SHEET 4	3002385-DGE-2034	02
TYPICAL CROSS SECTIONS SHEET 5	3002385-DGE-2035	02
TYPICAL CROSS SECTIONS SHEET 6	3002385-DGE-2036	02
VARIANT 2C - ROADS - GENERAL ARRANGEMENT PLANS		
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 1 OF 5	3002385-DRD-2111	02
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 2 OF 5	3002385-DRD-2112	02
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 3 OF 5	3002385-DRD-2113	02
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 4 OF 5	3002385-DRD-2114	02
GENERAL ARRANGEMENT PARKES WAY MAINLINE SHEET 5 OF 5	3002385-DRD-2115	02
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 1	3002385-DRD-2121	02
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 2	3002385-DRD-2122	02
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 3	3002385-DRD-2123	02
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 4	3002385-DRD-2124	02
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 5	3002385-DRD-2125	02
GENERAL ARRANGEMENT PARKES BOULEVARD SHEET 6	3002385-DRD-2126	02
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 11	3002385-DRD-2131	02
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 12	3002385-DRD-2132	02
GENERAL ARRANGEMENT COMMONWEALTH AVENUE SHEET 13	3002385-DRD-2133	02
GENERAL ARRANGEMENT LONDON CIRCUIT SHEET 14	3002385-DRD-2134	02
LONDON CIRCUIT COMMONWEALTH AVENUE SURFACE LEVEL SHEET 15	3002385-DRD-2135	02
VARIANT 2C - LONGITUDINAL SECTIONS		
LONGITUDINAL SECTION - VARIANT 2C COMMONWEALTH AVENUE (MCC0) SHEET 1 OF 2	3002385-DRD-2201	01
LONGITUDINAL SECTION - VARIANT 2C COMMONWEALTH AVENUE (MCC0) SHEET 2 OF 2	3002385-DRD-2202	01
LONGITUDINAL SECTION - VARIANT 2C LONDON CIRCUIT (MCD0) SHEET 1 OF 1	3002385-DRD-2211	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY (MCP0) SHEET 1 OF 3	3002385-DRD-2221	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY (MCP0) SHEET 2 OF 3	3002385-DRD-2222	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY (MCP0) SHEET 3 OF 3	3002385-DRD-2223	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY RIGHT TURN RAMP TO COMMONWEALTH AVENUE (MCR0) SHEET 1 OF 1	3002385-DRD-2241	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY SERVICE ROAD EASTBOUND (MCS0) SHEET 1 OF 2	3002385-DRD-2251	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY SERVICE ROAD EASTBOUND (MCS0) SHEET 2 OF 2	3002385-DRD-2252	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY SERVICE ROAD WESTBOUND (MCT0) SHEET 1 OF 2	3002385-DRD-2261	01
LONGITUDINAL SECTION - VARIANT 2C PARKES WAY SERVICE ROAD WESTBOUND (MCT0) SHEET 2 OF 2	3002385-DRD-2262	01
LONGITUDINAL SECTION - VARIANT 2C ENTRY TO EDINBURGH AVENUE (MCV0) SHEET 1 OF 1	3002385-DRD-2271	01
VARIANT 2C - SERVICE RELOCATIONS		
TRUNK UTILITIES SERVICES PLAN LEGEND AND NOTES	3002385-DUT-2001	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 1	3002385-DUT-2111	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 2	3002385-DUT-2112	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 3	3002385-DUT-2113	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 4	3002385-DUT-2114	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 5	3002385-DUT-2115	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 6	3002385-DUT-2116	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 7	3002385-DUT-2117	02
TRUNK UTILITIES SERVICE PLAN PARKES WAY SURFACE BOULEVARD SHEET 8	3002385-DUT-2118	02

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Suite 2, Level 1
243 Northbourne Av
Lyneham, ACT 2602
Ph: 02 6234 1900
Fax: 02 6234 1966

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TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 11	3002385-DUT-2121	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 12	3002385-DUT-2122	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 13	3002385-DUT-2123	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 14	3002385-DUT-2124	02
TRUNK UTILITIES SERVICE PLAN COMMONWEALTH AVENUE SURFACE LEVEL SHEET 15	3002385-DUT-2125	02
CONSTRUCTION STAGING PLANS		
STAGING PLANS - VARIANT 2C STAGE 1A SHEET 1 OF 4	3002385-DCS-2111	01
STAGING PLANS - VARIANT 2C STAGE 1A SHEET 2 OF 4	3002385-DCS-2112	01
STAGING PLANS - VARIANT 2C STAGE 1A SHEET 3 OF 4	3002385-DCS-2113	01
STAGING PLANS - VARIANT 2C STAGE 1A SHEET 4 OF 4	3002385-DCS-2114	01
STAGING PLANS - VARIANT 2C STAGE 1B SHEET 1 OF 1	3002385-DCS-2115	01
STAGING PLANS - VARIANT 2C STAGE 1C SHEET 1 OF 1	3002385-DCS-2116	02
STAGING PLANS - VARIANT 2C STAGE 2 SHEET 1 OF 4	3002385-DCS-2211	01
STAGING PLANS - VARIANT 2C STAGE 2 SHEET 2 OF 4	3002385-DCS-2212	01
STAGING PLANS - VARIANT 2C STAGE 2 SHEET 3 OF 4	3002385-DCS-2213	01
STAGING PLANS - VARIANT 2C STAGE 2 SHEET 4 OF 4	3002385-DCS-2214	01
STAGING PLANS - VARIANT 2C STAGE 3 SHEET 1 OF 4	3002385-DCS-2311	01
STAGING PLANS - VARIANT 2C STAGE 3 SHEET 2 OF 4	3002385-DCS-2312	01
STAGING PLANS - VARIANT 2C STAGE 3 SHEET 3 OF 4	3002385-DCS-2313	01
STAGING PLANS - VARIANT 2C STAGE 3 SHEET 4 OF 4	3002385-DCS-2314	01
STAGING PLANS - VARIANT 2C STAGE 4 SHEET 1 OF 5	3002385-DCS-2411	01
STAGING PLANS - VARIANT 2C STAGE 4 SHEET 2 OF 5	3002385-DCS-2412	02
STAGING PLANS - VARIANT 2C STAGE 4 SHEET 3 OF 5	3002385-DCS-2413	01
STAGING PLANS - VARIANT 2C STAGE 4 SHEET 4 OF 5	3002385-DCS-2414	01
STAGING PLANS - VARIANT 2C STAGE 4 SHEET 5 OF 5	3002385-DCS-2415	01
STAGING PLANS - VARIANT 2C STAGE 4B SHEET 1 OF 1	3002385-DCS-2416	01
STAGING PLANS - VARIANT 2C STAGE 5 SHEET 1 OF 4	3002385-DCS-2511	01
STAGING PLANS - VARIANT 2C STAGE 5 SHEET 2 OF 4	3002385-DCS-2512	01
STAGING PLANS - VARIANT 2C STAGE 5 SHEET 3 OF 4	3002385-DCS-2513	01
STAGING PLANS - VARIANT 2C STAGE 5 SHEET 4 OF 4	3002385-DCS-2514	02
TOTAL NUMBER OF SHEETS =	**193**	

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Re-engineering Parkes Way and Civic's Southern Road Network

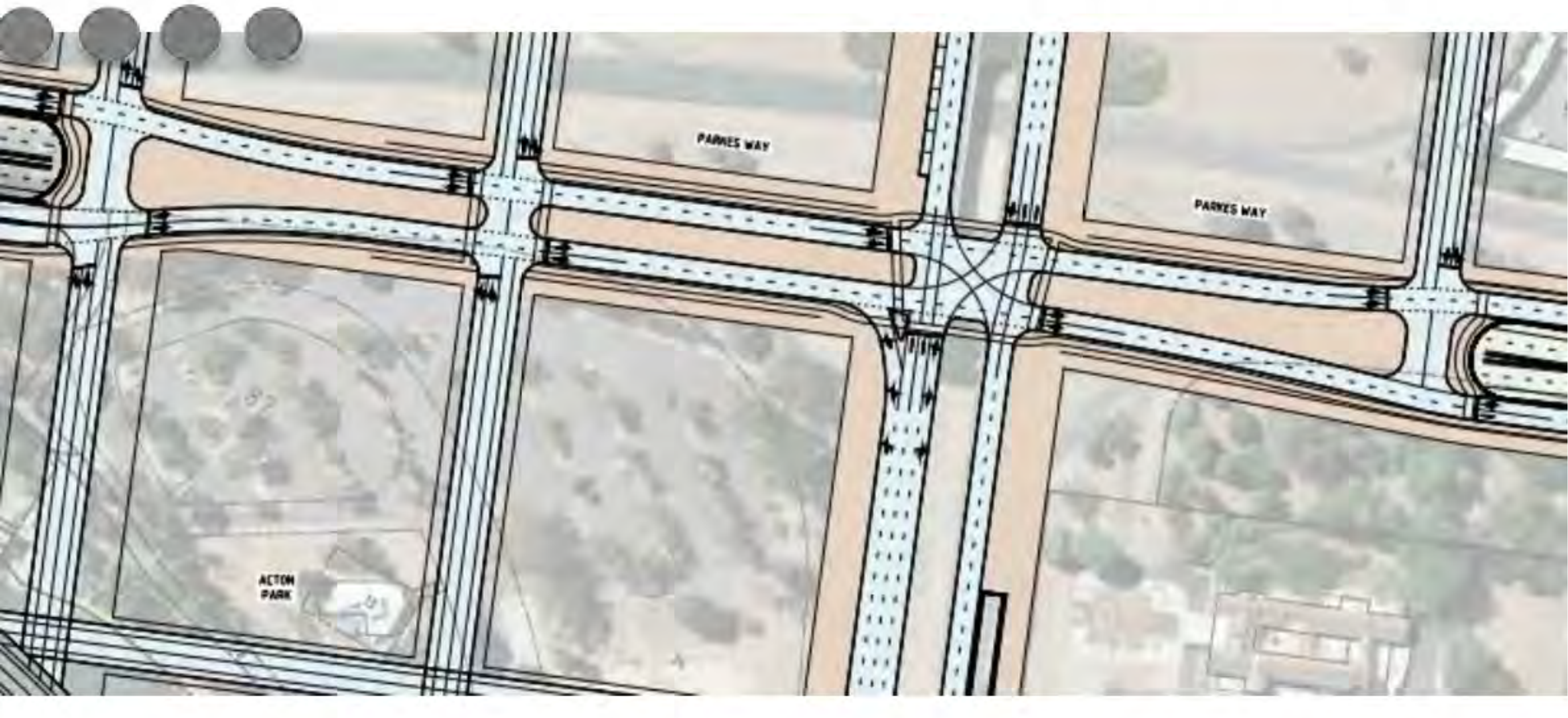
Volume 1 – Feasibility Design

Project Number: 3002385

Contract Number: 2014.23470.110

Prepared for the ACT Economic Development Directorate

10 December 2014



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CONTACT DETAILS

SMEC Australia Pty Ltd | www.smec.com

Suite 2, Level 1, 243 Northbourne Avenue,
Lyneham, ACT, 2602

Tel: 02 6234 1900
Fax: 02 6234 1966

Representative:
Name: Sch 2.2(a)(ii)
P:
E:

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1. INTRODUCTION

In 2013 the ACT Government procured an Urban Design Study for the Linking City Centre to the Lake strategy. This study developed a master plan that consisted of numerous design elements including the requirement to undertake significant civil infrastructure works to re-form the street and arterial road grid from City Hill to the West Basin foreshore.

As a major design and cost element of the urban strategy, the Economic Development Directorate (EDD) identified the need to investigate and identify key project risks concerning the major civil infrastructure works associated with the lowering of Parkes Way and adjustment to other major roads within Civic.

This study aims to develop a strategy to mitigate these risks by developing a feasibility design, undertaking constructability and cost assessment, considering the procurement options in the context of the current construction market, and investigating the implications of the project on the local transport network.

This report forms Volume 1 of 6 of the Feasibility Study for the Re-engineering Parkes Way and Civic’s Southern Road Network (the Project):

- **Volume 1 – Feasibility Design**
- Volume 2 – Constructability Assessment
- Volume 3 – Transport Assessment
- Volume 4 – Procurement Strategies
- Volume 5 – Project Risk
- Volume 6 – Project Cost Estimate

The Feasibility Design forms the basis of analysis for all elements of this Feasibility Study. The conceptual design informs the constructability assessment and cost estimates (and related procurement analysis); analysis of the transport implications of the project; and the project risk assessment. The primary deliverable of this Volume is the Feasibility Design developed in response to the Urban Design Study (UDS), however a second option (Variant 2c) was developed as part of the feasibility process to in response to concerns about project scale and construction cost.

The design has been based in the first instance on the road network presented in the Urban Design Study. The goal of the design development process was to maintain the intent of the Urban Design Study, whilst ensuring that an appropriate engineering design was developed with due consideration to site constraints, engineering standards and guidelines, road network operation, and constructability and cost concerns. The design focuses on the arterial road network associated with the City to the Lake project inclusive of Parkes Way (both mainline and boulevard), Commonwealth Avenue, London Circuit and Coranderrk Street. Whilst it does not investigate in detail the internal road network of West Basin, it does broadly consider the geometry of these local streets insofar as they relate to the alignment, and intersect with, the arterial roads that form part of this study. An overview of the site extents is indicated in Figure 1.

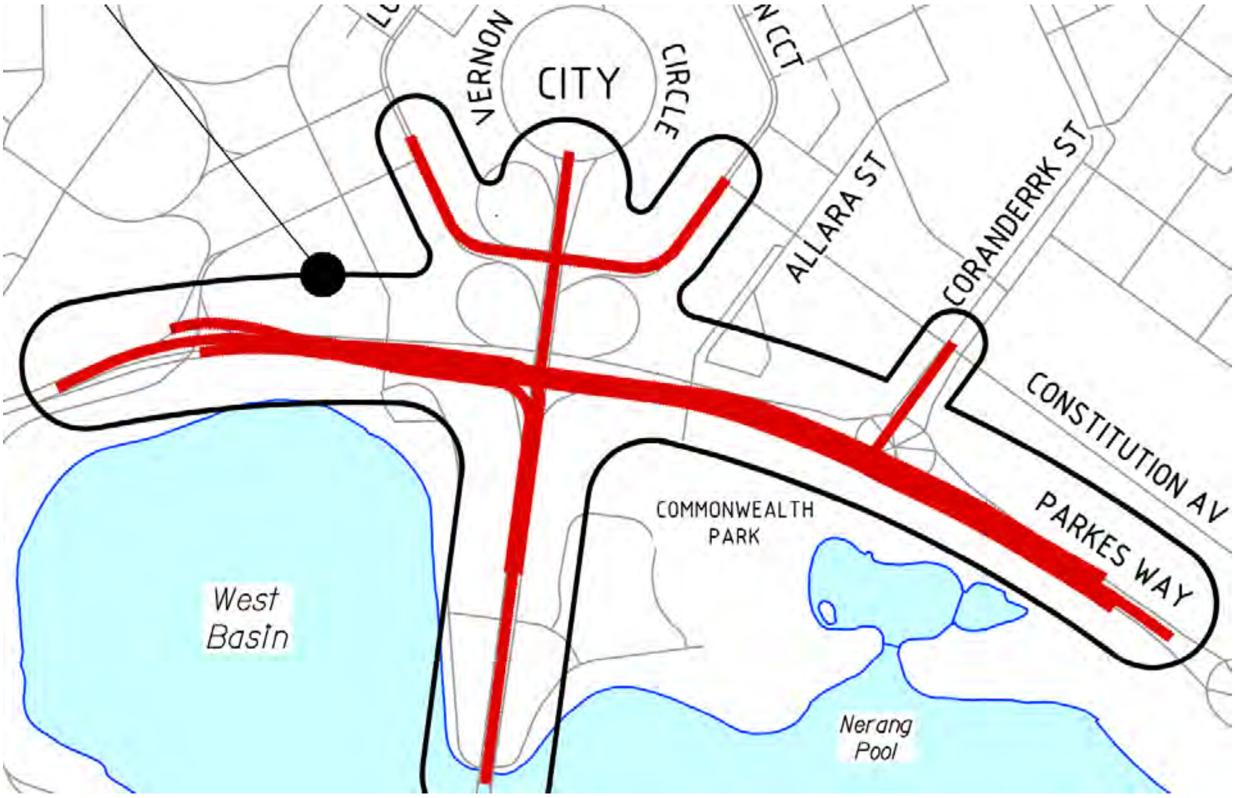


Figure 1 - Project Site

In meeting these objectives the Feasibility Design developed engineering concepts for civil, structural, tunnelling, geotechnical, stormwater / WSUD and utility elements of the project. In addition, the report provides commentary on the compliance of the design, as proposed, with the intent and principles imbedded in the Urban Design Strategy.

This report seeks to provide context to the above design elements and background into the key engineering design decisions that have been made. A key element of the report are the Feasibility Design sketches contained in Appendix A which depict the intent of the Feasibility Design.

The conceptual design presented in this report has been developed with the objective of testing the feasibility of the project in terms of operation, cost and constructability. It should be noted that it is not the product of an exhaustive optioneering process that has arrived at a preferred design solution, but rather presents a concept that is considered to meet the objectives of the project and the City to the Lake Strategy. Accordingly, the design analysis that has been undertaken as part of the study is relatively high level. As such, it is anticipated that should the project be advanced to future phases of development, optioneering, design refinement and further studies will be necessary. In recognition of this, the report also identifies a suite of future activities that are likely to be required before the project is construction ready.

2. ROAD DESIGN

2.1 Design Criteria

In order to develop a design for the arterial road network, a set of design criteria has been assumed. The table below provides a summary of some of the key design criteria proposed for the road alignment design, including all max and min requirements. These criteria are based primarily on the requirements of the Road Design Guide (TRDG) published by Austroads (2013).

Road Design Criteria	
Design Speed and Vehicle	
Parkes Way	▪ 80km/h (Posted speed) ▪ 90km/h (Design Speed)
Commonwealth Ave and Local Roads	▪ 50km/h (Posted speed) ▪ 60km/h (Design Speed)
Boulevard and Ramps	▪ 50km/h (Posted speed) ▪ 60km/h (Design Speed)
London Circuit	▪ 50km/h (Posted speed) ▪ 60km/h (Design Speed)
Design vehicle	▪ B-Double for Parkes Way ▪ 19m semi-trailer & Tag Steer Bus for other arterial roads*
Horizontal Geometry	
Desirable min horiz. radius Parkes Way	360m
Desirable min horiz. radius Commonwealth Ave and Local Roads	180m
Desirable min horizontal radius Service Roads	100m
Desirable min horizontal radius Ramps	60m - min 50m (note – where these radii have been adopted, lane / shoulder widening has been provided to ensure allowance for design vehicles and sight distance)
Vertical Geometry	
Desirable max grade	6%
Desirable min grade	1.0%
Absolute min grade	0.5%

Crest VC K value - Desirable Minimum (90 kph based on 1.5 sec reaction time braking coefficient – 0.36)	K = 35.5
Crest VC K value - Absolute Minimum (90 kph based on 1.5 sec reaction time braking coefficient – 0.46-)	K = 25.5 (Variant 2c)
Stopping sight distance – Desirable Min (based on 2sec reaction time)	140m
Stopping sight distance – Desirable Min (based on 2sec reaction time)	120m
Cross Section	
Dual Carriageway pavement	7.0m (2 x 3.5m lanes)
Normal cross fall	3%
Maximum cross fall	5%
Desirable Outer Shoulders/ On Road Cycle lane	2.5m
Minimum Outer Shoulders/ On Road Cycle lane	2.0m
Inner Shoulder	1.0m
Verge (fill)	1.5m
Kerb types	Barrier and Mountable
Fill slope	4H to 1V
Cut slope	2H to 1V
Road Corridor Parkes Way	▪ West of Allara St: 45m ▪ East of Allara St: 55m
Road Corridor Commonwealth Avenue	60m

It is noted that Commonwealth Avenue is currently designated a B Double Route. It is considered that this designation will be removed as part of the City to the Lake project.

2.2 Road Network Alterations to Urban Design Strategy

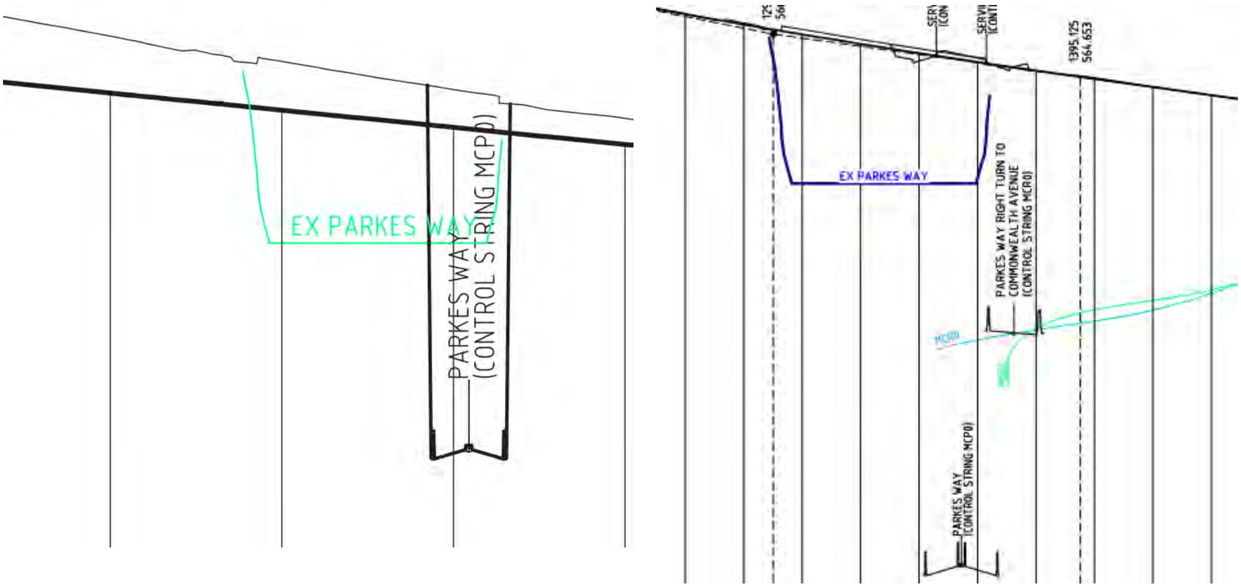
The intent of the design process was to maintain the design of the road network proposed in the Urban Design Strategy (UDS) to the extent possible given engineering, construction, site and cost constraints. However, through the development of the Feasibility Design adjustments and refinements to the design were identified that provided cost and / or performance efficiencies, improved construction impacts, and provided a stronger compliance with design standards. A summary of key design adjustments to the UDS are summarised below.

2.2.1 Vertical Profile of Commonwealth Avenue

The UDS requires a lowering of Commonwealth Avenue between Vernon Circle and Commonwealth Bridge. The purpose of this lowering was to facilitate accessible grades on both the new at-grade connection to London Circuit and the Parkes Way Boulevard.

A concept was developed during the development of the Feasibility Design that allowed Commonwealth Avenue to be retained on its existing vertical alignment. This allowed for the retention of large parts of the road pavement and underground utilities, in addition to reducing earthworks requirements. It also provided a vertical grade between Vernon Circle and London Circuit that is compliant with accessibility requirements.

Retaining Commonwealth Avenue on its existing grade also significantly reduced the construction complexity associated with the need to undertake significant road works on live arterial carriageways. A comparison of these two alternatives at Parkes Way is provided in Figure 2.



Feasibility Design

Urban Design Strategy

Figure 2 – Commonwealth Avenue Profile – UDS vs Feasibility Design

2.2.2 Re-grading of London Circuit

With the retention of Commonwealth Avenue on its existing vertical alignment, the at-grade intersection with London Circuit was subsequently raised. This resulted in a steepening of London Circuit to a maximum of 4.5% and an increase in the extent of works on London Circuit from what was previously proposed in the UDS. This is steeper than what is typically considered desirable for accessibility purposes.

2.2.3 *Re-grading of Boulevard and North-South Streets*

The grading of the Marcus Clark St extension and New West Road proposed in the UDS created a sag in both road corridors to the north of Parkes Way. This was considered undesirable as it created a trapped low point that impeded the conveyance of overland flow and also compromised view corridors on the streets. As such, the design process developed a solution that provided for continuous grades on both these roads and allows for the passage of overland flow and clear view corridors to the lake.

The creation of this revised ground plane required the re-grading of both the Parkes Way mainline and boulevard, in addition to Marcus Clark Street and the New West Road.

2.2.4 *Introduction of Parkes Way to Commonwealth Avenue Free-flow Ramps*

One of the largest traffic movements through the project site is the AM route from eastbound Parkes Way to southbound Commonwealth Avenue (and the reverse movement in the PM). This movement is currently catered for by free flow loop ramps.

The UDS proposed to facilitate this movement by the introduction of signalised right turn only part-seagull intersection from the lowered Parkes Way onto Commonwealth Avenue. Whilst a signalised subsurface intersection was not considered an ideal outcome, at the time this was believed to be the most viable solution for the movement as it was understood that an existing trunk sewer main immediately below the lowered Parkes Way was a constraint to the design.

However, through the development of the feasibility design it was recognised that the trunk sewer main could be diverted and this constraint removed. Concurrently, Roads ACT raised concerns over the function of the intersection arrangement proposed in the UDS. As a consequence the feasibility design proposes two single lane free flow ramps to cater for these movements. Whilst this revised design increases the overall project cost from that proposed in the UDS, it provides significant operational and safety improvements. The layout of these ramps is depicted in Figure 3.

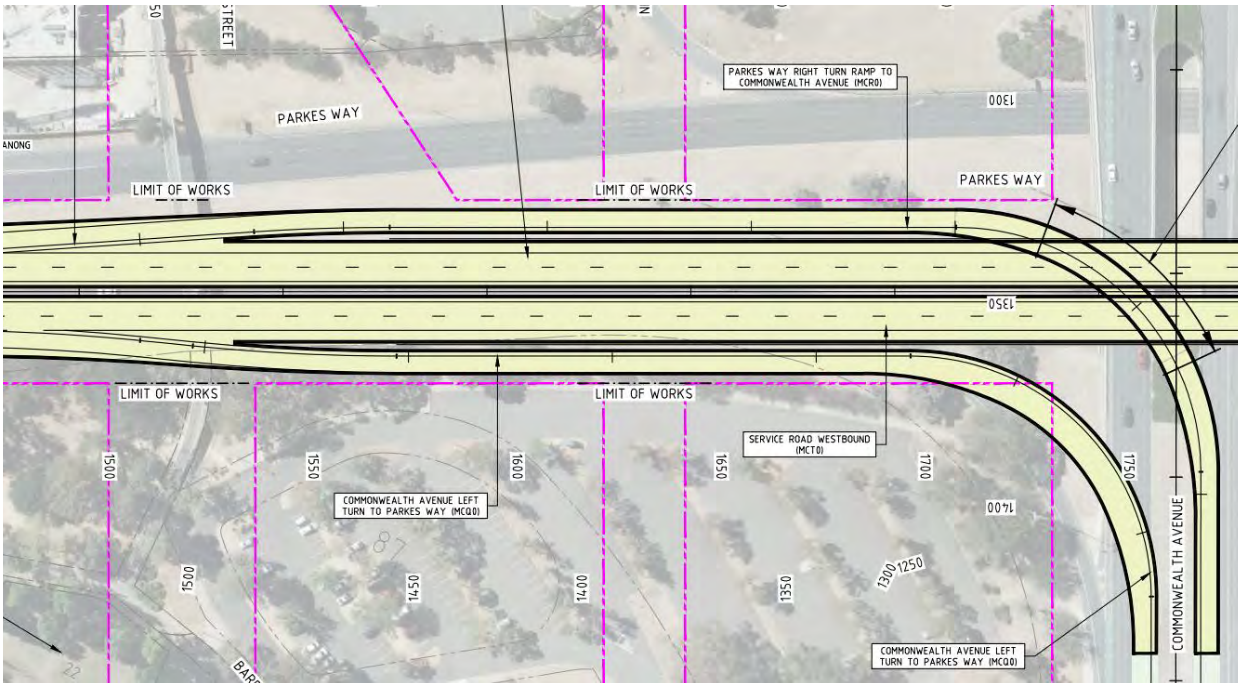


Figure 3 – Commonwealth Avenue to Parkes Way Ramps

2.2.5 Creation of a Boulevard Clearway

The UDS proposed single lane carriageways with parallel parking for both directions of the Boulevard. The provision of on street parking was considered a key element for the project to ensure activation of frontages. However, the traffic modelling undertaken as part of the feasibility study (discussed in more detail in Volume 3 of the study) provided a strong indication that the local road network is likely to become heavily congested in the peak periods and open to potential failure should the single lane boulevard arrangement proposed in the UDS be provided. The modelling indicated that the provision of two lanes on the boulevard was likely to significantly reduce local traffic congestion. Given these two competing issues (traffic congestion and frontage activation), it was decided that a clearway approach should be adopted for the boulevard, such that two through carriageways could be provided in peak periods, and parallel parking provided outside of peaks. The location of this clearway is indicated in Figure 4.

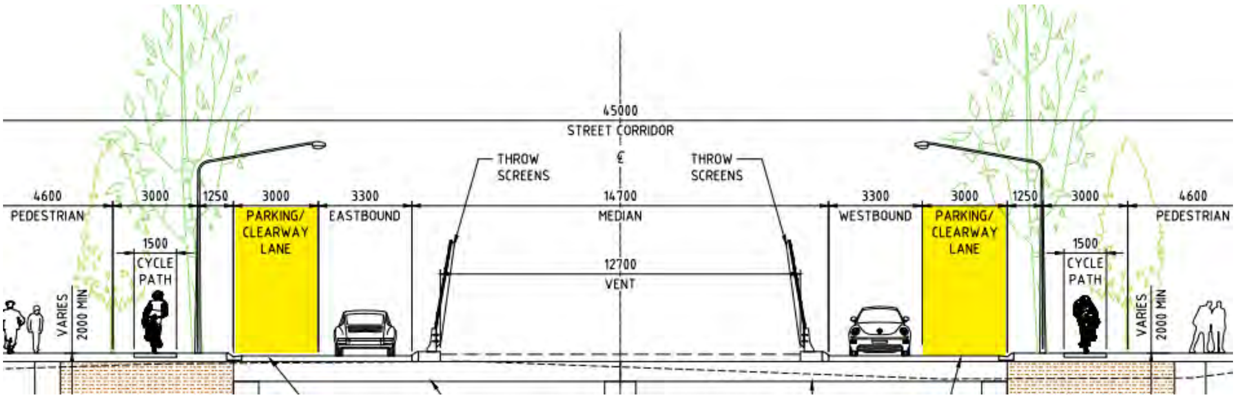


Figure 4 – Parkes Boulevard Clearway

2.2.6 Commonwealth Avenue Lane and Intersection Configuration Adjustments

The Commonwealth Avenue lane configuration proposed in the UDS consisted of three through lanes (consistent with the existing condition). However, given the requirements of both the City Plan and the National Capital Plan, it is noted that Commonwealth Avenue between Parkes Way and Barry Drive (in addition to London Circuit and Vernon Circle) is to be downgraded in terms of road hierarchy such that in the future they will no longer act as arterial roads servicing through traffic but rather present a more local road condition. As such, and at the direction of the ACT Government, Commonwealth Avenue has been reduced to two through lanes from the Parkes Way ramps to Vernon Circle.

This reduction in lane numbers has also assisted in incorporating the proposed free flow ramps (described above), an allowance for future light rail, and sufficient verge widths for appropriate landscaping within the 60m Commonwealth Avenue road reservation.

In addition to the above, the nature of the access into West Basin has been altered from what was proposed in the UDS. The UDS proposed a three-phase signalised intersection from Commonwealth Avenue to West Basin, with both right-in and right-out movements allowed. The feasibility design now proposes to provide entry access into West Basin by a southbound right turn at the Parkes Boulevard intersection and egress from West Basin by a signalised two phase right-out only intersection at the current location of Albert Street. This arrangement provides an improved outcome in traffic performance in addition to facilitating pedestrian movement across Commonwealth Avenue from West Basin to Commonwealth Park at the most desirable location.

2.3 Road Alignment Considerations and Constraints

2.3.1 Commonwealth Avenue / Parkes Way Free Flow Ramps

2.3.1.1 Commonwealth Avenue Median Ramp Trenches

The two proposed free flow ramps that connect Commonwealth Avenue to the Parkes Way mainline consist of a 3.5m lane within a 5m carriageway (as per the minimum requirements stated in Austroads TGRD). When combined with barrier, working width and retaining wall requirements the plan footprint of each ramp trench becomes 7.3m.

As such, these two ramps represent a significant incursion into the avenue space and were subsequently both a key road design and urban design consideration. Options for median trench ramps and verge trench scenarios were tested as part of design development. There were a number of key factors considered when determining the preferred ramp arrangement on Commonwealth Avenue, including:

- A verge trench option would act to sever the Commonwealth Avenue frontages from the Avenue, compromising urban and landscape design outcomes,
- The verge trench solution would compromise the strong linear character of the Avenue created by straight and consistent kerb lines along the road edge of the Avenue.
- The median ramp solution creates a right hand side entry / exit from Commonwealth Avenue. This arrangement is unconventional and potential incoherent to unfamiliar users of the road network. To mitigate this effect and reduce potential conflict through merge and diverge, it was decided that the ramp would have dedicated (trapped) lanes such that no merge or diverge movement is required

On balance of the above considerations, in conjunction with the proposed speed regime of Commonwealth Avenue, it was agreed between the design team and ACT Government that the Feasibility Design should adopt the ramps trenches in the median as the preferred design solution. The location of these ramp trenches are indicated in Figure 5.

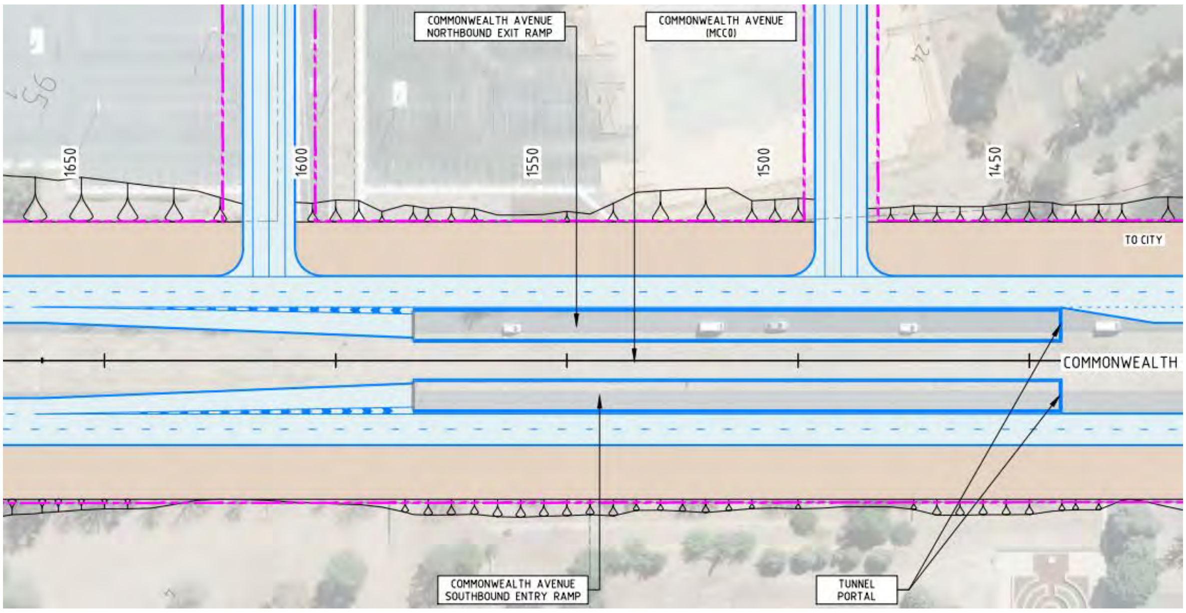


Figure 5 – Median Ramp Trench Locations on Commonwealth Avenue

2.3.1.2 Parkes Way Mainline Ramp Merge / Diverge

Two ramp configurations were considered for entry / exit onto the Parkes Way Mainline:

- Right hand side entry / exit with associated fast lane merge / diverge
- Left hand side entry / exit with associated slow lane merge / diverge

Primarily for safety and efficiency reasons, left hand side entry / exit of the ramps was preferred in the feasibility design given that this is the conventional arrangement for freeway conditions (consistent with the speed regime of Parkes Way). In addition, our constructability team has noted significant constructability advantages in adopting left hand entry / exit ramps.

In terms of merge safety, future iterations of the design should consider the provision of run-out areas downstream of merges. The need for these areas should be determined as part of a detailed risk analysis.

2.3.1.3 Commonwealth Avenue Northbound Ramp Strata Title

Due to the confined nature of the Commonwealth Avenue and Parkes Way road reserves (60 m and 45 m respectively), there is insufficient space within the road reserve to accommodate an appropriate horizontal radius curve for the northbound Commonwealth Avenue exit ramp. As such, the proposed ramp necessarily intrudes on block boundaries proposed in the UDS.

In consultation with the ACT Government, it was agreed to allow this intrusion with the future intent that a strata title be created for the site. To accommodate this, the road design has allowed space in the north east corner of the block such that a structure can span over the proposed ramp tunnel and have foundations that are fully independent of the tunnel. This ensures that no interface between the structures will be required in the future. The interfaces between the ramp geometry and the block boundary are indicated in Figure 6.

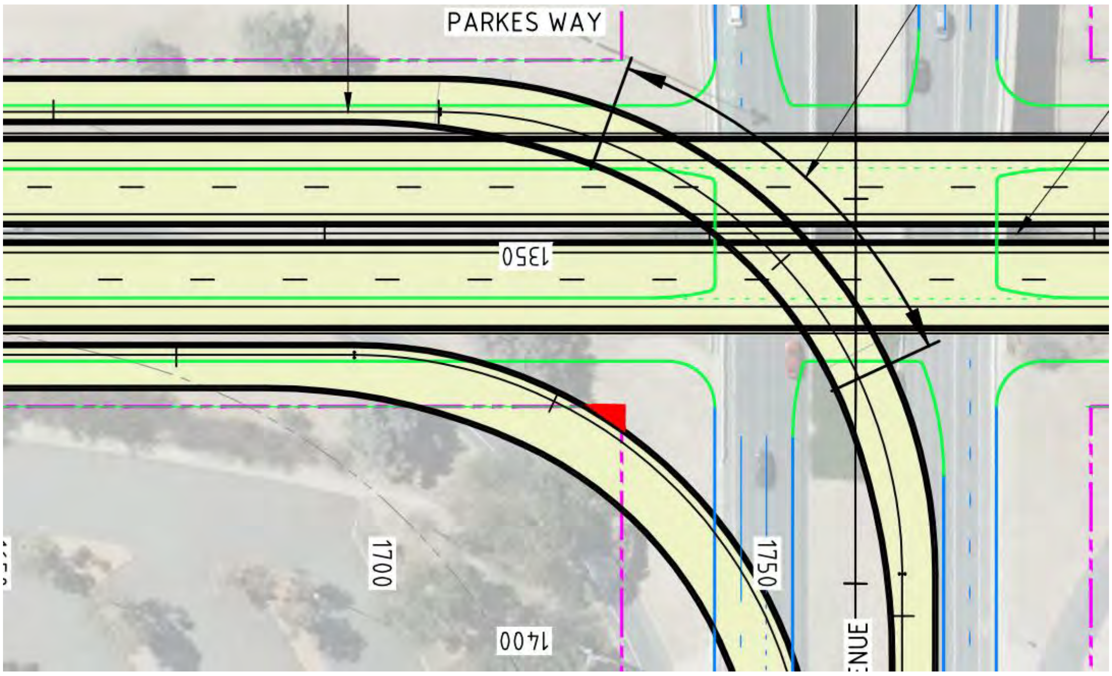


Figure 6 – Northbound Ramp Conflict with Block Boundary

2.3.2 Parkes Way Boulevard / Commonwealth Avenue Intersection

It was noted through the design development that due to increased cost associated with the free flow ramps, alternatives to facilitate this key movement should be considered. Whilst it is noted that this feasibility study is not intended to be an optioneering process, the option of directing all traffic associated with this movement to an at grade intersection was considered. The traffic implications of such an alternative are discussed in more detail in Volume 3 of this study, however it is noted that such an alternative would put significant traffic volumes on the Boulevard (in direct conflict with its intended use as outlined in the UDS) and also put significant pressure on the Parkes Boulevard / Commonwealth Avenue intersection. This would in turn increase the scale of the intersection and compromise its function as a key pedestrian route from the city to the lake. To provide a sense of the implications of adopting a single point intersection at the site (the most efficient from a traffic operation perspective), the design team developed an overlay of the Kings Avenue overpass at the intersection, shown in Figure 7.

Figure 7 – Kings Avenue Overpass Overlay on Project Site

2.3.3 Parkes Way / Coranderrk Street Intersection

The Parkes Way / Coranderrk Street Intersection is a signal controlled T intersection catering for movements associated with Coranderrk Street leg in addition to the Parkes Way mainline and Parkes Boulevard. Elements of the operation of this intersection are unconventional in that one of the critical movements is the left turn from Parkes Way mainline eastbound onto Coranderrk Street. This movement will be required to operate across the Parkes Boulevard service road. As such, careful consideration will need to be given during future phases of design development of this site with respect to signal phasing and lantern siting to ensure the efficient and safe operation of the intersection. A layout of the intersection is depicted in Figure 8.

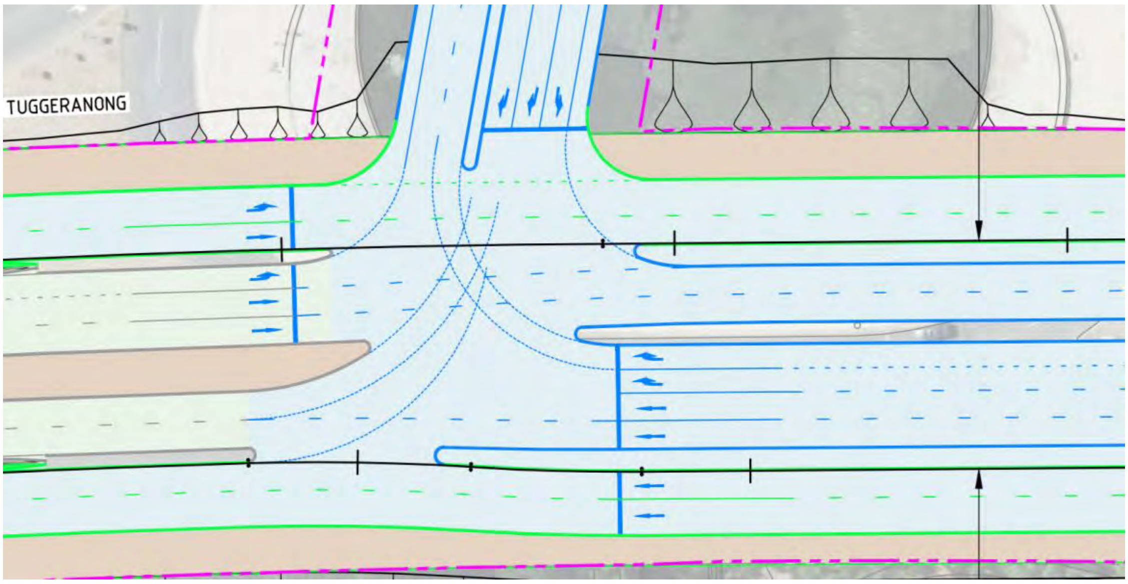


Figure 8 – Parkes Way / Coranderrk St Intersection

2.3.4 *Edinburgh Avenue Exit Ramps*

A key offload point for the eastbound Parkes Way mainline will be the Edinburgh Avenue interchange. Given the nature of the local road network changes and the development proposed as part of the City to the Lake UDS, it is anticipated that additional load will be placed on the Parkes Way eastbound exit ramp at Edinburgh Avenue. As such, upgrade of this ramp to two lanes has been proposed as part of the Feasibility Study. The proposed widening of Edinburgh Avenue ramp is depicted in Figure 9.

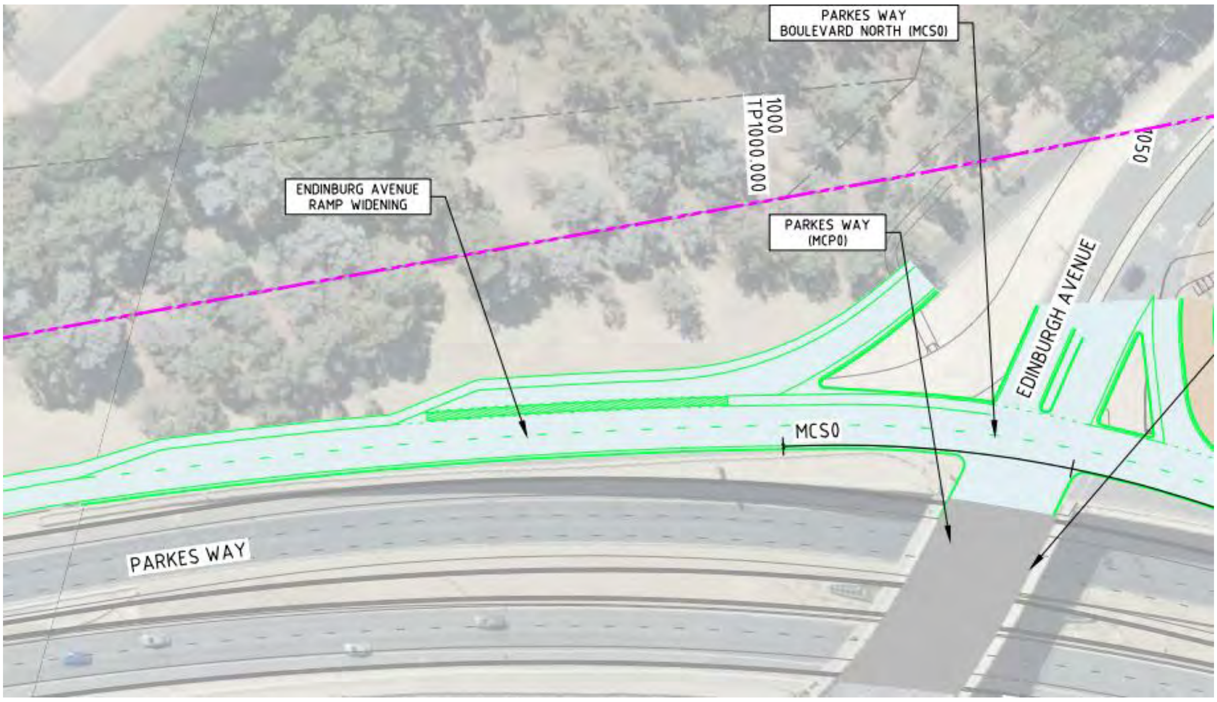


Figure 9 – Edinburgh Ave Ramp Widening

2.3.5 Parkes Way Alignment and UDS block boundaries

Initial constructability advice indicated that construction and cost efficiency could be had if the alignment of the proposed Parkes Way was shifted north from the location proposed in the UDS. This was based primarily on perceived constructability advantages associated with staging around the existing Commonwealth Avenue bridge over Parkes Way. This alternative was tested in terms of road geometry and its impact on the block boundaries proposed in the UDS. Through this design process it was recognised that this revised alignment, whilst technically feasible, compromised the objectives for a number of the future blocks proposed in the UDS and as such the Feasibility Design proposes to retain Parkes Way on the alignment originally proposed in the UDS. It is noted that constructability issues associated with this alignment have since been resolved and are discussed in greater detail in Volume 2 of the Study.

2.3.6 London Circuit Reconfiguration

The UDS proposed that London Circuit be reconfigured to one way clockwise circulation for general traffic and segregated two way operation for buses. This proposal has been retained in the Feasibility Study.

This arrangement is in contrast to the current two-way operation of London Circuit. It is noted that there are number of possible configurations for London Circuit and it is anticipated that these will be tested in greater detail in future phases of the design.

2.3.7 Entrance into Future Car Parks

Through the course of the feasibility design process, the possible inclusion of an access / egress from Parkes Way to a future multi-level sub-surface car park in block to the north of the alignment has been raised. Whilst allowance for such an access has not been explicitly made in the Feasibility Design, it is noted that the design concept does not preclude this access and that alterations to the concept may be possible to allow this connection when details on future car park arrangements are better understood.

2.3.8 Non-conformances with Design Guidelines

Through the development of road designs, site, constructability, cost and other constraints often result in solutions that do not conform with the requirements of road design guidelines. Whilst such departures from standards become more apparent as the design progresses to greater detail and design assumptions are subject to more rigorous analysis, it is noted that a number of non-conformances exist within the current Feasibility Design for the road network. These non-conformances include:

- The horizontal radius on the Commonwealth Avenue northbound exit ramp. The absolute minimum radius for a design speed of 60kph with 5% superelevation is 75m. We note that the Feasibility Design proposes localised widening in the tunnel at the curve site, which results in a stopping sight distance of 55m. This provides an equivalent design speed of 60kph assuming an absolute minimum reaction time and maximum allowable braking force. Given the above, it is proposed to mitigate this non-conformance with advisory curve / speed warning signage, and the conspicuity of the curve could be enhanced by vertical patterns on the tunnel wall panels.

- Non-frangible plantings on Parkes Boulevard, Parkes Way mainline and Commonwealth Avenue in the carriageway clear zone. Given the proposed speed regime, particularly on Parkes Way east of Coranderrk Street, the UDS proposes landscaping and trees in close proximity to the carriageway which are potentially a safety risk for errant vehicles. Either protection to these plantings will be required or the asset owner be required to accept the residual risk associated with this issue.
- Some longitudinal grades at potential bus stop locations on London Circuit exceed the desirable maximum of 2.5%. Furthermore, accessible grades on some of the proposed local roads (notably Parkes Boulevard and London Circuit) have been exceed due to site constraints.
- A number of the merge areas on Parkes Way do not achieve mutual sight between cars equivalent to 5 seconds of travel time. In future iterations of the design this requirement should be analysed in detail in relation to the urban constraints of the site, the possibility of using steeper maximum grades to reduce ramp length and increase the length of matched carriageway levels, or relaxation of the guidelines where this criteria cannot be achieved.

2.4 Road Cross Sections

The cross section for each road that forms part of this Feasibility Study has been developed in the context of the requirements of road design guidelines, urban design considerations, spatial constraints and future upgradability.

2.4.1 Parkes Way Mainline

As a key arterial / freeway that conveys large traffic volumes, the Parkes Way mainline carriageway cross section has been developed to ensure adequate lane widths and setback to barriers such that through capacity is maximised and safety / emergency access is maintained through the provision of wide nearside shoulders. Furthermore, the proposed overall carriageway width of 10.5m allows for future upgrade to a 3 lane carriageway with minimal shoulders should future conditions require. The dimensions of the Parkes Way mainline are as follows:

Cross Section – Parkes Way Mainline	
Travel lanes	2 x 3.5 m
Median (tunnel)	3.0 m
Median (open trench)	2.6 m
Median (east of Coranderrk St)	Varies
Nearside Shoulder	2.5 m
Offside Shoulder	1.0 m

The typical section for the Parkes Way Mainline is depicted in Figure 10.

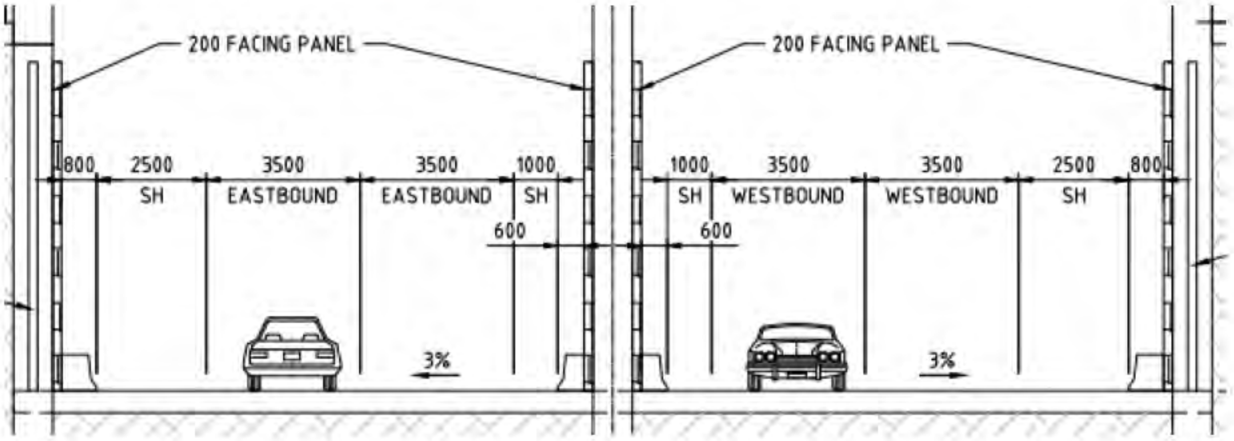


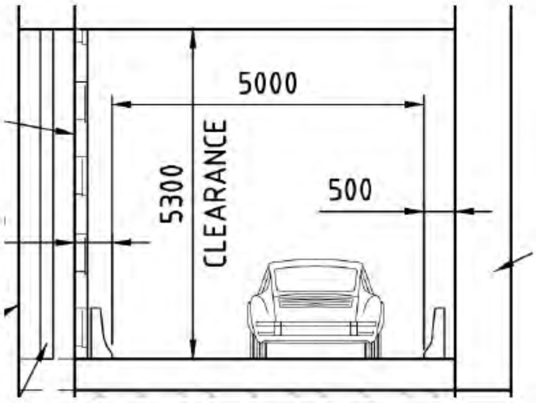
Figure 10 – Typical Cross Section - Parkes Way Mainline

2.4.2 Parkes Way Ramps

The Parkes Way ramp carriageways have an overall width of 5.0 m between barriers. This width allows for passing of a broken down vehicle and is the minimum specified in Austroads TRDG. The dimensions of the Parkes Way ramps are as follows:

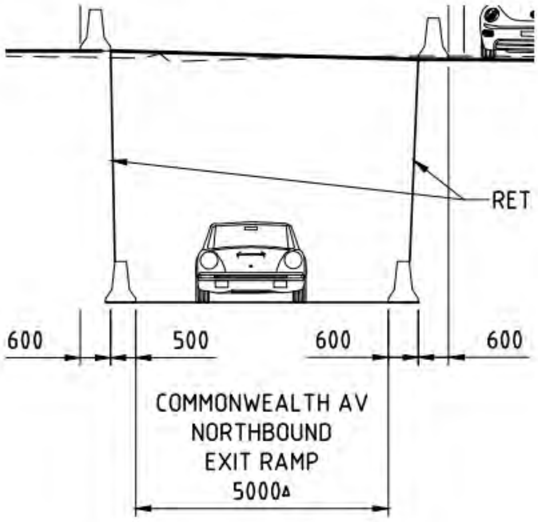
Cross Section – Parkes Way Ramps	
Carriageway Width	5.0 m
Travel lane	3.5 m
Shoulder (min)	0.5 m

The typical section for the Parkes Way ramps is depicted in Figure 11.



NOTE
▲ 3.5 METRE WIDE TRAFFIC
LANE WITHIN CARRIAGEWAY

Ramp in Tunnel



Ramp in Trench

Figure 11 – Typical Cross Section - Parkes Way Ramps

2.4.3 *Parkes Boulevard*

The Parkes Boulevard carriageway consists of a single through lane and clearway lane that will operate as a through lane in peak periods and as a parking / turn lane outside of peaks. The dimensions of the Parkes Boulevard are as follows:

Cross Section – Parkes Boulevard	
Clearway / Turn Lane	3.0 m
Travel lane	3.5 m
Offside shoulder	0.3 m
Verge / Public Realm	8.85 m

The typical section for the Parkes Boulevard is depicted in Figure 12.

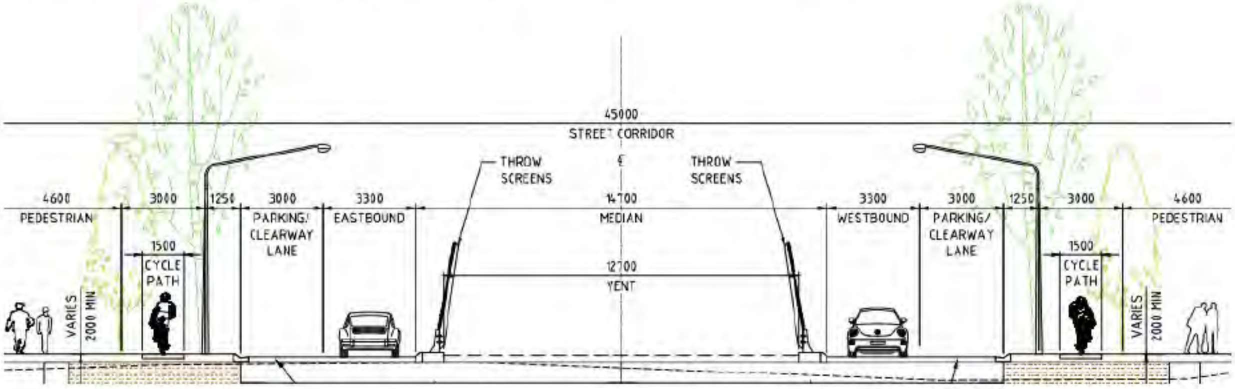


Figure 12 – Typical Cross Section - Parkes Boulevard

It is noted that clearway systems are not currently in use in the ACT. The introduction of clearways would require the development of a clearways policy approach, a policing regime and a related tow-away system.

2.4.4 *Commonwealth Avenue*

Commonwealth Avenue is comprised of three travel lanes to the south of the ramp trenches and two lanes to the north through to Vernon Circle occupying a similar location within the road reserve to the existing condition. The dimensions of Commonwealth Avenue are as follows:

Cross Section – Commonwealth Avenue	
Travel lanes (south of ramps)	3 x 3.3 m
Travel lanes (north of ramps)	2 x 3.3 m
Median	16.9 m
Verge / Public Realm	11.65 m

The typical section for Commonwealth Avenue is depicted in Figure 13.

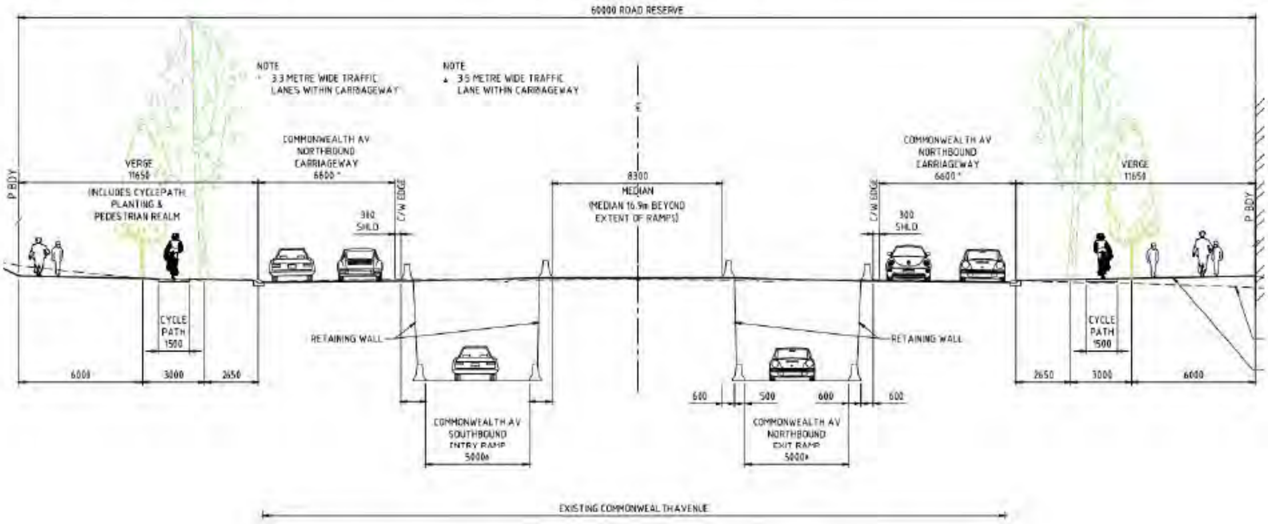


Figure 13 – Typical Cross Section - Commonwealth Avenue

2.4.5 London Circuit

The Feasibility Design (and the UDS) proposes to reconfigure London Circuit to a one-way clockwise circulation for general traffic with a 2.6 m adjacent parking bay. In addition it is proposed to include a two-way segregated carriageway for buses. The dimensions of Commonwealth Avenue are as follows:

Cross Section – London Circuit	
Clockwise travel lanes	2 x 3.5 m
Bus lanes (two way)	2 x 3.5 m
Median	3.0 m
Verge / Public Realm	varies

2.5 Road Network Operation

The operation of the proposed road network, and in particular the 1 km trench / tunnel section of the Parkes Way mainline and associated ramps, is a key consideration of the Feasibility Design. The trench / tunnel section is an isolated length of road and could become inaccessible in the event of an emergency. Similarly it could become heavily congested in the event of a breakdown or accident.

The operational and safety risks associated with these are mitigated to a large extent by the provision of 2.5 m shoulder which can accommodate break downs and allows for the passage of emergency vehicles. Furthermore, it is understood from discussions with Roads ACT that a traffic control centre will be operational at project opening. As such, it anticipated that the operation of Parkes Way will be fully monitored and any issues or incidents within the trench / tunnel will be the subject of prompt response directed by the traffic management centre. Additionally, it is anticipated that intelligent transport systems and real time information signage will be incorporated into the final design of the project which will assist the traffic control centre to manage traffic on Parkes Way.

Whilst static signage has not been considered as part of this feasibility study, a comprehensive package of signage will be developed in futures phases of the design. This signage will be critical in ensuring that all movement requirements and safety issues are clearly communicated to road users.

2.6 Public Transport Considerations

Servicing of the City to the Lake precinct by public transport will be an important element to the success of the development. Whilst public transport operation is analysed in more detail in Volume 3 of the Study, the manner in which public transport infrastructure relates to the road network is discussed following.

2.6.1 Bus Network

Commonwealth Avenue acts as bus route for rapid, peak express and some frequent local services. Similarly London Circuit conveys rapid, peak express and numerous frequent local services. As such, both these roads are key public transport corridors. In particular, London Circuit has been identified as a potential interchange location for bus services that will utilise a segregated bi-directional busway.

These dedicated bus lanes have been incorporated into the design cross section for London Circuit. However, an important consideration with bus stops on London Circuit is that the regraded portion of the road has longitudinal grades of up to 4.5%, which is steeper than desirable for accessibility requirements.

2.6.2 Allowance for Future LRT

It is noted that the ACT Government is currently committed to the development of Light Rail Transit (LRT) system between Gungahlin and the City. Furthermore, a master planning activity for the remainder of future light rail network is also underway. It is understood that Commonwealth Avenue is a likely LRT route and as such the Feasibility Design has sought to ensure that allowance is made for the future provision for light rail in the corridor.

To this end, sufficient space has been allowed in the median of Commonwealth Avenue for a light rail envelope and a light rail station. This allowance was based on the likely spatial requirements of the LRT system that was provided by consultants currently engaged on both the technical advisory role for the Gungahlin to City line and the network master planning activities. This envelope is indicated in Figure 14.

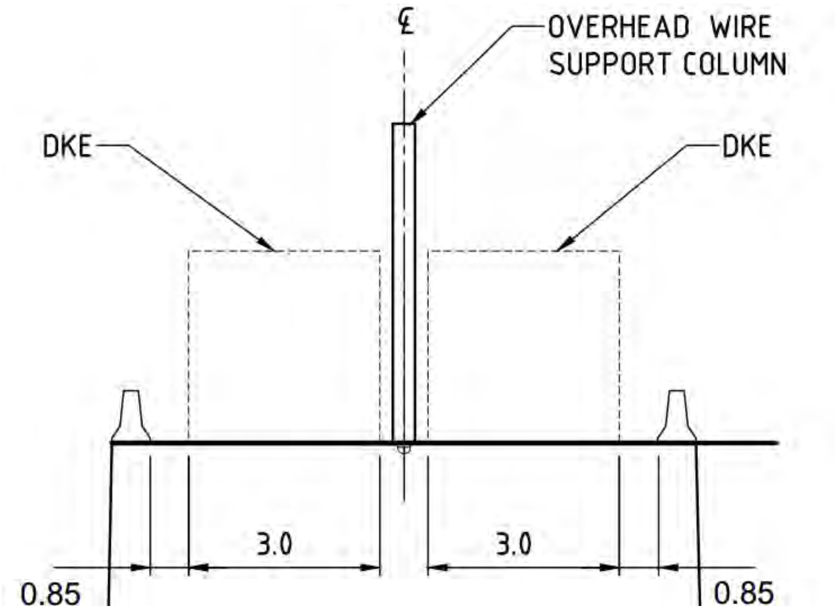


Figure 14 – Provision for LRT Envelope on Commonwealth Avenue

A potential site for a light rail stop to service the West Basin development has been identified on Commonwealth Avenue adjacent to the Albert Street intersection. This site is convenient to the West Basin development and Kings Park and would utilise the proposed signalised pedestrian crossing in this location to provide access to the stop.

2.7 Pedestrians and Cyclists

2.7.1 Pedestrian Movement

2.7.1.1 Network Permeability

One of the primary objectives of the City to the Lake project is to create accessible and convenient pedestrian linkages from the city, across the Parkes Way corridor to the lake. The lowering of Parkes Way plays a critical role in providing this pedestrian permeability. The proposed Feasibility Design provides eight pedestrian crossing points across the Parkes Way alignment inclusive of an 80 m land bridge at Commonwealth Avenue. In addition to creating a ground plane that gently falls from the city to the lake. All of these crossing points will have signalised control across the Parkes Boulevard.

2.7.1.2 Access to Commonwealth Park

In addition, pedestrian access to Commonwealth Park will be improved from West Basin by the inclusion of the permanent Albert Street signalised in intersection and the associated pedestrian crossing.

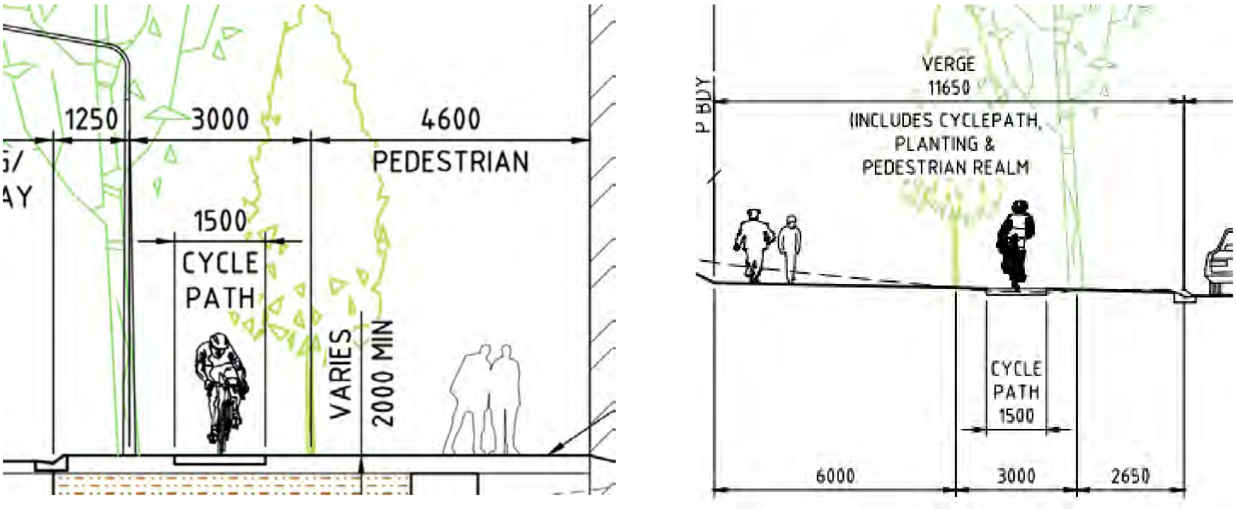
2.7.2 Cycling

2.7.2.1 On-road Facilities

Due to the nature of the changes proposed to the local road network and the desire to create generous public realm spaces with opportunity for planting, carriageway widths have been minimised. Whilst this has enhanced urban design and landscape outcomes it has limited the space available to include on-road cycle lanes. As such, the Feasibility Design does not make provision for on-road cycle lanes on any of the arterial roads that form part of the Study area.

2.7.2.2 Copenhagen Cycle Ways

As cycling and cycle ways are a key part of the Canberra transport network, there is need to ensure that dedicated cycle routes are provided for throughout the development of the arterial roads that form the basis of this study. In lieu of on road cycle lanes, it is proposed that Copenhagen style cycle facilities are provided in verge areas. This approach will allow the desired urban and landscape design outcomes to be realised whilst also providing dedicated cycle facilities. Possible locations for these cycleways are indicated in Figure 15.



Parkes Boulevard

Commonwealth Avenue

Figure 15 – Dedicated Cycleways on Arterial Road Corridors

This treatment has been adopted for the City Cycle Loop that has recently been installed in the city centre and it is proposed to be adopted on the Parkes Boulevard and Commonwealth Avenue in both directions.

2.7.2.3 Parkes Way

Through the development of the Feasibility Design, the possibility of providing cycle access to the proposed shoulders of Parkes Way on the 1km trench tunnel section was raised by stakeholders. The provision of cycle facilities through enclosed / isolated sections of carriageway was considered by the design team as undesirable from a safety perspective, particularly when there is a viable alternative route (as is the case with the Parkes Boulevard) .

As such, and in consultation with the ACT Government, it was decided that the Feasibility Design should not make provision for cycle facilities on Parkes Way.

2.8 Future Studies

There are a number of future studies relating to road design that are considered required prior to the project proceeding to detailed design and construction. The studies are expected to include those listed following.

2.8.1 Concept / Reference Design

Depending on the preferred procurement method, some form of concept design development will be required. Should a conventional Construct only contract be utilised, it is likely that there will be a requirement to develop a set Preliminary Sketch Plans (PSP) that will form the basis of the project that is to be developed through detailed design and the subject of a business case.

Should a Design and Construct / PPP form of contract be preferred then there will be a requirement to prepare a reference design. Whilst the design documents would be similar in nature to a PSP set of deliverables there would also be a need to prepare performance specification to accompany the design. This performance specification would define a set of parameters by which the contractor would need to develop their tender design submission.

Notwithstanding the preferred procurement method, it is anticipated that the concept design would involve an optioneering process that would investigate alternatives to the design proposed in this Feasibility Study and comparatively evaluate those alternatives, likely through a multi criteria analysis process.

2.8.2 Cycle and Pedestrian Study

This Feasibility Study ensures that provision is made for cyclists and pedestrians within the arterial road network. However, it is important to understand the way in which the project interrelates with the surrounding pedestrian and cycle network. As such, it is recommended that a study be undertaken to ensure that the proposed changes to the road network maintain connectivity with the adjacent pedestrian and cycle network and provide appropriate access in to the West Basin Development and other projects associated with the City to the Lake Strategy. A key element of such a study will be consultation with local stakeholders including bodies such as pedal power to provide an opportunity for feedback from user groups.

2.8.3 Accessibility study

As noted above, a key element of the project is to facilitated pedestrian movement between the city and the lake. As such, accessibility will be an important feature of the project. In view of this, it considered appropriate that the concept design be subject to review by an accessibility specialist in order to ensure that the proposed works achieve accessibility outcomes to the extent possible.

2.8.4 Preliminary Environmental Assessments

The early design stages for the Linking project require some consideration to the environmental studies that may be required for approval of the project.

- At the feasibility stage a basic constraints and opportunities document would be developed. Environmental constraints will be scoped and opportunities to mitigate impacts will be explored;
- At the Preliminary Sketch Plan stage a preliminary environmental impact assessment (PEIA) document is required. This document will set out any environmental issues in line with how they will need to be resolved in the Works Approval;
- At the Final Sketch Plan stage an EIA should be provided with the development proposal. Being on National land the Works Approval process will involve consideration

of the impacted environment under the policies of the Environmental Protection and Biodiversity Conservation Act 1999. The NCA most often considers advice from local authorities.

Ecology

The study area is not renowned for containing any particular ecological characteristics, being close to the city centre and the subject of mass earthworks for the construction of the lake, Parkes Way and Commonwealth Avenue. However, within the Commonwealth Avenue loop ramps there are patches of Golden Sun Moth habitat which will require resolution in the DA.

The lake contains several species of EPBC Act listed fish that are stocked as recreational species. The level of protection afforded these fish needs to be established. The lake also contains other general aquatic habitat that will need consideration in the Works Approval process. Of primary concern are water quality and land reclamation impacts.

Heritage

Heritage issues were investigated as part of the previous UDS for the Linking City to the Lake project. It is not anticipated that the work proposed will compromise the findings of the earlier study.

Contamination

The study area is not known to have a significant contaminated land use history. However a limited desk top assessment is required to scope the potential for contamination to affect the development proposal and the design.

Noise

The reconfiguration of a number of trunk roads in the city will have an impact on noise generation of the road network. A preliminary noise impact scoping study is required for each feasibility design option and further levels of detail for the preferred options will then be required at the Preliminary and Final Sketch Plan stages.

3. STRUCTURAL DESIGN

3.1 Design Process and Assumptions

The development of the Feasibility Design of the underpass structure has been based on current design practices adopted for large tunnelling projects within Australia. The structural elements of the Feasibility Design is subject to the following assumptions, constraints and limitations.

3.1.1 Design Life

It is anticipated with the proposed enlarged central business district adjacent to the works, the re-engineering of Parkes Way and Civic's Southern Road network will form an integral part of the infrastructure to service this area. The infrastructure associated with the Project will need to continue to meet its intended function, without major replacement or refurbishment over the infrastructure's intended design life. To achieve this objective the following design life for various project elements are recommended:

- Underpass structural elements, including inaccessible drainage items: 100 years
- Overbridges: 100 years
- Retaining Walls: 100 years
- Embankments and cuttings: 100 years
- Drainage element that are accessible for refurbishment or replacement: 50 years
- Sign support structures including safety screens: 40 years
- Underpass linings and architectural panels: 40 years
- Fixed sign faces: 10 years

3.1.2 Constraints

The current Parkes Way road alignment forms an integral part of the road network within the ACT, and the proposal to lower Parkes Way will need to address and provide for the continuous traffic flow along Parkes Way during the construction phase of works.

The Feasibility Study has identified an opportunity to construct the new lowered Parkes Way road along the alignment of the existing west bound carriageway of the current Parkes Way road formation. This solution would allow the current Parkes Way west bound carriageway traffic to be temporarily diverted, providing sufficient space along the existing west bound carriageway alignment to undertake the Parkes Way lowering works.

To minimise the required space to undertake the construction activities associated with lowering Parkes Way, it is proposed the tunnel is constructed using a 'top down' approach. This form of construction would limit the required footprint of the construction works, and would avoid the requirement to batter back the excavation from its base. With the depth of excavation expected to reach over 10 metres below the current Parkes Way road formation level, the size of the construction footprint can be substantially reduced using a 'top down' construction technique.

3.1.3 *Drainage of Groundwater*

The tunnel structure has been developed on the basis of a ‘drained configuration’, where by the anticipated influx of ground water through the trench walls would be managed via a sump system located near Commonwealth Avenue Bridge. Provision for the influx of ground through the trench walls would be via the integration of subsoil drains and weep holes within the shotcrete concrete between the contiguous piles. This anticipated influx of ground water would suit a ‘drained configuration’, and would reduce the upfront capital expense for the proposed works.

The alternative to this proposal would be an ‘undrained configuration’, with the structure being water tight preventing the influx of ground water through the trench walls and base slabs. This arrangement would need to be designed to cater for the hydrostatic ground water pressure against the sides of the trench walls and base slabs, and generally would be more structural robust than a ‘drained’ arrangement. A life cycle cost analysis could be undertaken during the preliminary design phase of the project to compare the benefits of a ‘drained’ and ‘undrained’ strategy for the tunnel structure. Further modelling of the seasonal groundwater hydrology would need to be conducted as part of the life cycle cost analysis to accurately assess the anticipated ingress of groundwater into the lowered parks way alignment. The findings of this investigation will determine the most appropriate drainage strategy for the structure.

3.2 Road Bridges over Parkes Way

As part of the proposal to lower Parkes Way road alignment (MCPO), four new road overbridges, one footbridge and the replacement of two overbridges with a land bridge are proposed. The four new road overbridges will provide traffic and pedestrian access to the proposed West Basin development site from the current central business district (CBD) in the north. These four overbridges include Marcus Clark Street bridge on alignment MC20, the New West Road bridge on alignment MC30, New East Road bridge on alignment MC40 and the Alara Street Bridge on alignment MC50. The land bridge will replace the two existing Commonwealth overbridges, spanning over the existing Parkes Way road formation. Details of the overbridges are below;

3.2.1 *Western Footbridge*

The new western footbridge (between the Edinburgh Avenue Bridge and the Marcus Clark Avenue overbridge) consists of two 16 m spans utilising 600 mm deep, and 600 mm wide precast PSC planks, with a 200 mm cast in-situ deck. During the concept design the plank depth may be optimised once the earth pressure and pedestrian loadings are further investigated. The precast planks will be supported on 1100 mm wide blade walls at each abutment and pier locations. The bridge will form the roof of the cut and cover tunnel and to stabilise the abutment walls from lateral earth pressure, the bridge abutments have been detailed as semi integral for this purpose.

The overbridge will form part of the local pedestrian networks service the new precinct, and will be approximately 17 m wide between parapets.

3.2.2 *Marcus Clark Avenue, alignment MC20,*

The new Marcus Clark Avenue overbridge on road alignment MC20, consists of a 2 x 18m span arrangement utilising 700mm deep, and 600mm wide precast PSC planks, with a 200mm cast in-situ deck. The precast planks will be supported on 1100mm wide blade walls at each abutment and pier locations. The bridge will form the roof of the cut and cover tunnel and to stabilise the abutment walls from lateral earth pressure, the bridge abutments have been detailed as semi integral for this purpose.

The overbridge will form part of the local network of roadways to service the new Boulevard precinct, and will be 30 metres wide between the traffic containment barriers. The bridge will contain pedestrian and cyclist space in both verges and two 3.5m wide traffic lanes.

Regular or medium performance vehicle containment barriers have also been provided along the sides of the bridges to contain vehicles from entering the open vent penetrations, with throw screens supported on the back face of these containment barriers.

3.2.3 New West Road, alignment MC30,

The New West Road overbridge on road alignment MC20, consists of a four span arrangement (max. 12m span) utilising 535mm deep, and 600mm wide precast PSC planks, with a 200mm cast in-situ deck. The precast planks will be supported on 1100 mm wide blade walls at each abutment and pier locations. The bridge will form the roof of the cut and cover tunnel and to stabilise the abutment walls from lateral earth pressure, the bridge abutments have been detailed as semi integral for this purpose.

The overbridge will form part of the local network of roadways to service the new Boulevard precinct, and will be 30 metres wide between the traffic containment barriers. The bridge will contain pedestrian and cyclist space in both verges and two 3.5m wide traffic lanes.

Regular or medium performance vehicle containment barriers have also been provided along the sides of the bridges to contain vehicles from entering the open vent penetrations, with throw screens supported on the back face of these containment barriers.

3.2.4 Commonwealth Avenue, alignment MCC0,

With the realignment of the lowered Parkes Way road contain to a narrower road formation, the existing twin two span box girder Commonweath overbridges will become redundant, and will be required to be replaced to integrate with the proposed cut and cover tunnel structure beneath.

The twin Commonwealth Avenue bridges on alignment MCCO will be replaced by an 80m long land bridge consisting of 2 x 12m span arrangement utilising 535mm deep, and 600mm wide precast PSC planks, with a 200mm cast in-situ deck. The precast planks will be supported on 1100mm wide blade walls at each abutment and pier location. The bridge will form the roof of the cut and cover tunnel and to stabilise the abutment walls from lateral earth pressure, the bridge abutments have been detailed as semi integral for this purpose.

Regular or medium performance vehicle containment barriers have been provided along the sides of the bridges to contain vehicles from entering the open vent penetrations, with throw screens supported on the back face of these containment barriers.

3.2.5 New East Road and Allara Street, alignment MC40 and MC50

The New East Road and Allara Street overbridge on road alignment MC40 and MC50, consist of a two span arrangement (max. 12m span) utilising 535mm deep, and 600mm wide precast PSC planks, with a 200mm cast in-situ deck. The precast planks will be supported on 1100 mm wide blade walls at each abutment and pier locations. The bridge will form the roof of the cut and cover tunnel and to stabilise the abutment walls from lateral earth pressure, the bridge abutments have been detailed as semi integral for this purpose.

The overbridge will form part of the local network of roadways to service the new Boulevard precinct, and will be 30 metres wide between the traffic containment barriers. The bridge will contain pedestrian and cyclist space in both verges and two 3.5m wide traffic lanes.

Regular or medium performance vehicle containment barriers have also been provided along the sides of the bridges to contain vehicles from entering the open vent penetrations, with throw screens supported on the back face of these containment barriers.

3.3 Parkes Boulevard and Vent Structures

The set out of the Parkes Boulevard roads on alignment MCSO and MCTO, requires the roads to be suspended above the lowered Parkes Way tunnel. To support the Boulevard roads, 700mm deep and 600mm wide PSC planks positioned in a perpendicular direction to the road alignment have been proposed. The precast planks will be supported on 1100mm wide blade walls at each abutment and pier location. To cater for the natural ventilation of the lowered Parkes Way tunnel between the East and West Service Roads, the PSC planks have been spaced at 1800mm centres. This arrangement provides a clear ventilation opening of 1200mm between the adjacent plank units, which equates to a 66% clear opening over the plan area of the vent structure.

Along the Boulevard roads, permanent 'transfloor' formwork will span between the adjacent plank units to support a 200mm cast in-situ deck slab. Similar to the new overbridge structures, the PSC plank units will also form the top compression strut between the abutment walls, to resist lateral earth pressure effects. The abutments have also been detailed as semi integral for this purpose.

Regular performance vehicle containment barriers have also been provided along the sides of vent structure to contain vehicles from entering the open vent penetrations, with throw screens supported on the back face of these containment barriers. The structural members associated with the support of the Parkes Boulevard are depicted in Figure 16.

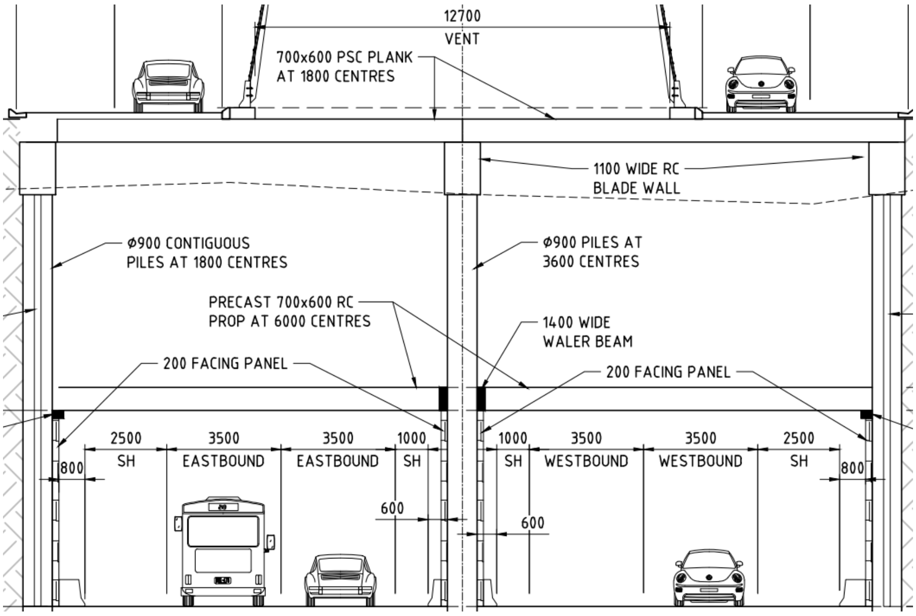


Figure 16 – Parkes Boulevard Structures

3.4 Retaining Structures

To retain the insitu material and fill against the sides of the lowered Parkes Way alignment, three retaining structural systems have been proposed. These retaining systems are below.

3.4.1 Cut and Cover Tunnel Structures

The Feasibility Design of the trench wall retaining structures has been developed based on a 'top down' construction methodology, where by the contiguous piles will be installed at ground level prior to excavating the soil between the contiguous pile walls. This form of construction will utilise traditional and readily available construction techniques for cut and cover construction. This form of construction will minimise disruption to surrounding infrastructure and will allow the continuous operation of Parkes Way (under a modified traffic management arrangement) during the construction works. Where the trench walls extend above the existing ground level, a reinforced concrete blade wall has been proposed that will tie into the contiguous piles below.

3.4.1.1 Contiguous piles

Further optimisation of the pile size, length and longitudinal spacing can be undertaken during the concept design phase, taking into consideration the unique ground geology, ground water profile and formation level along the length of the Parkes Way alignment.

It is currently proposed that the piles are 900 mm diameter concrete piles at varying centres (3600 mm for the carriageway division in the Parkes Way median and 1800 mm at the side walls) with a 200 mm thick shotcrete layer between piles containing a single layer of mesh at the side walls. The piles extend down to a short socket to enable excavation of the tunnel. In addition, facia panels are provided in front of the piles to provide a suitable finish. The top of the piles (base of the blade wall) are propped by precast concrete props resting on lintels / outstands formed in the blade wall to support the high lateral earth pressures acting on the sides of the trench walls. The props are approximately at centre height of the total clear height with a maximum vertical spacing of 6 m. Further optimisation of the size of the props and their vertical and longitudinal spacing can be undertaken during the concept design, taking into consideration the unique ground geology and formation level. The proposed layout for the contiguous pile walls and associated horizontal props are depicted in Figure 17.

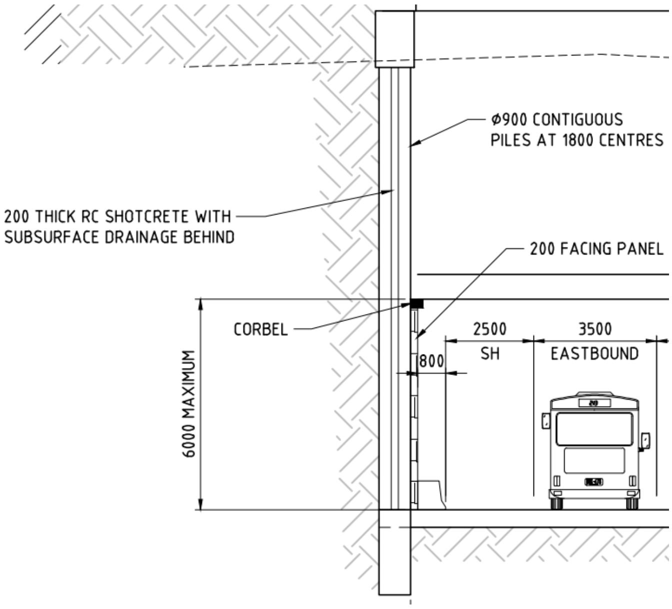


Figure 17 – Tunnel Wall Arrangement

3.4.1.2 Base Slab

A reinforced concrete base slab may be required in some areas, it is proposed that the slab is 400 mm thick and founded on good rock. If the rock quality is poor, ground anchors may be provided for additional stability.

3.4.1.3 Tunnel Ceiling

Over Parkes Way, the roof slab comprises a 700 mm deep by 600 mm wide standard precast prestressed concrete plank at 1800 mm centres. A 200 mm thick cast in-situ reinforced concrete deck spans between beams. The slab is removed over a width of approximately 13 m to provide ventilation for the tunnel.

The roof of the entry and exit ramps to Commonwealth Avenue comprise a 535 mm deep by 600 mm wide standard precast prestressed concrete plank at 900 mm centres with a 200 mm thick concrete slab.

3.4.2 Open trough

An open trough section will be utilised where clearances cannot be achieved. It is proposed that a contiguous pile wall of similar to construction to that above is to be used. 900 mm diameter piles at 1800 mm centres with a 200 mm thick concrete shotcrete infill are proposed. In addition, there is scope for the introduction of soil nail walls or reinforced earth walls in these locations, dependant on the construction restraints. A cast in-situ concrete base slab will be provided between walls. Further optimisation can be undertaken during the concept design, taking into consideration the unique ground geology and formation level.

3.4.3 Embankments

Where required and possible, embankments will be graded to a 1V:4H batter. Should embankments need to be steeper than 1V:2H then soil nailing may be require to stabilise these areas. Other stabilisations techniques such as geotextiles will be considered during the concept design.

3.4.4 Minor Retaining walls

There may be a requirement for cast in-situ concrete "L-Shaped" walls where the required retained height is less than 2 m. The inclusion of these walls will be further investigated at the concept design stage.

3.5 Miscellaneous Structures

3.5.1 Vehicle Containment Barriers

Regular performance vehicle containment barriers have been detailed at the edge of the vent along the east and west service roads, to contain vehicles from entering the open vent penetration. The containment barriers would be construction for precast or cast in-situ concrete, with cast in ferrules to support the throw screen posts. The vehicle containment barriers would need to be designed in accordance with AS5100.2, and local road authority requirements.

A higher performance level may be required where the potential for errant vehicles to enter the vent is increased. This would typically occur at traffic intersection locations, where vehicles travel in a perpendicular direction relative to the vehicle containment barrier. Subject to the adopted traffic speed limits and unique turning arrangements at each road intersections, a risk assessment would need to be carried out by an appropriate qualified engineer to assess the appropriate vehicle containment barrier performance level at these locations.

3.5.2 Throw Screens

To prevent objects from been throw on to the lowered Parkes Way from the Boulevarde and cross streets, throw screens have been proposed to be supported from the back face of the traffic barriers. The throw screens would consist of steel support posts at 2 metre centres, with attached steel infill mesh panels. The aperture of the mesh would be typically set at 40mm x 400mm to prevent large objects from been throw on to the roadway beneath.

3.5.3 Underpass Architectural Panelling Works (Facia Panels)

The proposed tunnel panel is comprised of fibre cement sheet with an epoxy coating that provides reflectance and a cleanable surface, and secured in place with a light steel frame that is secured to the tunnel wall with stainless steel fasteners. The steel frame is to be chaired away from the tunnel wall with polymer spacer washers that incorporate a drip groove in their shape so that any seepage that does drip down the face of the tunnel wall does not readily lead to a build-up of salt on the fasteners to the tunnel panels. A similar type of fixing is required for cable tray and sprinkler pipe supports.

4. TUNNEL DESIGN

The following section describes our appreciation of the tunnel related components that are likely to be necessary for the lowered section of the Parkes Way realignment.

4.1 Lowered Alignment

The lowered section of the re-aligned main east and west bound carriageways for Parkes Way commences just east of the existing Edinburgh Avenue overbridge, and extend for approximately 1km through to the Coranderrk Street intersection. Entry and exit ramps are also provided to link the lowered main carriageway west of Commonwealth Avenue, with Commonwealth Avenue on the southern side of Parkes Way.

The lowered section of the alignment contains a combination of ramps, open trenches, vented trenches and trenches closed in by road and land bridges. The vented sections have been included to provide natural ventilation. This combined approach has been developed to shorten the lowered sections of the alignment that may have to be defined as a 'tunnel', and therefore minimise the fire, ventilation and other services requirements associated with tunnels.

The Australian Standard 4825-2011 'Tunnel Fire Safety' provides guidelines for fire safety in new road tunnels. In clause 1.6.32 a tunnel is defined as:

'*A substantially enclosed roadway or track-way greater than 80m in length.*

NOTE : What constitutes a tunnel depends on the likelihood of development of untenable conditions. If the degree of cover is less than 75%, the accumulation of smoke is unlikely.'

Where sections of the lowered alignment cannot be covered for a length less than 80m, Clause 1.4(a)(i) of AS4825 describes a road tunnel longer than 120 m as a 'long tunnel' for applying the requirements of the standard.

It must be noted that the above assessment and statements must be tested by a fully developed Fire Life Safety review, i.e. a Fire Engineering Brief, Fire Engineering Report and Ventilation Study must form part of such a development.

4.1.1 Parkes Way Mainline Carriageways

The lowered section of the Parkes Way realignment consists of open trenches, vented trenches and trenches closed in by road and land bridges.

The open trenches at either end of the lowered section do not provide any cover therefore have not been considered as part of the 'tunnel' when assessing the main carriageway against the definition provided in AS4825.

The vented trench areas consist of partially open roof sections comprising spaced precast concrete planks. The planks are typically 600mm wide spaced at 1800mm centres, therefore the vented areas have been assumed to provide one-third cover. The vent areas are 12.7m wide centred over the trench, which is typically around 50% of the combined width of the east and westbound main carriageways. Vented areas are therefore typically considered to have two-thirds cover when applying the AS4825 definition; and it is therefore reasonable to assume that these sections will naturally ventilate during a fire event without the need for mechanical ventilation.

A land bridge is provided for Commonwealth Avenue to cross over Parkes Way. The land bridge has been limited to less than 80m in length so that it is not considered a tunnel when looked at in isolation of the rest of the lowered alignment.

Additional bridges are provided to allow future traffic to cross Parkes Way. Four 30m long bridges are provided between vented sections.

When assessing the degree of cover for the main alignment for the vented and bridged sections, a degree of cover of less than 75% is calculated, in accordance with AS4825. Therefore it is possible that smoke will not accumulate during a fire event, and tenable conditions will be provided without the need to install mechanical ventilation.

4.1.2 Entry and Exit Ramps

An exit ramp from the lowered Parkes Way eastbound carriageway to the southbound carriageway on Commonwealth Avenue is provided, and crosses over the Parkes Way carriageway beneath the Commonwealth Avenue land bridge before exiting onto Commonwealth Avenue in the existing median. The ramp runs parallel with the main carriageway alignment at a different level for approximately 180m, and is separated from the main carriageway by 900mm diameter piles spaced at 1800mm centres. The spaces between the piles are currently left open to allow for ventilation between the ramp and the main carriageway. Where the ramp crosses over the main carriageway, the sides of the ramp are also proposed to be left open to allow ventilation of the ramp. The remaining length of the ramp is slightly less than the 80m limit for a tunnel as defined in AS4825.

An entry ramp to the lowered Parkes Way westbound carriageway from the northbound carriageway on Commonwealth Avenue also provided from the existing median on Commonwealth Avenue. The start of the underground component of the ramp from the median on Commonwealth Avenue to where it runs parallel with the main carriageway is around 105m long, therefore defining it in isolation as a short tunnel according to AS4825.The ramp then runs parallel with the main carriageway alignment at a different level for approximately 150m, and is separated from the main carriageway by 900mm diameter piles spaced at 1800mm centres. Again, the spaces between the piles are currently left open to allow for ventilation between the ramp and the main carriageway.

4.2 Segregation and Egress

The current arrangement does not provide segregation of the main east and west carriageways, and does not segregate the ramps where they run parallel or over the main carriageways. The current arrangement is unique, and therefore further modelling of the effectiveness of the passive ventilation needs to be undertaken by a ventilation engineer in future design stages to confirm adequate ventilation is provided. Areas that will require further consideration include:

- The impact of a fire in the main carriageway on the ramps, including the ramp crossover;
- The effectiveness of the central 12.7m wide vent providing passive ventilation to the full carriageway width; and
- The effectiveness of passive ventilation between the piles separating the main carriageways from the ramps.

In addition to the ventilation aspects, the agreed egress strategy will impact on the final segregation arrangements. These requirements will need to be confirmed with all stakeholders during the fire engineering process to ensure sufficient egress paths are provided during emergencies. Whilst emergency egress points (eg stairs etc) have not bee included on the drawings, it is possible that they may be required and will be identified and included in future phases of the design.

It is highly likely that the outcomes of the ventilation and egress studies will lead to the requirement for an updated design whereby the ramps are segregated from the main carriageway. This outcome would classify the ramps as long tunnels according to AS4825, and will therefore lead to more onerous requirements for fire control and egress which may include:

- Deluge and associated drainage systems;
- Bi-directional jet fans within niches; and
- Emergency exit stairs to the surface.

The impact of the study to the east and westbound carriageways may be that firewalls between the two carriageways are required for all or part of the height of the columns. If this is required, sliding doors for egress to the adjacent carriageway may be required.

4.3 Ventilation Requirements

Natural ventilation is currently provided with the vents at surface level. Modelling of the ventilation will need to be undertaken to confirm any requirements for mechanical ventilation in normal traffic flow, congested traffic flow and emergency operation.

For normal and congested traffic flow, assessment will depend on the traffic study including:

- Traffic volume per day & daily peak periods;
- Percentage traffic mix (passenger cars, buses, trucks, petrol tankers);
- Vehicle fuel type and age of vehicle fleet.

The traffic study should also provide guidance as to any restrictions on vehicle types for the ramps.

For emergency operation, *Computational Fluid Dynamics (*CFD) modelling will have to be carried out to determine whether jet fans would be required to manage the smoke control to ensure tenability of the tunnel environment for both tunnel patrons and emergency firefighting personnel.

4.4 Fire Systems

The final fire system will require design by a fire engineer in association with a ventilation specialist on the finalised design arrangement through the fire engineering process. The system will require design to comply with AS4825, Austroads Guide to Road Tunnels, and relevant international standards including the PIARC Road Tunnels Manual. The most critical areas of the design are the ramps and the Commonwealth Avenue land bridge, and these two areas are discussed further below.

The following details the likely fire system requirements for the Commonwealth Avenue land bridge, should the fire engineering review show that the effectiveness of a passive ventilation system does not provide ongoing tenable conditions in a fire:

- Deluge and associated fire detection system; and
- Mechanical ventilation for emergency conditions

Similarly, the likely fire system requirements for the ramps would be:

- Deluge and associated fire detection system;
- Mechanical ventilation; and
- Fire cabinets.

A typical arrangement for a cut and cover tunnel inclusive of jet fan ventilation systems can be seen in Figure 18 which depicts the arrangement adopted in the Tugun by-pass project.

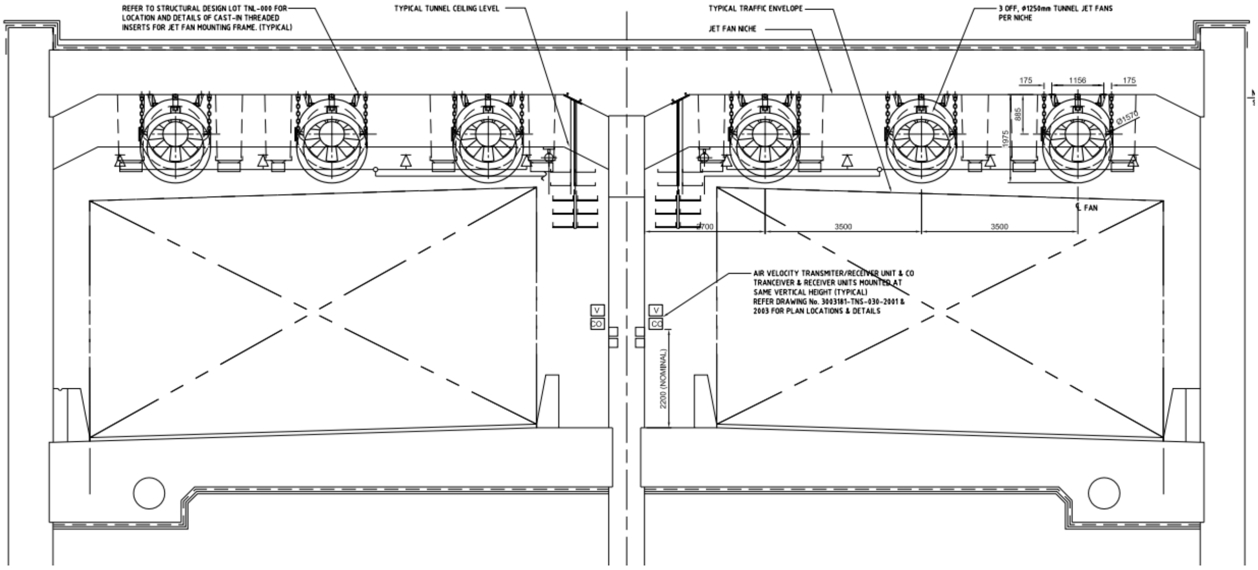


Figure 18 – Typcial Seciton for Cut and Cover Tunnel – Tugun Bypass

4.5 Tunnel Assessments in Future Phases of the Design

4.5.1 Drainage Requirements

Based on the current alignment a low point sump will be required beneath the Commonwealth Avenue land bridge.

The size and pump requirements for this sump will need to be determined in further design stages once the alignment is fixed and any required deluge systems are designed. The main factors that will govern the design of the sump include:

- Inflow from possible deluge systems;
- Catchment area;

- Anticipated groundwater inflows; and
- Requirement to treat tunnel water prior to discharging into surface level drainage systems.

4.5.2 Lighting

An assessment of the lighting requirements will be required by a lighting specialist to ensure driver safety. As a minimum, lighting is likely to be required in the covered sections and within the ramps to provide consistent lighting levels throughout. Emergency lighting may also be required.

4.5.3 Maintenance Requirements

Power supply is likely to be required for the full length of the trench and ramps to assist in carrying out maintenance activities. An assessment of other requirements such as provision of a hydrant ring main should be assessed in consultation with the stakeholders.

4.5.4 Operations Requirements

Signage will be required to control entry of traffic and notify speed limitations. These requirements shall be assessed in consultation with the stakeholders.

4.5.5 Services cupboards

The requirement for services cupboards in the sections of the trench and ramps should be confirmed between fire engineers and stakeholders.

5. GEOTECHNICAL DESIGN

5.1 Geotechnical

5.1.1 Geotechnical Investigations

A site specific geotechnical investigation was undertaken by Coffey Geotechnics Pty Ltd (Coffey) during November and December 2013 and the results of the investigation are presented in the report entitled "Parkes Way Geotechnical Profiling (Linking City to the Lake), Geotechnical Investigation Report, 13 January 2014 (GEOTFYSH09693AA-AE)" (Geotechnical Report) included in Attachment B of the report.

The geotechnical investigation comprised 10 boreholes with piezometers installed in all the boreholes and geophysics testing along the proposed alignment consisting of Rapid Seismic Refraction (RSR) and Rapid Seismic Shear-wave Testing (RSSP). The borehole locations are depicted in Figure 19.

Figure 19 – Parkes Way Borehole Locations

5.1.2 Site Geology

The 1:50,000 Geological Map of Canberra indicates that the site is generally bound by two major faults trending north south, comprising Acton Fault beyond the western alignment extent and the Oakes Fault beyond the eastern alignment extent. Further unmapped minor faulting is expected within the study area with a similar orientation.

The majority of the Parkes Way alignment area is expected to be within the Canberra Formation with a high possibility of presence of alluvial soils towards the eastern and western extents. The Canberra Formation generally consists of calcareous shale, limestone, sandstone and tuff.

The geological sheet indicates a general dip of the bedrock to the south-east, with the sedimentary Canberra Formation dipping at approximately 30°.

5.1.3 Subsurface Conditions

The results of the geotechnical investigation show that the site is underlain by the following subsurface strata:

- Fill / Topsoil – Sandy/Silty CLAY or Clayey SILT of low to medium plasticity. Thickness range 0.1-0.6m. RL range top of layer 557.3-560m
- Fill – Gravelly/Silty/Sandy CLAY of medium to high plasticity; or Sandy SILT/Silty SAND of medium grained. Thickness range 0-3.7m. RL range top of layer 556.6-559.8m.
- Residual Soil – Silty/Sandy CLAY of medium to high plasticity and typically stiff to very stiff consistency. Thickness range 0.5-1.7m. RL range top of layer 555-559.2m.
- Siltstone Bedrock
  - Extremely to highly weathered. Thickness range 0.7m-unproven. RL range top of layer 555.3-559.5m.
  - Moderately to slightly weathered. Thickness range 1.6m-unproven. RL range top of layer 547.7-557.2m. Only found in four boreholes.
  - Slightly weathered to fresh. Thickness range unproven. RL range top of layer 547-556.4m. Only found in three boreholes.

Details of the subsurface conditions are presented in the Geotechnical Report.

It is noted that a relatively deep weathering profile was observed within bedrock over the majority of the alignment, with lesser weathered and higher strength bedrock observed towards the eastern site extent.

5.1.4 Groundwater

The measured groundwater levels within the piezometers ranged between RL 551.2m and 555.7, as presented in the Geotechnical Report.

The water levels within Lake Burley Griffin adjacent to the south of the Parkes Way alignment were observed to be at an approximate reduced level of 556m. This water level is greater than those measured in the piezometers, indicating that the groundwater flows northward from the lake to the project alignment.

Details of the hydrogeological conditions of the site are reported in the Hydrogeology section below.

5.1.5 Geophysics

The RSR and RSST are interpreted as P-wave velocities and S-wave velocities respectively and the results are presented in the Geotechnical Report. These velocities were correlated with boreholes logs and the interpreted ground conditions are as follows:

- P-Wave
  - 500-1600 m/s – Sandy clay, clays, extremely weathered siltstone
  - 1600-2400 m/s – Highly to medium weathered siltstone

  - 2400-2900 m/s – Medium to slightly weathered siltstone
  - 2900-5000 m/s – Fresh siltstone
- S-Wave
  - 180-360 m/s – NEHRP Classification D
  - 360-760 m/s – NEHRP Classification C
  - 760-1000 m/s – NEHRP Classification B
  - >1000 m/s – NEHRP Classification A

The seismic velocities are relatively low to considerable depth between Ch. 400m to 600m and this represents a deep weathered condition or a possible shear or fault zone. It is noted that medium to slightly weathered siltstone are present at approximately Ch. 250m to 350m at the base of the excavation and medium to fresh siltstone are encountered at shallow depths around Ch. 650m to 800m.

5.1.6 Comments and Recommendations

5.1.6.1 Additional Geotechnical Investigation

The available geotechnical information shows considerable variability of the subsurface conditions along the length of the alignment. Additional boreholes will be required to better define the extent and distribution of the various subsurface strata. It is also recommended that some additional boreholes are positioned along the proposed wall alignments supporting the excavation. These boreholes will provide necessary information for design of walls and also allow a better understanding of the subsurface profile across the alignment.

5.1.6.2 Excavatability Assessment

Seismic velocities indicate areas where rock blasting may be required, i.e. approximately Ch. 680m to 770m. However, excavatability of rock is generally governed (among other factors) by the rock strength and defect spacing. Further assessment of the rock cores and boreholes logs is recommended to better define the excavation characteristics of the site materials.

5.1.6.3 Retaining System

The decision of the retaining system for the excavation depends on the ground and groundwater conditions, constructability, cost, site constraints, programme, etc. A number of retaining wall types are considered to be potentially applicable, including (but not limited to) diaphragm wall, contiguous bored pile wall and secant pile wall. These walls can be used to temporarily and/or permanently support the excavation depending on the design requirement.

5.1.6.4 Drained/undrained Structure

It is found that the groundwater table is potentially above the base level of the excavation. As such, the excavation may be subjected to groundwater inflow. Depending on the project requirement and the magnitude of the groundwater inflow, the tunnel may be constructed as a drained or undrained structure. There could be a substantial cost implication and maintenance requirement between the two types of structure and hence further hydrogeological investigation and study are recommended to assist decision making.

5.1.6.5 Contamination

There is limited information about the status of ground and groundwater contamination. It is recommended that further investigation is undertaken to investigate contamination conditions of the site.

5.1.6.6 Impact on Adjacent Structures

Excavation of ground could potentially induce ground movement in the surround area. Such movement may be caused by equipment vibration, blasting, loss of ground support, etc. It is recommended that a detailed assessment of the impact of excavation induced ground movement on adjacent structures be undertaken prior to construction and appropriate remediation measures implemented to minimise and control risks of damages to the surrounding structures/utilities.

5.1.6.7 Instrumentation and Monitoring

Adequate instrumentation and monitoring should be implemented to closely monitor the performance of the project works during and post construction. An instrumentation and monitoring plan shall be developed which sets out trigger levels of the instrument readings and required actions when the trigger levels are reached.

5.2 Hydrogeology

5.2.1 Background Information

Existing information on the geology and hydrogeology was provided in Coffey's Geotechnical Report (13 January 2014, GEOTFYSH09693AA-AE) including 10 piezometers installed along Parkes Way median strip between Coranderrk St and Edinburgh Ave. The data provided in the report indicated a depth to the water table of between 3.1m and 7.2m. It was anticipated that groundwater levels would reflect the level of Lake Burley Griffin (RL 556m AHD), however monitoring indicated the groundwater level to be below the lake level.

Further hydrogeological investigation and study were undertaken by SMEC Australia Pty Ltd and the findings are presented in the report entitled "Parkes Way Upgrade, Groundwater Investigation Report, 1 April 2014", provided as Appendix C of this report.

5.2.2 Additional Investigation Undertaken

Monitoring indicated the water table was lower than Lake Burley Griffin in all but one piezometer. In addition the volume of groundwater inflow and quality for disposal purposes required further investigations to be undertaken. These consisted of:

- Cleaning the piezometers using a compressor and air line or hose and foot valve on three occasions over the course of 2 weeks. Most piezometers were found to be clogged with drill cuttings;
- Installation of pressure transducers with data logging capability to measure the water level recovery after cleaning and undertaking permeability (slug) testing;
- Collection of samples for water quality analysis; and

- Survey of the top of the piezometer casing and average ground level to confirm water level elevation.

5.2.3 Findings

5.2.3.1 Groundwater Levels

The groundwater level was confirmed to be lower than the Lake, with the exception of one borehole which is at roughly the same level. These bores were screened in fill or across the interface and may reflect perched water. The finding indicates the lake is isolated from the regional groundwater table, i.e. is perched, or there is extraction north of the road alignment which is drawing the water table down.

5.2.3.2 Hydraulic Permeability

Permeability tests were performed on nine of the ten monitoring bores using the air compressor and wattera foot valve to remove the groundwater (i.e. blow dry) where possible and then the groundwater level recovery was measured. The measured recovery, via electronic dip meter and data logger, was input into AQTESLOV Pro and assessed as a slug test. In essence the removal of groundwater was considered to be instantaneous and thus a rising head test could be performed. The aquifer model is considered to be unconfined and the solution applied was Hvorslev. Well data was determined from the construction details supplied in the Geotechnical Report and measured manual water levels.

The results of the hydraulic permeability show values with several orders of magnitude difference. Boreholes which were very muddy and continued to produce mud have the lowest permeability. This may reflect the extremely weathered nature of the rock in which they are screened, leading to very fine drill cuttings clogging the filter pack. Boreholes have the highest permeability likely represent the permeability of the less weathered siltstone. The permeability may be considered in the range from 0.1 to 0.0001 m/day with an average of 0.003 m/day.

5.2.3.3 Groundwater Chemistry

No odour or hydrocarbon sheen was observed during the development or sampling of the monitoring boreholes. TPH was not detected and the levels of heavy metals reflect the geology and are considered natural. Groundwater discharges to Lake Burley Griffin is licensed by the EPA. The following criteria may be considered a guideline for key analyses:

- Total Suspended Solids: 40mg/L in East Basin, 20mg/L in West Lake
- Total Phosphorus of 0.06mg/L
- Total Nitrogen of 1.4mg/L in East Basin and 1.0mg/L in West Lake
- pH range of 6.5 to 8.5
- TPH: 300ug/L

Note these levels are indicative only. An EPA discharge licence may have higher or lower limits and could include other parameters not listed above. These are provided as an indication of the current groundwater quality compared to the lake.

The groundwater quality results indicate that some monitoring bores exceed the Lake Burley Griffin guidelines for Total Phosphorus and Total Nitrogen. No hydrocarbon contamination was observed during sampling or in the laboratory results. Should dewatering require discharge to the lake some treatment of the water may be required unless EPA licence conditions have different levels.

5.2.4 Groundwater Modelling

5.2.4.1 Method

Anaqsim (Analytic Aquifer Simulator) is an analytical element modelling tool that allows a fast assessment of the groundwater regime and the potential impacts of definable activities on the water table. A simple one-layer Anaqsim model was developed based on the available information to:

- simulate the existing local groundwater conditions;
- assess the potential groundwater inflow during excavation activities; and
- simulate the draw-down in a post-construction scenario.

5.2.4.2 Assumptions

In the absence of a comprehensive conceptual hydrogeological model, several assumptions were made during the design process. These assumptions are based on the data and information available, which present many gaps and inconsistencies. The information collected from the site, including the bore water levels, an estimation of adjacent building basement levels and their positions relative to the groundwater table, as well as Lake Burley Griffin's stage height, do not offer a consistent picture of the local groundwater flow patterns. While Lake Burley Griffin sits at approximately 556.0m AHD, all bores read the water table lower than that level with the exception of one borehole.

This suggests a flow direction towards the bores (north) from the lake. However, the basements further north relative to the location of the bores circumstantially point to groundwater levels higher than those measured in bores (indicating a gradient toward the lake). A possible disconnect between the lake and the aquifer by an impermeable formation might explain this contradiction. In the absence of any other credible groundwater table data, away from the road line where all the bores are located, it is difficult to determine the nature of the hydrogeological regime in this locale. Therefore, the existing hydrogeological conditions have been simulated to fit the available data. All the available information point to a slight gradient from west to east and from both the lake (south) and the basements (north) to the bores (in the midsection of the model domain). This model assumes a single layer with an approximate thickness of 12 meters. This layer is isotropic, and the vertical hydraulic conductivity (Kv) is one tenth of the horizontal hydraulic conductivity (Kh). All permeability values are based on recent field measurements. After eliminating the seemingly unreliable bore data, an average permeability value of 0.003 m/d was used for parameterization of this model.

Two types of boundaries have been used in this model. The southernmost boundary represents the lake and has been set as a head-specific boundary with the value of 555.93m AHD. The northern boundary is an arbitrary boundary with a calibrated flux to simulate the lateral groundwater flow in order to simulate the available data on the groundwater table.

The model was initially manually calibrated to the known (borehole data and lake elevation) and assumed existing conditions resulting in simulation of the existing water table. To simulate the post construction conditions new head elevations were imposed on the bores which match the depth of the excavation at the bore. The resulting water table was then subtracted from the initial water table to yield the drawdown as a result of the road construction.

5.2.4.3 Inflow Assessment

To maintain the water table at the desirable level (8m below ground) a continuous flow is estimated to be extracted from each bore. Note that the water table will not be intersected at tunnel ramps – west and east extents. Based on an average permeability of 0.003 m/day the steady state inflow to the excavation is estimated to be around 1 m^3/day. The estimated inflow is steady state long term as would be expected after the excavation has been open for several weeks. Initial inflows during excavation may be an order of magnitude higher. Should the groundwater system be connected to Lake Burley Griffin or structures be intersected that are not indicated in the investigations undertaken to date then higher inflows may also be expected.

5.2.5 Comments and Recommendations

The groundwater conceptual model carries high levels of uncertainty as there is very limited information on groundwater levels surrounding the alignment. The monitoring bores installed along the alignment were exceptionally muddy and several rounds of cleaning were required before hydraulic conductivity testing could be undertaken with any certainty. The permeability of the bedrock is low, ranging from 0.0001m/day to 0.1m/day and inflows are expected to be low in the order of 1 m^3/day are anticipated into the excavation.

Whilst there are numerous car park basements north of the alignment, it is not known whether these are currently subjected to dewatering and whether they are below the groundwater table. Evidence of water seepage was observed in several of the deeper basements indicating they may be close to the groundwater table. Impacts from the excavation may reach the basements. Based on the modelling there may be a 0.5m increase in average groundwater level in this area, assuming the basements are not actively dewatering.

Groundwater sample analysis shows no evidence of hydrocarbon contamination and the quality of the water in general may be suitable for discharge to Lake Burley Griffin (under an approved EPA licence). Treatment of water before discharge would be dependent on license conditions. However, total phosphorous and nitrogen exceed the Lake Burley Griffin guideline value. Additional sampling and a broader analysis suite may be required by the EPA as part of any licence conditions.

Under the provided set of assumptions, inflows to the excavation will be small (< 1m^3/day or 0.001 L/sec). Inflows to the excavation may be controlled by either:

- conventional dewatering systems consisting of dewatering bores down each side of the excavation; or
- a series of sumps in the excavation.

A network with pumping bores could result in rapid drawdown of enough magnitude to minimise/stop the inflows into the excavation during construction. However this method would require installation of at least 20 dewatering bores to a depth of around 12m around the perimeter of the excavation. The use of sump and pump methods for control of groundwater inflows may not allow sufficient dewatering of the base of the excavation and subsequent trafficability issues. Note should the excavation be deeper than modelled or structures intercepted of high permeability the inflow to the excavation may be higher.

Other recommendations may include:

- information on the water table elevation surrounding the site should be gathered to assess the assumed groundwater gradient and elevation;
- should additional data indicate conditions which are different from that assumed in this report then the modelling should be reassessed; and

If dewatering via a conventional system be adopted additional modelling to design the system should be undertaken to optimise any installed system.

6. STORMWATER

6.1 Background

The Urban Design Strategy investigated the capacity of the existing stormwater drainage system in the City East and City West catchments. Various inadequacies in the existing stormwater drainage system were identified. These inadequacies mainly centred around the Coranderrk Street culverts and the Coranderrk pond. Realignments and augmentations were proposed to the existing system which addressed the proposed lowering of Parkes Way and the proposed urban layout whilst also improving the capacity of the existing stormwater drainage system.

In the current Feasibility Study, the stormwater realignment and augmentation measures discussed in the UDS have been refined and changes have been incorporated, as required, to suit the design changes that evolved during the course of the current study.

6.2 Basis for the Review

Initially, an acceptable pipe/culvert layout was developed to suit the new road layout. Once this was developed overland flows were checked for safe paths and flow depths. The velocity-depth product was also checked to be within tolerable limits. When these conditions were met the pipe/culvert design was further developed.

6.3 Proposed Trunk Stormwater Drainage

A Feasibility Design for the proposed trunk stormwater drainage has been developed and is depicted on the design sketches contained in Appendix A of this report, inclusive of notional conduit sizes, alignment and invert levels. Assumptions and discussion on the trunk stormwater drainage design are contained following.

6.3.1 City West Catchment

6.3.1.1 Overland Flow and Gravity System

Design of the trunk stormwater drainage system for the City West part of Parkes Way was initially based on an overland flow capacity estimation of the cross sections proposed for each cross-road running north-south.

Carriageways of Commonwealth Avenue would require a 600 dia pipe each. However, given the invert levels of the existing pipe system upstream of Parkes Way, it is infeasible to run these pipes across the trenched section of Parkes Way. The piped flows from the two carriageways will need to be diverted and accommodated in the verge space within the Parkes Way cross-section, running in a westerly direction. Larger pipes/culverts will be required for the New West road and the other cross-roads to its west.

All 'piped' flows from the cross-roads north of Parkes Way are proposed to be diverted by a culvert system towards Edinburgh Avenue. From here they are proposed to run under the Parkes Way into the West Basin.

The 600 dia pipes for Commonwealth Avenue are sized to convey the 20-year ARI flow. However, the 1200 dia pipe from the New West Road is sized for the 5-year ARI flow. This is a departure from the requirements of the current TaMS Design Standards for Urban

Infrastructure, which requires the pipe system to be sized to carry the 20-year ARI flow. The 5-year pipe has been adopted to address the constraint of not being able to run conduits across Parkes Way and to take advantage of the availability of overland flow capacity along the New West Road. This also allows the pipe/culvert sizes to be reduced to a manageable size for the available verge space.

The Marcus Clarke Street culvert is also sized for the 5-year ARI flow to take advantage of the significant overland flow carrying capacity of the road above Parkes Way and to circumvent the constraints associated with running the pipe across Parkes Way or within the void space in the Parkes Way cross section.

It is intended that major storm event overland flow generated from the City West catchment would traverse the Parkes Way over cross bridges, in particular the Marcus Clarke St bridge. The cross-sections proposed for Commonwealth Avenue, the New West Road and Marcus Clarke Street above Parkes Way have ample capacity to take any additional overland flows which could result from potential pipe blockages upstream of Parkes Way. Relevant allowances are to be made for blockages as per applicable standards. However, the estimated overland flow capacities of these cross-sections would far exceed the additional overland flow from potential blockages.

The culvert across Parkes Way which eventually discharges to the West Basin will need to be aligned to suit the development layout for West Basin. The culvert invert level at the outlet is proposed to be at 556.03, higher than the Lake Burley Griffin operating water level.

6.3.1.2 Trench Drainage and Pumping Requirements

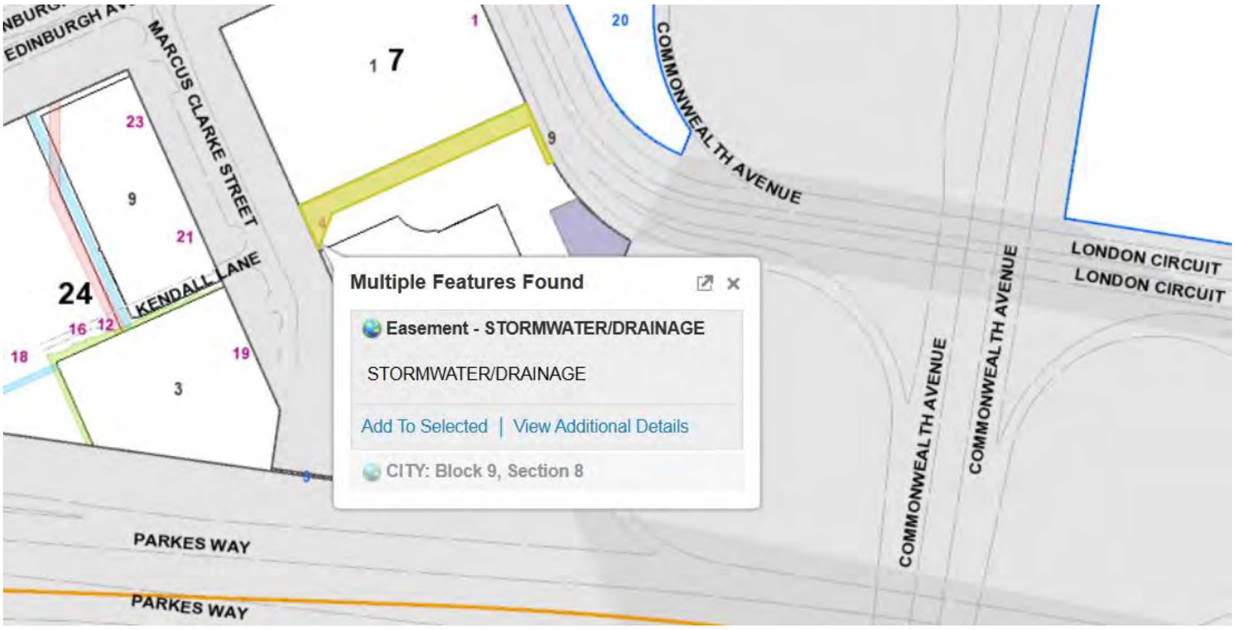
Within the trenched section of Parkes Way, sump inlets and underground pipes are proposed to have a 100-year ARI capacity. These pipes would drain towards a collection point and a pump station complete with pumps, and associated controller, electrical and other requirements will be required to pump the collected stormwater to a discharge system. Details of this system will need to be determined during detailed design.

The proposed pumps are sized for a 100-year ARI flow. Generally, a two pump system each with a capacity of 75% of the design flow is likely to be adequate. However, electricity requirements at pump start-up will need to be considered in the actual configuration of the pumps, which could result in the selection of a different number of pumps with a collective pump capacity of 150% of the design flow. A holding tank with a holding volume of 20 m^3 is proposed. This storage volume will need to be refined at detailed design stage in conjunction with the detailed design of the pumps and accessories.

6.3.1.3 Easement Requirements

It is noted that with the re-grading of Commonwealth Avenue and London Circuit, the existing location of the western low point on London Circuit will shift to the north-west. This creates a trapped low point that has the potential to confine overland flow and cause localised flooding in major storm events. As such, it is proposed that overland flow be directed down an adjacent existing stormwater easement located in City Block 9, Section 8. Based on available information on existing stormwater infrastructure, there is at least one 900mm dia pipe within this easement. As per the current DSUI, pipelines 750mm dia and larger are to be located within unleased open space or separate drainage reserves.

The local profile of London Circuit and the easement will need to be shaped in future phases of the design such that overland flow is directed down (and contained within) this easement. The location of this stormwater easement is shown in Figure 20.



Multiple Features Found

Easement - STORMWATER/DRAINAGE

STORMWATER/DRAINAGE

CITY: Block 9, Section 8

Figure 20 – Current Stormwater Easement through City Block 9, Section 8 (source ACTPAPi)

6.3.2 City East Catchment

6.3.2.1 Overland Flow and Gravity System

Design of the trunk stormwater drainage system for Coranderrk Street has been retained as previously proposed for the Urban Design Strategy. The proposed system consists of twin 3600x1200 box culverts under each carriageway. These box culverts are proposed to continue across Parkes Way and discharge at the upstream end of an existing concrete channel which drains to Nerang Pool. Structures are proposed at intermediate locations on these box culverts and where there is a change in culvert direction, for maintenance purposes. The access hatches for these structures would need to be located in the verges for safe and easy access. The UDS proposal also includes the decommissioning of the Coranderrk pond, which has been adopted for this Feasibility Study.

A majority of the pipes currently draining Parkes Way between Allara and Coranderrk Streets will require decommissioning to allow for the new Parkes Way construction. Two new 600 dia pipes are proposed along the northern and southern verges of the new Parkes Way, to the west of Coranderrk Street intersection, to replace the decommissioned assets described above.

6.3.2.2 Easement Requirements

It is noted that with the re-grading of Commonwealth Avenue and London Circuit, the existing location of the eastern low point on London Circuit will shift to the north-east. This creates a trapped low point that has the potential to confine overland flow and cause localised flooding in major storm events. As such, there will be a requirement to create a stormwater easement through City Block 16, Section 10 to allow the relief of overland flow. It is noted that this block has been identified for redevelopment as part of the City to the Lake Strategy and it is expected that this redevelopment will incorporate such an easement. The local profile of

London Circuit and the proposed easement will need to be shaped in future phases of the design such that overland flow is directed down (and contained within) the easement. The location of the proposed stormwater easement is shown in Figure 21Figure 20.

Figure 21 – Required Stormwater Easement through City Block 16, Section 10 (source ACTPAPi)

7. WATER SENSITIVE URBAN DESIGN

7.1 Background

The Urban Design Strategy reviewed previous Water Sensitive Urban Design (WSUD) strategies presented for the City East and City West catchments, and presented a new WSUD strategy for the two catchments. This strategy included WSUD initiatives to suit the realignment of the existing stormwater conduits proposed as part of the UDS, re-direction of overland flows to WSUD measures and roadways, and measures to minimise the impact of pollutants entering the lake. The strategy was based on a whole-of-catchment approach to achieve Best Management Practice (BMP) water quality targets, and was aimed at achieving positive pollutant reduction outcomes, whilst improving safe passage of floodwater through a connected network of green and blue corridors. Acknowledging that opportunities will be initially limited as the catchments are already mostly developed, the strategy included GPTs, swales, bioretention systems, ponds and water gardens, distributed throughout the catchment, but located, where feasible, close to the source of the pollutants. The measures proposed covered both public space (street reserves, promenades and public parks) as well as private blocks earmarked for future development.

As part of the Feasibility Study, the WSUD measures presented in the UDS were reviewed with respect to their suitability and effectiveness, adopting a whole-of-catchment approach. The main focus was on stormwater management for the City East catchment. In the ensuing sections of this chapter, we present the basis for our review, the approach that was adopted and the review outcomes that were achieved.

7.2 Basis for the Review

The Waterways: Water Sensitive Urban Design General Code (ACTPLA, 2007) aims to integrate the management of the total water cycle into the urban development process within the ACT. The code applies to the following:

- Development of new residential neighbourhoods and estates,
- Re-development or infill development within the existing built environment, and
- Institutional, commercial and industrial developments.

The code does not apply to existing blocks. Within the code, it is acknowledged that opportunities in existing developed areas are often constrained. WSUD measures fall under three categories:

- Mains water use reduction,
- Stormwater management, and
- Wastewater reuse.

Stormwater management covers stormwater quantity and quality. Stormwater quantity deals with peak flows and flow attenuation. Stormwater quality relates to the following:

- Gross pollutants and coarse sediment removal, and
- Fine pollutant removal.

7.2.1 *Treatment Targets*

Performance targets for stormwater quantity management have been specified for 3-month ARI and 5-year to 100-year ARI. For the 3-month ARI, post-development peak flow is to be reduced (attenuated) to pre-development levels, and the captured flow is to be released over a period of 1 to 3 days. For the 5-year to 100-year ARI, post-development flows are to be reduced to pre-development levels.

There are no performance targets set for gross pollutant and coarse sediment removal. However, the current Design Standards for Urban Infrastructure (TaMS) stipulates the trash rack to be designed for a 1-year ARI and the sediment trap to be sized for 70% retention of grain sizes equal to or greater than .04mm.

Performance targets for stormwater quality management have been specified for fine pollutant removal, and cover two cases: development and redevelopment sites and regional or catchment-wide, as given in the table below. The responsibility for meeting targets for the former lies with the developer or the builder, while responsibility for meeting the targets for the latter lies with the Government. These targets refer to reduction in pollutant export compared to an urban environment with no water quality management controls.

Pollutant Retention Targets

	TSS (% Reduction)	TP (% Reduction)	TN (% Reduction)
Regional or catchment-wide	85	70	60
Development and redevelopment sites	60	45	40

7.2.2 *Treatment Measures*

7.2.2.1 *Flow Attenuation*

Flow attenuation is generally achieved by the introduction of retardation basins at strategic locations within the catchment. These basins provide temporary storage for the stormwater, which enables the basin outflow rate to be smaller than the basin inflow rate. Flow attenuation measures target high flows in the range of 5 to 100-year ARI flows for the catchment.

7.2.2.2 *Gross Pollutant and Coarse Sediment Removal*

Gross pollutant removal is commonly achieved by trash racks designed to treat the 1-year ARI flow. Trash racks physically screen the gross pollutants and floatables whilst allowing the water to pass through. Coarse sediment removal is achieved by the introduction of sediment traps, which encourage the coarse sediments carried by the stormwater to settle to the floor by gravity. In the ACT, it has been a common practice to combine a trash rack with a sediment trap in a built-in-situ Gross Pollutant Trap (GPT). Proprietary GPTs also include components for both gross pollutant and coarse sediment removal, although commonly available proprietary models are for relatively small design flow rates.

7.2.2.3 Fine Pollutant Removal

Common fine pollutant removal measures include swales, bioretention systems, ponds and wetlands, which encourage interaction between the fine pollutants carried by the stormwater in suspended form, and plant biota. Alternatively, stormwater is made to infiltrate into and percolate through the soil profile. Fine pollutant removal schemes typically target low flows in the range of 3-month to 1-year ARI flows.

7.3 Existing Catchment

7.3.1 City West Catchment

City West catchment is approximately 45 ha in area. Existing pipes generally have the capacity convey the 20-year ARI flow up to Parkes Way and less than a 5-year ARI capacity downstream of Parkes Way, assuming no blockages in the pipes. Although overland flows are large, overland flow paths exist, particularly south of Parkes Way, to carry overland flows safely to West Basin.

There is currently no known formal stormwater flow attenuation or fine pollutant removal measures within the catchment. However, there are two Minor DUS GPTs within the median strip of Parkes Way.

It is clear that the catchment is currently lacking effective stormwater management measures, apart from some gross pollutant removal by the two GPTs. Implementing WSUD measures, wherever possible, is therefore paramount for this catchment. In undertaking a review of the UDS WSUD concept plan, those measures that are relevant and beneficial to the current project were identified for further investigation.

7.3.2 City East Catchment

The City East catchment is approximately 260ha in area for the piped system and about 480 for the overland flow system. Conduits generally have the capacity to convey the 20-year ARI flow, assuming no blockages in the conduits. Estimated overland flow rates are large and overland flow paths traverse through unleased blocks or have inadequate capacity to carry the flow safely.

Currently, there is no known formal stormwater flow attenuation, gross pollutant, coarse sediment or fine pollutant removal measures upstream of Parkes Way. The original design intent of the Coranderrk Pond at the Coranderrk Street / Parkes Way roundabout would have been to achieve gross pollutant and coarse sediment removal, and possibly some fine pollutant removal. Gross pollutants are believed to be removed monthly from the trash basket within the Coranderrk Pond. Coarse sediment removal has not been undertaken for many years due to maintenance difficulties (mainly due to the sediment trap being submerged in water), and due to environmental issues. As a result, the pond and the surrounding stormwater infrastructure are heavily sedimented, physically impacting on the flow carrying capacity of the existing twin 3600 x 2000mm box culvert on Coranderrk Street. Sedimentation of the box culverts could be due to a number of reasons, including:

- Flat (0.2%) grade of the culvert,
- Undersized sediment trap,
- Coranderrk Pond below Lake Burley Griffin and Nerang Pool water level, and

- Lack of maintenance.

The Coranderrk Pond is physically an extension of Lake Burley Griffin and Nerang Pool, as it is below the water levels of the two water bodies. The pond would provide minimal increase in fine pollutant removal compared to the pollutant removal by Lake Burley Griffin and Nerang Pool.

Therefore, the Coranderrk Pond would provide minimal, if any, flow attenuation or coarse sediment and fine sediment removal, even if it was well maintained. If the sediment trap was located above the Nerang Pool water level and kept 'dry', maintenance of the facility would have been much easier. If it was maintained, the Coranderrk Pond would have had some level of coarse sediment removal functionality, although it is likely undersized for its catchment.

It is clear that the catchment is currently lacking effective stormwater management measures, except for some gross pollutant removal at Coranderrk Pond. Implementing WSUD measures, where there are opportunities, is therefore paramount for this catchment. In undertaking a review of the UDS WSUD concept plan, those measures that are relevant and beneficial to the current project were identified for further investigation.

7.4 Review of the UDS WSUD

A summary of our findings on the feasibility of the WSUD measures proposed in the UDS is given in the table below. The locations for the WSUD measures proposed in the UDS are given in the table below. Where reported, treatment effectiveness of the WSUD measures was assessed using relevant modelling techniques. Flow attenuation effectiveness has been assessed using the XP-Rafts model. Fine pollutant removal effectiveness has been assessed using the MUSIC model.

Feasibility of the UDS WSUD Measures

ID*	Location*	WSUD measures in UDS	Review Comments
City West Catchment			
X	Marcus Clarke Street	A and B	There is room to incorporate a GPT at the corner of Marcus Clarke Street and the Parkes Boulevard. Bio retention (BR) systems and swales may be feasible along the verges of Marcus Clarke Street.
Y	West Basin	A, B and Water gardens with a permanent moisture level and biological role in later treatment stages. Ability to treat significant volumes.	Water gardens, GPTs and bio-retention systems should be feasible at the waterfront. West Basin is outside the current project area. Not relevant to this project.
City East Catchment			

1	Campbell Section 5	A	Outside City East catchment. Developer responsibility. Not relevant to this project.
2	Campbell Section 5	A	Outside City East catchment. Not relevant to this project. However, a RB and pond may be feasible.
3	Anzac Parade	B	Existing grass swales provide some pollutant retention. Major rework of Anzac Parade verges is not recommended, although it may be considered with future road or verge works.
4	Reid Oval	A and B	Site is located within the Reid Housing Precinct, a heritage listed area. It is also a heavily used sporting facility for Grade cricket and football. A pond/wetland is not feasible at this site. A retardation basin (RB) may be feasible, subject to ACT Heritage Council approval. Up to 50% reduction in 100 year peak flow can be achieved at the site, if a large basin was built. This would result in some flow attenuation up to about Constitution Avenue and negligible flow attenuation at Constitution Avenue.
5	Geerilong and Dirrawan Gardens, Reid	B	Sites fall within the Reid Housing Precinct, a heritage listed area, and within a residential neighbourhood. BR systems/grass swales may be feasible, with some modification to road crossfall and kerb, subject to Heritage Council approval. However, it is recommended that implementation of the above measures be considered and programmed to coincide with future road upgrade works.
6	Coranderrk Street and Ainslie Avenue	B	BR systems/grass swales may be feasible, with some modification to road crossfall and kerb. However, it is recommended that implementation of the above measures be programmed to coincide with future road upgrade works.
7	Block adjacent to Glebe Park	A and B	There is some underground structure at the southern end of Block 24 Section 65. It is not clear if this structure is a GPT or a water tank. In the top half of Block 24 Section 65, both a RB and a pond may be feasible at this site. Some modifications to the existing pipe system in Glebe Park will be required to divert low flows into the new pond. Further investigation will be required to ascertain the feasibility of a basin and pond. About 15% reduction in 100 year peak flow can be achieved by a basin at the site. A pond at the site would provide the following pollutant reductions at the site: ▪ TSS - 30%, ▪ TP - 26% and ▪ TN - 14%.

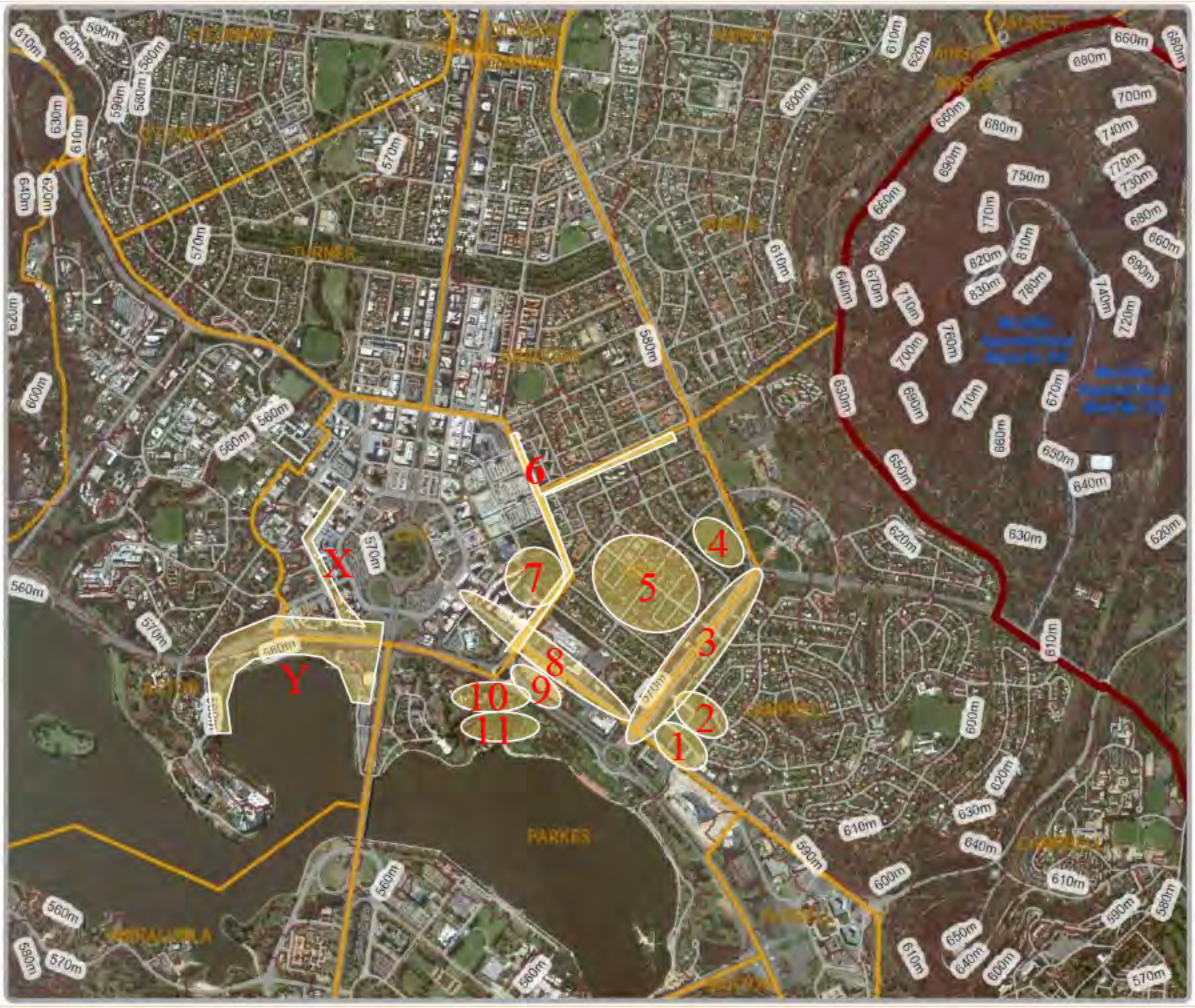
8	Constitution Avenue	B	Bioretention systems, WSUD pods and swales have been included in the SMEC design of Constitution Avenue Upgrade. Construction of these elements is expected in the very near future. Two GPTs were considered but were not included in the design. However, the stormwater conduit system is designed to accommodate a retrofit of the two GPTs. These GPTs were located on Constitution Avenue, to keep them 'dry' by having them where the conduit invert levels are above the Nerang Pool water level.
9	Parkes Section 3	A and B	Within block measures were proposed in the UDS. Developer responsibility.
10	Commonwealth Park. Channel to Nerang Pool	A	Any measure introduced at the site will become part of Nerang Pool as the new measure will be at a very low level and will be submerged by the lake water. A pond/wetland at this location would not add significant benefits to the WSUD outcome for this catchment. A sediment pond is not feasible at this location as it would become a maintenance challenge similar to the Coranderrk Pond, through inundation by lake water.
11	Commonwealth Park. Nerang Pool.	Water gardens with a permanent moisture level and biological role in later treatment stages. Ability to treat significant volumes.	Nerang Pool and the surrounding area are an important part of Commonwealth Park. Nerang Pool water level is currently only marginally higher than the LBG water level. Existing Nerang Pool would provide some fine pollutant removal and any modifications to Nerang Pool are not expected to provide any significant benefits in terms of pollutant removal. It is recommended that Nerang Pool be largely retained in its current form. Some modifications may be considered in consultation with the NCA.

Where A: Opportunities for capture, treatment and deep soil infiltration. On-site reuse within blocks. These are primarily rainwater tanks, grass swales, bioretention systems and infiltration systems.

Where B: Significant capture, treatment and reuse within the public domain along major flow lines in median, kerbside or integrated swales and dry beds. These are primarily retardation basins, ponds, wetlands, large bioretention or infiltration systems.

Where B: Significant capture, treatment and reuse within the public domain along major flow lines in median, kerbside or integrated swales and dry beds. These are primarily retardation basins, ponds, wetlands, large bioretention or infiltration systems.

** Locations of each WSUD site are indicated in Figure 22*



7.4.1 *City West Catchment*

It can be seen from the above that the WSUD measure X in the City West catchment is relevant to this project, and that WSUD measure Y is not relevant to this project. Treatment effectiveness of WSUD measure X has been estimated.

WSUD measures 1 and 2 are outside the City East catchment, and 9 is a within-block developer responsibility. These WSUD measures are therefore not relevant to this project and will not be discussed. The remaining WSUD measures were further investigated for their treatment effectiveness.

7.5 Treatment Effectiveness of the UDS WSUD Measures

A qualitative assessment of the anticipated effectiveness of the WSUD measures at the 10 remaining locations was undertaken. Their ability to provide flow attenuation, gross pollutants and coarse sediment removal, and fine pollutant removal is summarised below.

Treatment Effectiveness of the UDS WSUD Measures				
ID	**Location**	**Flow Attenuation**	**Gross Pollutants and Coarse Sediments Screening**	**Fine Pollutant Retention**
City West Catchment				
X	Marcus Clarke Street	No	Yes	Yes
City East Catchment				
3	Anzac Parade	No	No	Yes (future)
4	Reid Oval	TBC	No	No
5	Geerilong and Dirrawan Gardens, Reid	No	No	Yes (future)
6	Coranderrk Street and Ainslie Avenue	No	No	Yes (future)
7	Block adjacent to Glebe Park	Yes	Yes	Yes
8	Constitution Avenue	No	TBC	Yes
10	Commonwealth Park. Channel to Nerang Pool	No	No	No
11	Commonwealth Park. Nerang Pool.	No	No	Yes (current)

7.5.1 *City West Catchment*

The treatment effectiveness of WSUD measure X was modelled. Gross pollutant and coarse sediment removal were not modelled. For the proposed system, the pollutant reductions achieved at the southern edge of Parkes Way are given below.

It is clear that some fine pollutant removal will be achieved by the proposed measures. Although these are below the Act Government targets, they are not much below the targets.

7.5.2 *City East Catchment*

The overall catchment-wide treatment effectiveness of the WSUD measures was modelled for the City East catchment. Flow attenuation and fine pollutant removal effectiveness were assessed. Gross pollutant and coarse sediment removal were not modelled.

For the stormwater quantity modelling, the Coranderrk Pond was included in the model for the existing system. For the proposed system, retardation basins were modelled at the Reid Park and at Block 24 Section 65, next to Glebe Park. The Coranderrk Pond does not provide any flow attenuation in the existing system. For the proposed system, a basin at Reid Park would provide minimal flow attenuation at Parkes Way.

For the stormwater quality modelling of the existing system, the Coranderrk Pond was included in the model. It should be noted that the Coranderrk Pond in its current condition would not be effective in fine pollutant reduction. The results presented for the existing system are therefore for an idealised system where the Coranderrk Pond is effective in fine pollutant reduction. For the proposed system, the treatment train included the WSUD measures 3, 5, 6, 7 and 8. The pollutant reductions achieved at the southern edge of Parks Way, at the boundary of Commonwealth Park, are given below for the two cases.

Pollutant Retention Results

	TSS (% Reduction)	TP (% Reduction)	TN (% Reduction)
City West Catchment			
Proposed System with UDS Measures	70	50	35
City East Catchment			
Existing System (with Coranderrk Pond)	31	25	10
Proposed System with UDS Measures	62	45	30

It is clear from the above that the Coranderrk Pond does not provide any flow attenuation. Retardation basins at Glebe Park and Reid Park would provide flow attenuation downstream of the basins but there will be minimal attenuation at Parkes Way.

It is also clear that much improved fine pollutant reductions could be achieved by implementing the WSUD measures specified in the UDS, compared to what could be achieved by the Coranderrk Pond, even if it was functional. A pond at Block 24 Section 65 will contribute significantly towards this improved fine pollutant reduction.

7.6 Conclusions

Based on the above discussion the following conclusions can be made for the City West and City East catchments:

7.6.1 City West Catchment

- The only WSUD measures are the two GPTs which are proposed to be removed.
- There are no known flow attenuation measures. There is also minimal opportunity for introducing new measures.
- There is currently some level of gross pollutant and coarse sediment removal by the two GPTs. Implementing a new GPT at the corner of Marcus Clarke Street and Parkes Way should compensate for the loss of the two existing Minor DUS GPTs.
- The proposed system provides improved fine pollutant reductions than the existing system.

7.6.2 City East Catchment

- There are currently no known formal WSUD measures.
- The Coranderrk Pond does not provide any flow attenuation and there are no other flow attenuation measures within the catchment. There is minimal opportunity for introducing new measures that would attenuate the flow at Parkes Way, although there are opportunities which could provide localised benefits further upstream within the catchment.
- There is currently a reasonable level of gross pollutant removal at the Coranderrk Pond. However, there is minimal coarse sediment removal. Implementing the two GPTs at Constitution Avenue, in 'dry' locations and a third GPT at the upstream end of the new pond in Block 24 Section 65 would leave only the 1200 dia pipe, which runs down Booroondarra Street and continues down Coranderrk Street and drains most of Reid, untreated. It will be worthwhile exploring the possibility of introducing a GPT on the northern strip of Block 11 Section 33 (Reid CIT), within the area covered by trees. Some pipe diversions may be required for this option.
- The proposed system provides much better fine pollutant reductions than the existing system even if the existing Coranderrk Pond was assumed to be fully functional.

7.7 Recommendations

Based on the above summary and conclusions, we make the following recommendations:

- Feasibility investigation for a GPT at the corner of Marcus Clarke Street and Parkes Way is recommended.
- Feasibility investigation of a pond/wetland and retardation basin at Block 24 Section 65, adjacent to Glebe Park, is recommended. SMEC's preliminary investigation indicates that both a pond for fine pollutant removal and a retardation basin for flow attenuation would be feasible at this site. A GPT can be provided upstream of the pond for gross pollutant and coarse sediment removal.
- The two GPTs originally considered for Constitution Avenue and subsequently excluded from the Constitution Avenue Upgrade should be reconsidered.
- Feasibility investigation for a GPT on Block 11 Section 33 Reid is recommended.

8. UTILITY WORKS

The project site is a major arterial road located adjacent to a number of trunk services. The majority of the trunk utilities located within the project footprint cross Lake Burley Griffin using the Commonwealth Bridge. Consequently, they will also cross Parkes Way on their way to service the City.

Services locations discussed as part of this Feasibility Study are based on those supplied by the relevant utility authorities in response to a Dial Before You Dig (DBYD) request was conducted for the site. This was supplemented from existing knowledge gained on the recent Constitution Avenue Upgrade project.

This section of the report discusses all of the service relocation requirements associated with lowering of Parkes Way with the exclusion of stormwater. Trunk stormwater services are discussed in Section 6 of this report.

8.1 Existing Utilities

8.1.1 Sewer

Sewer plans were provided by ActewAGL in pdf format in response to the DBYD request.

These drawings indicate that the sewer network within the project extents involves operational pump station at Regatta point and a 'Trunk' gravity main at the following locations:

- 750mm in the eastern verge of Commonwealth Avenue, constructed in the 1930s within a brick tunnel;
- 600mm in the verge of Parkes Way and bisecting the Civic Pool site, also partly brick tunnel construction method; and
- 450mm in the southern verge of London Circuit (western hemisphere of the City) – which is very flat.

Discussions with ACTEW indicate that this provides services to City and Gungahlin regions.

8.1.2 Water

Water supply plans were provided by ActewAGL in pdf format in response to the DBYD request. These drawings show reticulation mains present within the project footprint at the following locations:

- 300mm in the northern verge of Parkes Way;
- 600mm in the western verge of Commonwealth Avenue;
- 675mm in the eastern verge of London Circuit (western hemisphere of the City); and
- 300mm in the eastern verge of London Circuit (eastern hemisphere of the City).

8.1.3 Gas

Gas service plans were provided by ZNX in pdf format in response to the DBYD request. These drawings show reticulation mains present within the project footprint at the following locations:

- 350mm 1050kpa in the median of Parkes Way;
- 100mm 1050kpa in the eastern verge of Allara Street;
- 100mm 1050kpa in the eastern verge of Coranderrk Street; and
- 450mm 1050kpa in the eastern verge of Marcus Clarke Street.

Preliminary discussions with local ZNX staff indicate that this is their primary network and is managed out of Sydney. Enquiries with their Sydney design team have not occurred at this stage.

8.1.4 Electricity

Electrical service locations were provided by ActewAGL in pdf format in response to the DBYD request. The drawings provided by ActewAGL indicate that there is an extensive network of LV underground street lighting cables within the project footprint. For the purposes of assessing the feasibility of the project, this Study concentrates on the High Voltage (HV) network only.

Conflicts with the HV network include:

- Three HV crossings of Parkes way, one at Allara Street and two at Marcus Clarke Street;
- HV along Allara Street;
- HV along both verges of Marcus Clarke Street;
- HV along the foreshore in west basin; and
- HV in the median of Commonwealth Avenue.

8.1.5 Telecommunications - ICON, AAPT and TransACT

A shared trench is located along Commonwealth Avenue between London Circuit and Regatta Point that is currently utilised by AAPT, ICON and TransACT. This shared trench is currently under bored beneath the Commonwealth Avenue/Parkes Way interchange within the eastern loop.

A second shared trench also exists on Coranderrk Street and along Parkes Way between there and the Kings Avenue Interchange. These cables will need relocating to enable redefining of block boundaries for Parkes Section 3.

8.1.5.1 ICON

ICON currently have fibres around London Circuit, on Constitution Avenue, along Parkes Way and within the shared trench.

Preliminary discussions indicate that ICON have a significant volume of infrastructure assets (over 2700 optic fibre cores), within the Commonwealth Avenue shared trench. Splice points are such that the Constitution Avenue works will affect approximately half of these cables.

8.1.5.2 AAPT

AAPT currently have fibres around London Circuit, on Constitution Avenue and within the shared trench.

Preliminary discussions indicate that AAPT have 144 optic fibre cores within the Commonwealth Avenue shared trench with more than half currently in use. Splice points are such that the Constitution Avenue works do not affect this cable.

8.1.5.3 TransACT

TransACT currently have fibres around London Circuit, on Constitution Avenue and within the shared trench.

Preliminary discussions indicate that TransACT have 312 optic fibre cores within the Commonwealth Avenue shared trench. Splice points are such that the Constitution Avenue works will affect some of these cables.

8.1.6 Telstra, Optus and Nextgen

A 14 conduit shared trench is located along Allara Street and through Commonwealth Park between Constitution Avenue and Regatta Point that is currently utilised by Telstra, Optus and Nextgen. This shared trench currently crosses Parkes Way with buried cables east of the existing Parkes Way pedestrian overpass at Allara Street.

8.1.6.1 Telstra

A significant volume of Telstra communication cables were located within the site. Conflicts with the Telstra network include:

- Two crossings of Parkes Way, one within the shared trench at Allara Street, the other at Marcus Clarke Street;
- Conduits along London Circuit vary between 6 and 14; and
- Also in Marcus Clarke Street and Constitution Avenue.

8.1.6.2 Optus and Nextgen

In addition to the shared trench, both Optus and Nextgen are also in London Circuit and Constitution Avenue.

8.2 Proposed Utility Works

8.2.1 Sewer Relocation

After review of the existing services, it was considered that all of the service relocations could be achieved, although a diversion of the gravity trunk sewer represented a significant challenge. Sewer is the only gravity service that had physical constraints on length and fall between the City and Regatta Point. To relocate the sewer, two options were considered:

- Realign and regrade the sewer using a micro tunnelled gravity sewer (preferred if possible); or
- Provide a new pumping station upstream of the Parkes Way realignment.

Initially, due to the depth of the Parkes Way road trench, it was considered that a gravity sewer arrangement would be difficult to achieve. So both options were investigated.

Advice from ACTEW Water indicated that the trunk sewer network includes a pumping station on Commonwealth Avenue near Regatta Point, referred to as the Commonwealth Avenue Pump Station (CAPS), and a storage facility within Commonwealth Park, referred to as Parkes Emergency Sewage Storage Tank (PESST). All of the sewers within the site of works are nearly all in excess of the nominal hydraulic capacity and will surcharge during significant storm events. Currently the PESST allows maintenance of the CAPS and also protects against such a surcharge. With the proposed development works adding additional sewer loadings and impervious area, it is likely that the PESST facility will require upgrading or supplementing.

8.2.1.1 Rising Main Sewer

Whilst this option is technically feasible, the cost associated with a new pumping station and the difficulty in finding an appropriate site north of Parkes Way (with the associated requirement to vent gas above the inversion layer) pose significant difficulties for this option.

A potential site for the pump station in the ultimate arrangement would be within the paved verge adjacent surrounding the proposed stadium site. Required venting of the sewer could using the stadium facade. However the stadium may not be delivered for several years, and relocation of the sewer needs to occur immediately to unencumber the Parkes Way site of works.

For the above reasons, this option is not preferred.

8.2.1.2 Gravity Sewer - Overview

The gravity sewer within this area is close to capacity and has very little fall. The proposed arrangement works on the premise that Commonwealth Avenue is the deepest section of the Parkes Way road trench, transitioning back to existing levels on Parkes Way at the extremities of the project. Therefore if the sewer crossings can be moved towards the extremities of the project site, where they can cross by gravity, the need for a rising main will be removed. The primary constraint for this approach is the way and extent in which the additional length of sewer affects pipe grades.

As part of this study, SMEC modelled a potential alignment for the gravity sewer, to ensure that it will physically work and that achieved grades are acceptable. Whilst this deign resulted in very flat grades for the trunk main, consultation with ACTEW Water indicated that the proposed concept was likely to be feasible (and preferred). As such, this option is preferred and has been adopted in the Feasibility Design. The alignment of the proposed trunk sewer relocation is shown in Figure 23.

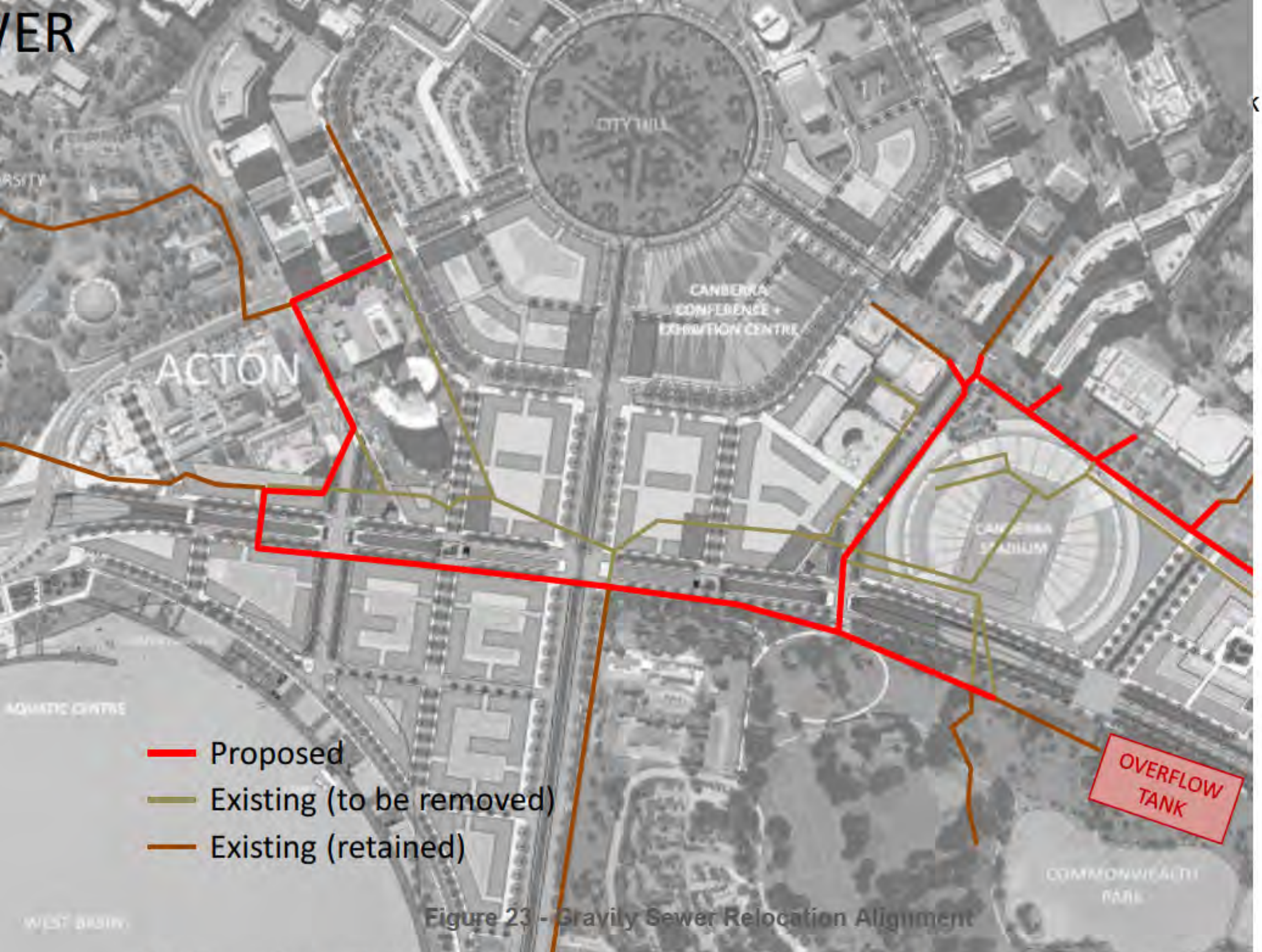


Figure 23 - Gravity Sewer Relocation Alignment

For discussions with ACTEW, the sewer relocation was split into Western and Eastern tributaries on either side of Commonwealth Avenue. The design issues and approach for each catchment is discussed following, and are to be resolved in future phases of the design.

8.2.1.3 Gravity Sewer – West of Commonwealth Avenue

- Existing sewer invert levels need to be confirmed at tie in points.
- There are a number of 90 degree manhole direction changes which are undesirable as they will create head loss. It is noted that there is limited hydraulic capacity in the existing system to accommodate increased head loss.
- To eliminate some of these 90 degree bends, ACTEW will accept skewed roadway crossings because of the design complexities. Areas to consider are:
  - Start the diversion on the north side of Edinburgh Avenue at a 45 degree angle across the road. This will remove the 90 degree bend and provide some extra grade.
  - Remove a number of manholes by cutting across Marcus Clarke street.
- The length of the diversion is to be minimised in order to provide as much grade as possible for the gravity service.
- The existing sewer has a critical control penstock that allows the Commonwealth Avenue Pump Station (CAPS) to be isolated from the west and flow to be backed up into a storage tank that is located near Barry Drive (Turner Tank). With this diversion, this penstock will need to be reconstructed in one of the new maintenance shafts. It is critical that the current operation allowing flow to back up to Turner Tank be maintained

for network protection from overflow and failure. The lid levels of the new manholes will be crucial to achieving this.

- Further discussion and agreement on the diameter of the new diversion is required.
- With the amount of development proposed in this region, some additional storage tanks to attenuate the flow will be required in this area/catchment. The Parkes tank already exists but its suitability for upgrade is unknown. Consideration may be required for possible storage tank locations, such as underneath some open public space or parkland.

8.2.1.4 Gravity Sewer – East of Commonwealth Avenue

The eastern side of Commonwealth Avenue present fewer complexities although there are two important areas that are critical in terms of the trunk sewer design.

- Design meets the requirements for the Constitution Avenue sewer redevelopment.
- The operation of the Parkes Emergency Sewage Storage Tank (PESST) on the South Side of Parkes Way. The Feasibility Design assumes the continuing operation of this asset in its current form, however we note that there is an opportunity to connect the tank from the new sewer on the south side of the Parkes Way.

8.2.2 Trunk Service Relocations

Several services may require relocation and are documented in the drawing package contained in Appendix A. It is noted that utility alignments depicted on these drawings are notional only and will require refinement and clash checking in future phases of the design. A summary of potential trunk service issues are as follows (excludes stormwater):

Proposed Utility Works	
Asset / Utility	**Relocation**
ICON	▪ Along Parkes Way between Edinburgh Av and Kings Av ▪ Along Coranderrk Street between Constitution Av and Parkes Way ▪ Along Commonwealth Av between London Circuit and Regatta Point ▪ All affected services within London Circuit ▪ Any affected services on Constitution Avenue
TransACT	▪ Along Parkes Way between Coranderrk St and Kings Av ▪ Along Coranderrk Street between Constitution Av and Parkes Way ▪ Along Commonwealth Av between London Circuit and Regatta Point ▪ All affected services within London Circuit ▪ Any affected services on Constitution Avenue
AAPT	▪ Along Parkes Way between Coranderrk St and Kings Av

	▪ Along Coranderrk Street between Constitution Av and Parkes Way ▪ Along Commonwealth Av between London Circuit and Regatta Point ▪ All affected services within London Circuit
Telstra	▪ Crossing of Parkes Way at Allara Street into Commonwealth Park. ▪ Along Marcus Clarke Street and crossing of Parkes Way ▪ All affected services within London Circuit ▪ Any affected services on Constitution Avenue
Nextgen	▪ Crossing of Parkes Way at Allara Street into Commonwealth Park. ▪ All affected services within London Circuit ▪ Any affected services on Constitution Avenue
Optus	▪ Crossing of Parkes Way at Allara Street into Commonwealth Park. ▪ All affected services within London Circuit ▪ Any affected services on Constitution Avenue
Gas	▪ Along Parkes Way between Edinburgh Street and Anzac Parade. ▪ Along Coranderrk St between Parkes Way and Constitution Avenue ▪ A crossing of Parkes Way at Commonwealth Avenue
Power (HV only)	▪ Relocation of Parkes Way crossing at Allara Street ▪ Relocation of Parkes Way crossing and realignment down Marcus Clarke Street ▪ Relocation of service on Parkes Way between Marcus Clarkes Street and Edinburgh Av. ▪ Relocation of services through west basin into the foreshore edge road between Marcus Clarke Street and Regatta Point.
Water	▪ Along Parkes way between Anzac Parade and Commonwealth Av ▪ In Commonwealth Avenue verge between Parkes Way and London Circuit ▪ Around London Circuit.
Sewer	Discussed above.

9. VARIANT 2C

The development of an alternative variant to the original Feasibility Design has been undertaken as part of the feasibility assessment process. Provided following is some context for the variant in addition to its design features, and specifically how they relate to the original Feasibility Design.

9.1 Variant Context

Following on from provision of initial cost estimates of the original Feasibility Design, the need to investigate a reduced scale version of the project was identified. The ambition of the new variant was to reduce the scale and cost of the project, whilst limiting compromises to road network performance and urban design outcomes. To this end, the project team in conjunction with EDD utilised value management principles to undertake an investigation into a number of variants of the original Feasibility Design. This process identified a preferred alternative, Variant 2c, which has subsequently been developed to a pre-concept design level and incorporated into this Feasibility Study.

9.2 Variant Description

Many of the principles that formed the basis for the original Feasibility Design have been maintained in Variant 2c. It preserves the primary objectives of:

- Creating a high amenity pedestrian and visual link between the City Centre and the West Basin foreshore; and
- Grade separation of through traffic on the Parkes Way Mainline.

The most notable differences between the original Feasibility Design and the Variant 2c design are as follows:

- Inclusion of an enclosed tunnel,
- Portal relocations,
- Revision to Boulevard cross sections,
- Deletion of Commonwealth Avenue northbound exit ramp,
- Lifting of Parkes Way Mainline vertical profile,
- Rearrangement of the boulevard / services streets east of Coranderrk St.

These amendments to the design seek to reduce the scale of the civil works, simplify construction requirements and subsequently reduce project cost. These are discussed in more detail in the following sections which focus discussion on the differences between the Feasibility Design and Variant 2c.

9.3 Road Design

There are a number of features of the proposed road design that have been amended in the Variant 2c design discussed following.

9.3.1 *Revision to Cross Sections*

The general arrangement of the cross sections (i.e. lane configurations etc) are reasonably consistent between the Feasibility Design and Variant 2c. However, Parkes Boulevard verges have been narrowed in Variant 2c, creating a narrower road corridor for a significant length of Parkes Boulevard (reduced from 45m in the Feasibility Design to 41.5m). This gifts land back to some adjacent blocks, increasing lot yield in these locations.

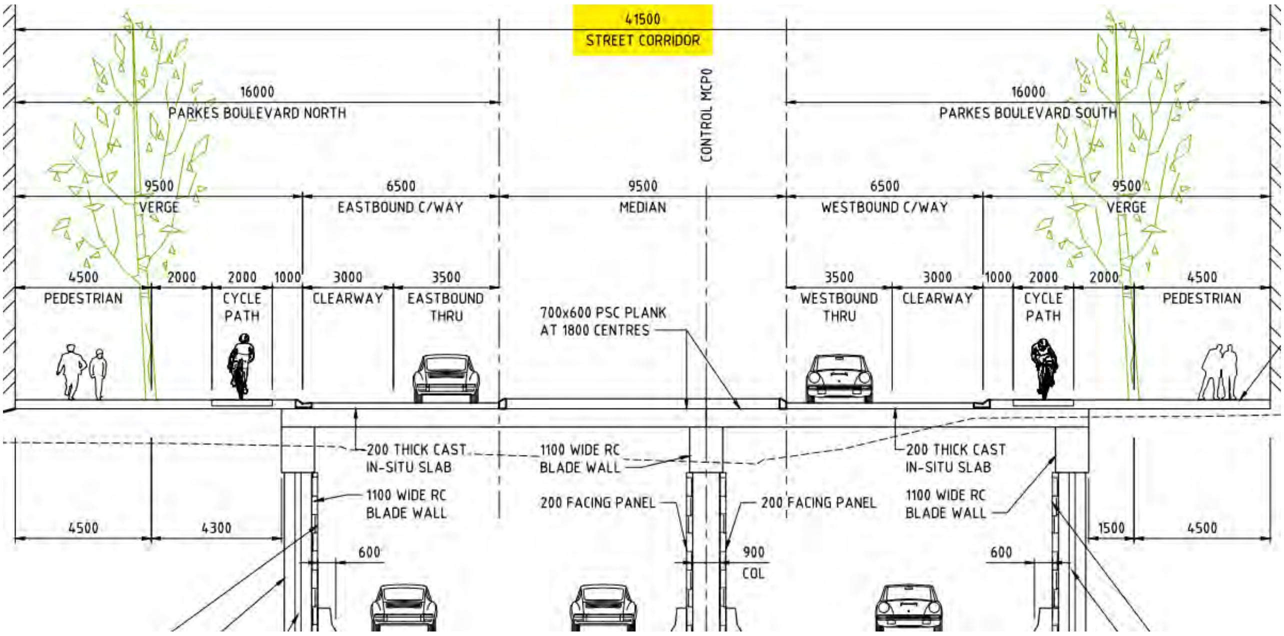


Figure 24 – Reduction in Parkes Boulevard corridor width

However, due to the relocation of the tunnel portals, and the shortening of the grade separation of Parkes Way, the Boulevard is required to flare out further to the west than was originally proposed in the Feasibility Design. In the Variant 2c design this flare takes place in the narrower part of the Boulevard corridor, rather than widen 55m zone proposed in the Feasibility Design. This has resulted on impacts on Commonwealth Park that are described below.

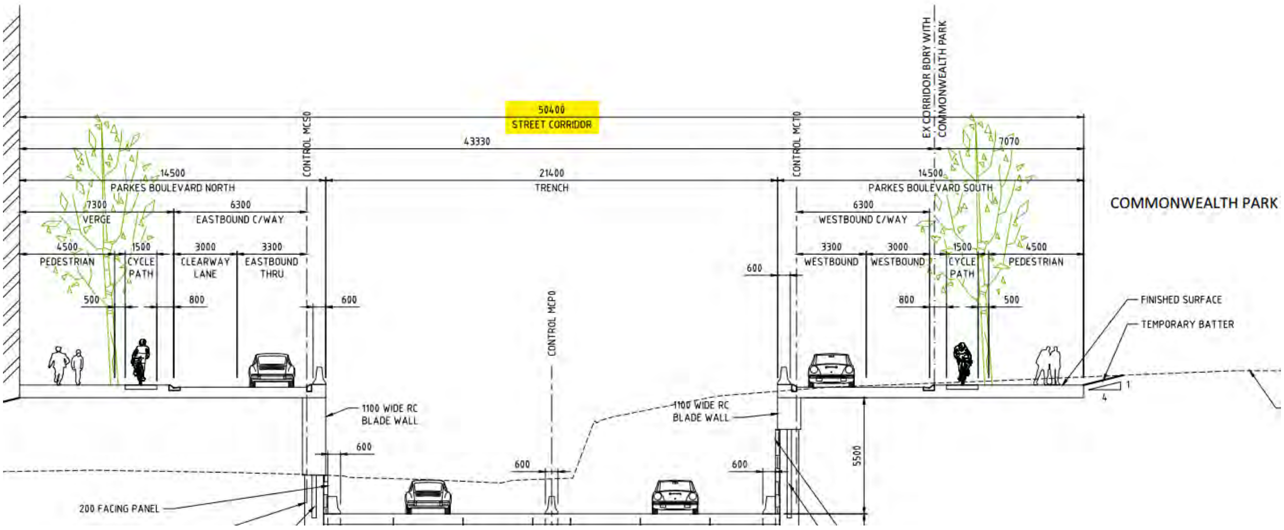


Figure 25 – Cross seciton of corridor adjacent to Commonwealth Park

9.3.2 Parkes Way Mainline Geometry

As the Parkes Way eastbound exit ramp has been changed from a flyover ramp to an underpass ramp in Variant 2c, the depth of cut required for the Parkes Way mainline has significantly reduced. The maximum depth of cut on the Parkes Way mainline in the Variant 2c design is approximately 6.7 m (max tunnel height 8.8m), compared with 12.5m in the Feasibility Design (max tunnel height 17m). Whilst the Feasibility Design generally has a more gentle vertical geometry than the Variant 2c design, it is noted that the maximum instantaneous grade of 4.5% in the Feasibility Design is actually higher than Variant 2c (4%).

It is noted that the horizontal geometry of the Parkes Way mainline is broadly similar to the feasibility Design, however reverse curves have been introduced near the western portal to accommodate a westbound entry ramp from Parkes Boulevard. The final geometry of these curves will require refinement in future phases of the design with consideration given to superelevation development and a separating tangent.

9.3.3 Parkes Way Eastbound Exit Ramp Geometry

As the eastbound exit ramp passes under the mainline in the Variant 2c design, there is a requirement to descend and then climb significantly further than in the original Feasibility Design. The descent on the ramp immediately after the divergence is a maximum of 5%. This was considered the maximum allowable grade given the requirement to decelerate and negotiate the tight curve at the base of the descent. Warning signage will be important to convey to drivers the combination of descent and horizontal curvature of the ramp.

Beyond the horizontal curvature the tunnel then climbs at 6% to join Commonwealth Avenue. This geometry was considered a reasonable compromise between the climbing grade and the need to join Commonwealth Avenue with sufficient distance to the Albert Street intersection.

In contrast to the Feasibility Design, Variant 2c proposes that the ramp merges with Commonwealth Avenue from the verge. Weave movements, urban design considerations and constructability are key considerations for the location of the ramp trench. It is also considered feasible to introduce the ramp through the median of Commonwealth Avenue, although in the median scenario access for ramp traffic to Albert St will not be possible.

9.3.4 Pedestrian Access

Pedestrian permeability across the Parkes Way corridor has been altered in the Variant 2c design. The removal of the void structures has created an open and traversable surface that allows pedestrians to filter mid-block across the boulevard. This improves pedestrian amenity between opposing blocks, between Marcus Clarke St and the New East Road.

However the deletion of the pedestrian bridge to the west of Marcus Clarke St and the truncation of the grade separation near the New East Road has removed pedestrian access across the corridor near the western extent of the site and at Allara St. As such, pedestrian amenity is reduced in these areas. It is noted that it may be possible in the future to provide pedestrian connectivity between the Civic pool site and Commonwealth Park from a podium level as part of the stadium development.

In addition, the increase in scale and the adjusted arrangement of the Commonwealth Av / Parkes Boulevard intersection proposed in the Variant 2c design will increase pedestrian crossing distances and reduce attractiveness to pedestrians.

9.3.5 Cyclist Considerations

The general approach to provision of cyclist facilities is largely unchanged between the two design options. That is, cyclists are accommodated in the precinct through a network of dedicated off-road, one way cycle paths that are located in verge areas. It is noted that some verge dimensions are altered and as such, the proposed relationship between cycle facilities and landscaping has been altered.

9.3.6 Boulevard / Service Streets East of Coranderrk St.

The Feasibility Design, consistent with the UDS, proposes to continue the Boulevard carriageways through the Coranderrk St intersection. This approach creates a complex and unusual intersection arrangement particularly in regard to eastbound left turn / through interface between the boulevard and mainline carriageways. As such a unique signal layout and phasing arrangement will be required to coordinate these movements. The Variant 2c design proposed a much simpler (and safer) arrangement at the intersection, by merging the Boulevard and mainline west (upstream) of the intersection and then providing a more conventional service road arrangement to access the Parkes Section 3 development to the east of Coranderrk St. This arrangement has been replicated on the westbound carriageway.

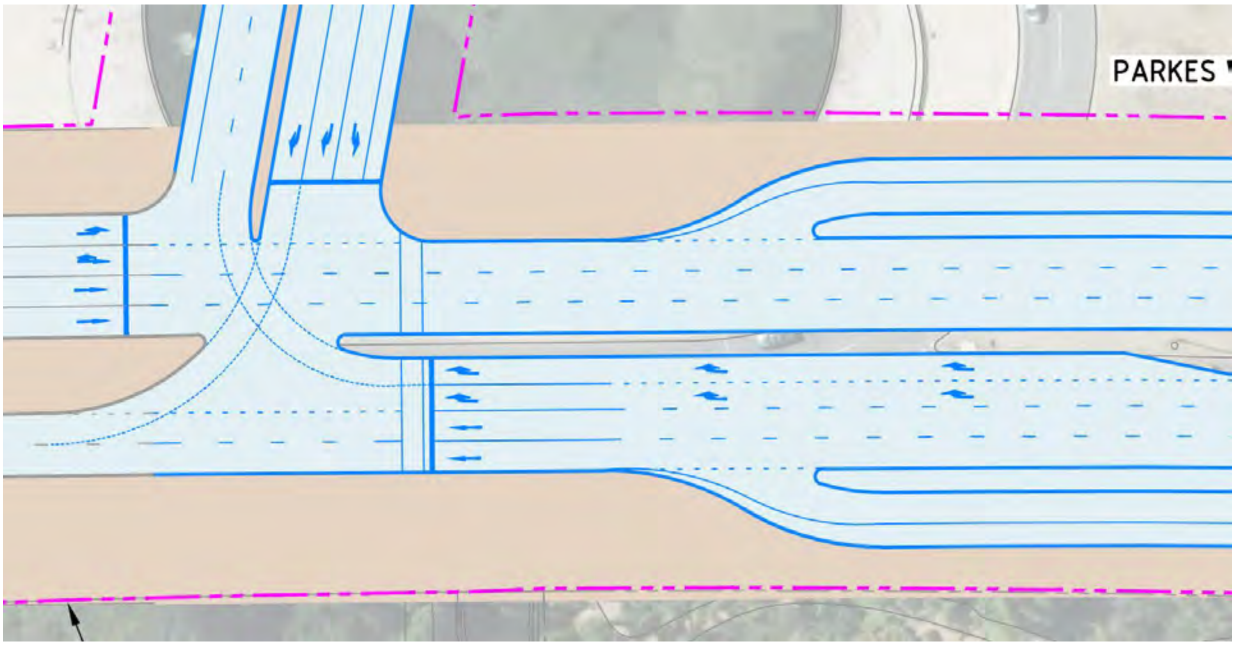


Figure 26 – Service street arrangment east of Corranderrk St

9.3.7 Eastbound Boulevard / Parkes Way Merge

Immediately to the east of the Allara St intersection, the Variant 2c design proposes a Form One Lane zip merge between the Boulevard and Parkes Way mainline carriageways. The purpose of this merge is to combine the two streams of traffic prior to the Coranderrk St intersection in order to simplify the turning movement arrangement.

Speed differential is a key consideration of this design. It is noted that the Parkes Way mainline is intended to have a posted speed of 80 kph, whereas the Parkes Boulevard is expected to be posted at 50 kph. Whilst there will be a length of carriageway available for acceleration immediately downstream of the Allara St intersection, it unlikely that there will be uniform speeds across merging vehicles. Related to this is the establishment of an appropriate merge length and its relationship to the storage requirements of the downstream Coranderrk St intersection. This issue will need to be investigated in further detail in future iterations of the design development.

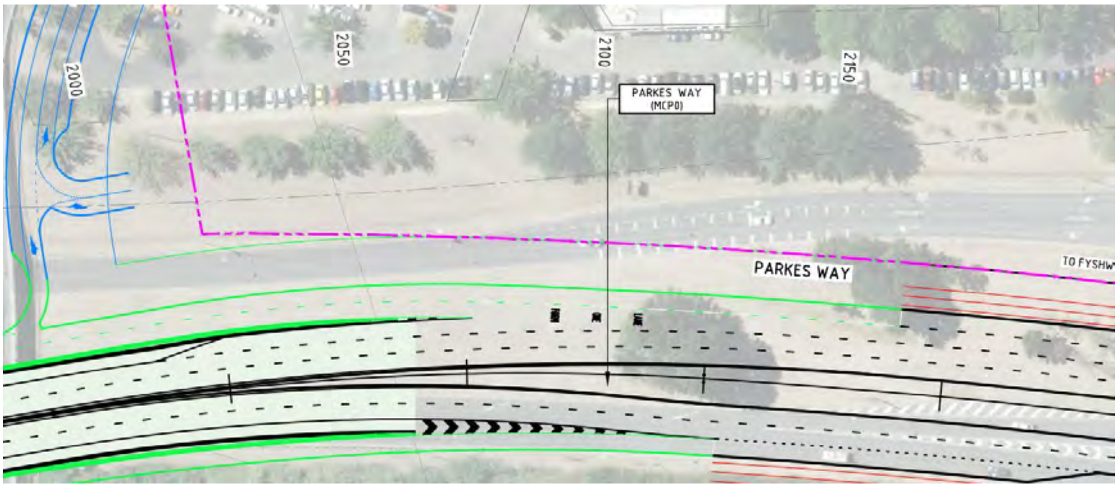


Figure 27 – Eastbound Boulevard / Parkes Way Merge

9.3.8 *Deletion of Commonwealth Avenue northbound exit ramp*

The deletion of the Commonwealth Avenue ramp connection to the westbound Parkes Way proposed in the Variant 2c design directs traffic making this movement to the Parkes Boulevard. This increased traffic has a number of implications for the Boulevard which are discussed below.

9.3.8.1 *Commonwealth Avenue / Parkes Boulevard Intersection*

Due to the demand for the south to west movement in the PM, a lot of pressure is placed on the Commonwealth Av / Parkes Boulevard intersection. In order to cater for this increased traffic the northbound leg, this intersection has been reconfigured to include a dedicated right turn lane, two through lanes and a trapped left turn lane. The left turn lane is a priority controlled high entry angle. Whilst this undermines pedestrian amenity to an extent, the project group and Roads ACT considered that it was important to maximise the capacity of this movement given the key role it plays in network performance.

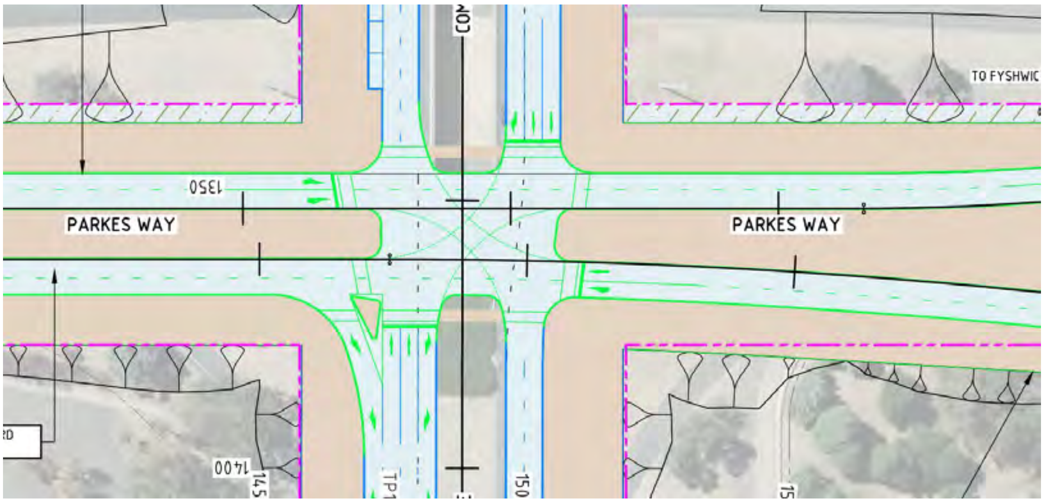


Figure 28 – Commonwealth Avenue / Parkes Boulevard Intersection

9.3.8.2 Impact on Parkes Boulevard

The Parkes Boulevard is currently proposed to operate as single lane with an additional parking / clearway lane that is operational in peak periods. Given the increased traffic on the Boulevard in Variant 2c, and depending on traffic volumes that use the westbound Boulevard during the day, it may be a requirement for two dedicated westbound through lanes (i.e. removal of provision for parking) on the Boulevard to the west of Commonwealth Avenue.

9.3.8.3 Provision of Westbound Parkes Way Entry Ramp

In an effort to avoid routing all of the increased Parkes Boulevard traffic through the Edinburgh Avenue intersection, an entry ramp to Parkes Way immediately to the west of the Marcus Clarke St intersection has been added. The provision of this ramp will be particularly important during the PM when the Edinburgh Avenue intersection is heavily loaded with vehicles leaving the City looking to join Parkes Way westbound. This ramp will reduce the volume of westbound traffic moving through the Edinburgh Av intersection.

9.3.9 Turn Movement Controls

Due to the removal of the free flow ramp connection between Commonwealth Avenue northbound and Parkes Way westbound, a significant increase in traffic on the westbound Parkes Boulevard has been predicted by the traffic modelling. This redistributes traffic to the Boulevard intersections to the west of Commonwealth Avenue, significantly increasing congestion. In an effort to mitigate this affect, a collection of turn movement controls have been proposed in the Variant 2c design, primarily relating to right turn bans. The objective of these controls is to simplify signal phasing and increase green time of the remaining movements, hence improving intersection performance and reducing congestion. The identified turn movement controls have attempted to find a balance between network performance and appropriate access throughout the City to the Lake precinct.

In addition, given the important network role that both Marcus Clarke St and Edinburgh Avenue play in the management of traffic, the need to include a westbound right hand turn at the Marcus Clarke St intersection has been identified (refer Figure 29). The inclusion of this turn lane relieves pressure on the both the Marcus Clarke St and the Edinburgh Avenue intersections on Parkes Boulevard, improving their performance.

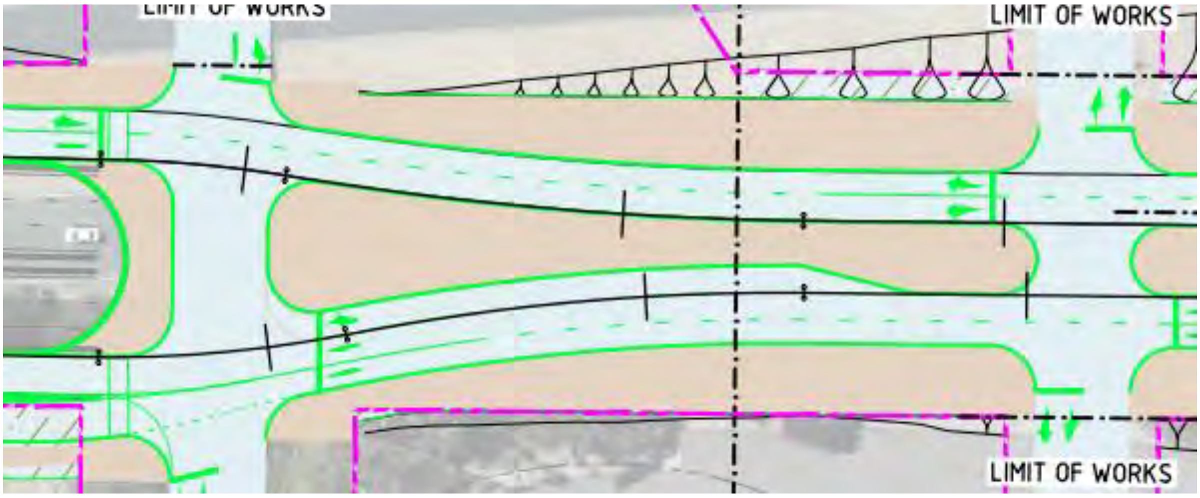


Figure 29 – Parkes Boulevard right turn slip lane at Marcus Clarke St intersection

9.4 Structural Design

9.4.1 *Tunnel Structure*

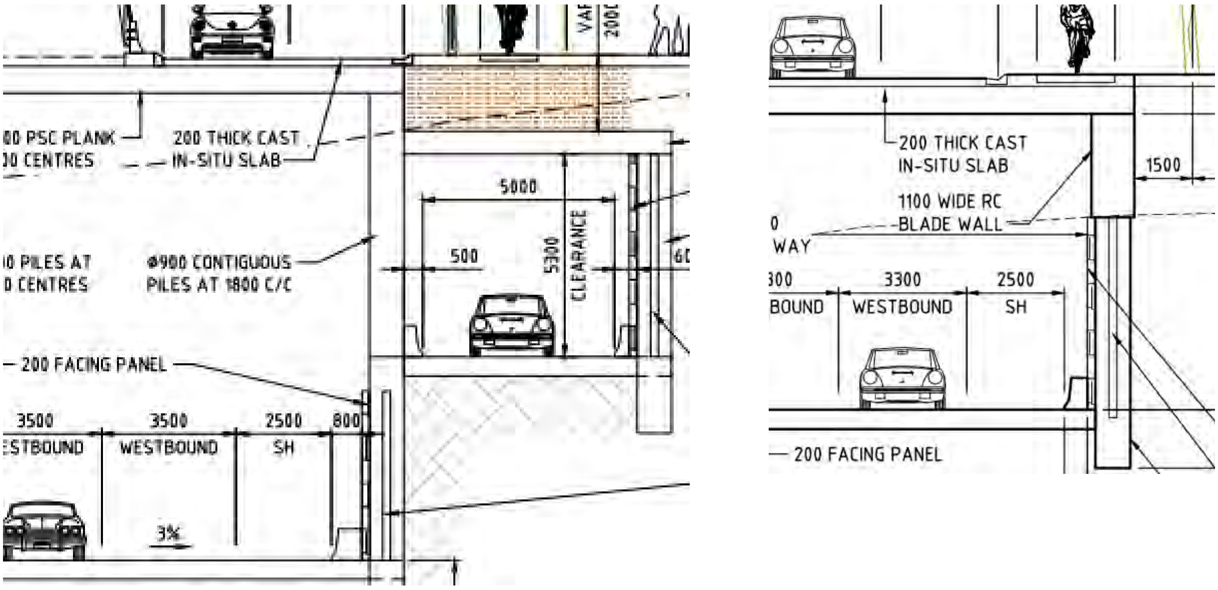
As Variant 2c proposes a fully enclosed cut and cover tunnel structure, in place of the partly enclosed voided structure proposed in the Feasibility Design, the Variant 2c cross section will require a larger area of cast in-situ slab. It is expected that the Variant 2c cost associated with this additional slab area will be more than offset by the reduction in tunnel length and the deletion of the concrete up stand barriers required to create the void proposed in the original Feasibility Design.

9.4.2 *Throw Screens*

The removal of the vent openings proposed in the Feasibility Design removes the need to include throw screens in these areas. Whilst there may remain a need to include throw screens at the portal locations, the extent of throw screens in the Variant 2c design has been significantly reduced compared to the original Feasibility Design.

9.4.3 *Retaining Wall Heights*

As the Parkes Way vertical alignment is significantly deeper in the Feasibility Design, more retaining wall area (longer contiguous piles) is required (see Figure 30 below). In reducing the cut depth, Variant 2c saves on the required retaining structures and as such reduced cost.


Feasibility Design Retaining Walls

Variant 2c Retaining Walls

Figure 30 – Comparative retaining wall heights

9.4.4 *Portal Relocations*

The proposed portals for the Parkes Way mainline have been relocated in the Variant 2c design, creating a shorter length of grade separated carriageway. This reduces the scale of the structure required and hence the overall project cost.

The relocation of the eastern portal removes the connection of Allara St to the westbound carriageway to the Parkes Boulevard, reducing connectivity of the road and pedestrian network.

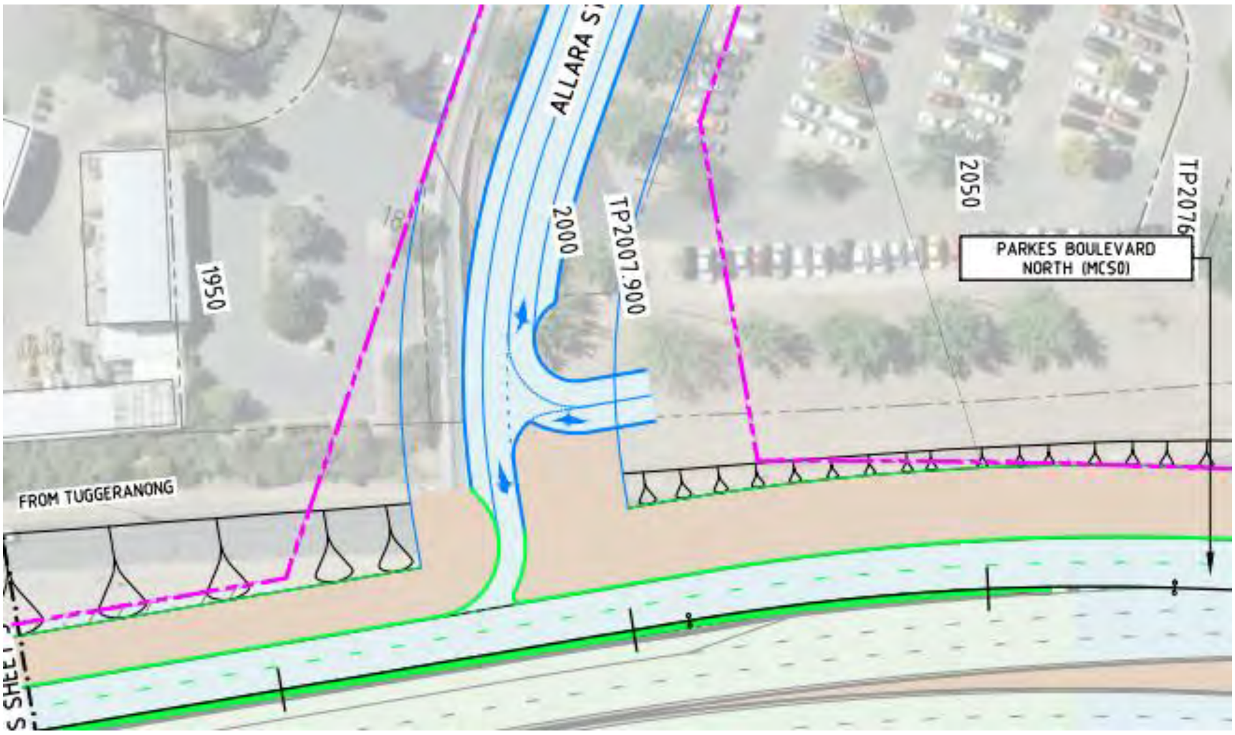


Figure 31 – Allara St intersecftion with parkes Bouldevard

9.5 Tunnel design

9.5.1 Inclusion of an Enclosed Tunnel

The Feasibility Design provided ventilation openings above the lowered Parkes Way mainline creating a partially enclosed tunnel. The objective of this approach was to ensure that the roadway would have passive ventilation, minimising mechanical plant requirements. However, providing a 450m fully enclosed will increase the requirements mechanical ventilation and emergency deluge requirements. A detailed investigation into the Variant 2c tunnel system requirements does not form part of the scope of this Feasibility Study, however it is understood that they will be investigated in detail as part of a future separate engagement.

9.6 Geotechnical Design

The primary impact of the Variant 2c design on geotechnical design relates to the reduction in cut depth associated with the lowered Parkes Way relative to the Feasibility Design. Decreased depth of cut will reduce the volume of water ingress into the cut (decreasing sub soil drainage and pumping requirements) and reducing the volume of non-rippable (shown in red in Figure 32) and marginal rock (yellow) that is required to be removed from the trench cut.

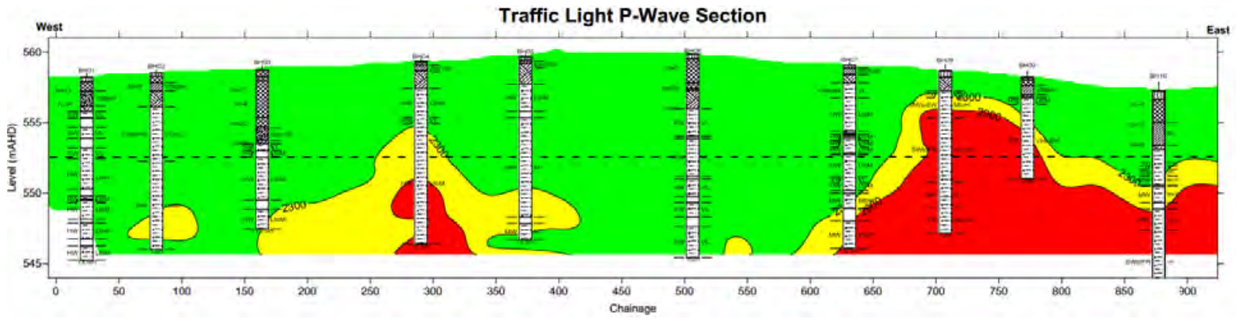


Figure 32 – Rippbility of Subgrade on Parkes Way Alignment

9.7 Stormwater & WSUD

Variant 2c is considered likely to have similar requirements with respect to stormwater drainage and water sensitive urban design. Minor changes to the Feasibility Design may include:

- Parkes Way Mainline Pavement Drainage - The inclusion of a fully enclosed tunnel may reduce the requirements of the pavement drainage system on the Parkes Way mainline as no direct rainfall will land on the road surface. Conversely, drainage requirements on the Boulevard may increase.
- Overland Flow - Managing overland flow across the Parkes Way corridor may be simplified relative to the Feasibility Design due to the removal of the voids.

Other than these minor alterations, it is considered likely that the stormwater regime will be largely consistent between the two options.

9.8 Utilities

Similar to the requirements for stormwater drainage, it is considered likely that the majority of the utility relocations are likely to be similar across the two options. An exception to this is the sewer relocation requirements. The Feasibility Design requires a diversion of the two 750mm gravity sewer mains due to the reduced depth of the cut trench for the Parkes Way mainline. The reduction in depth of the Variant 2c mainline cut has allowed the retention of the existing deep 750 mm gravity sewer across the Parkes Way corridor (previously severed in the Feasibility Design). This removes a significant portion of overall project sewer relocation works. The majority of sewer relocations indicated in the Variant 2c relate to the unencumberance of adjacent lots.

9.9 Impacts on Proposed Lot Boundaries

9.9.1 Reduction in Lot Yields

Due to the realignment of the Parkes Boulevard corridor, the required revised boundaries will reduce the size of a number of blocks in the City to the Lake precinct. These blocks are expected to include:

- Two southern Parkes Boulevard blocks to the west of Marcus Clarke St
- The northern Parkes Boulevard block to the immediate west of Marcus Clarke St

9.9.2 Increase in Lot Yields

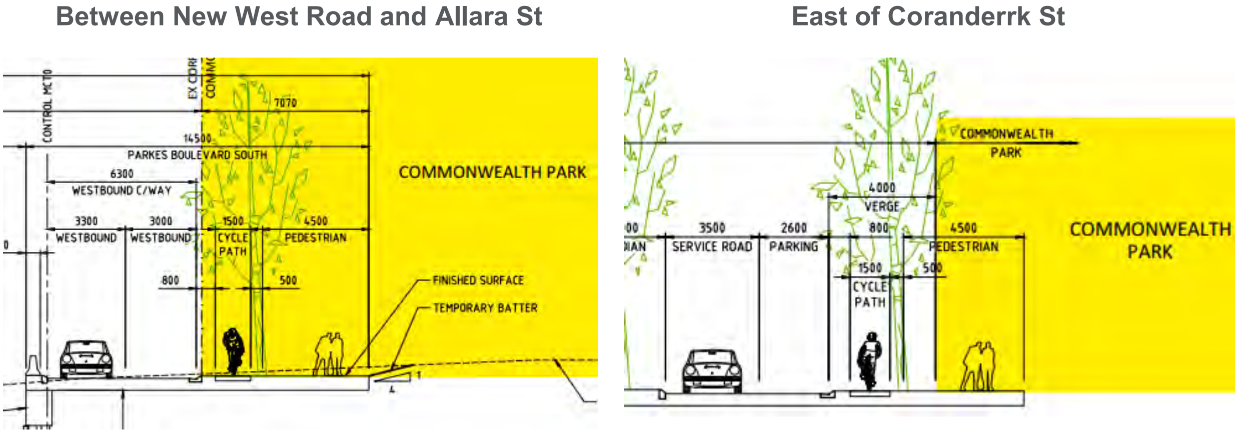
Due to the narrowing of the proposed Parkes Boulevard corridor, the four northern blocks fronting Parkes Boulevard between Marcus Clarke St and Allara St will increase in size.

9.9.3 Impacts on Commonwealth Park

As result of the footprint requirements of the Parkes Way and Parkes Boulevard proposed in Variant 2c, footpath verge areas are proposed to be incorporated into Commonwealth Park. This occurs in two locations:

- New West Road to Allara St - tunnel portal relocation proposed in Variant 2c, and the need to flare the Boulevard a between the New East Road and Allara St, the footprint of the project has increased in this area. As such, the verge area inclusive of cycle facilities, footpath and landscaping has been incorporated into Commonwealth Park.
- East of Coranderrk St – Due to the number of lanes required east of Coranderrk St and the design to implement tree planting in medians in this area, the requried cross section of Parkes Way and the associated services roads requires that part of the verge area, inclusive of footpath and landscaping, to be incorporated into Commonwealth Park.

It is noted that advice from the landscape and urban design team confirms the appropriateness of this approach given the ability to develop landscape designs in the verge that compliments the park area.



Between New West Road and Allara St

East of Coranderrk St

Figure 33 – Cross seciton of corridor adjacent to Commonwealth Park

APPENDIX A:
FEASIBILITY DESIGN SKETCHES

APPENDIX B:
VARIANT 2C DESIGN SKETCHES

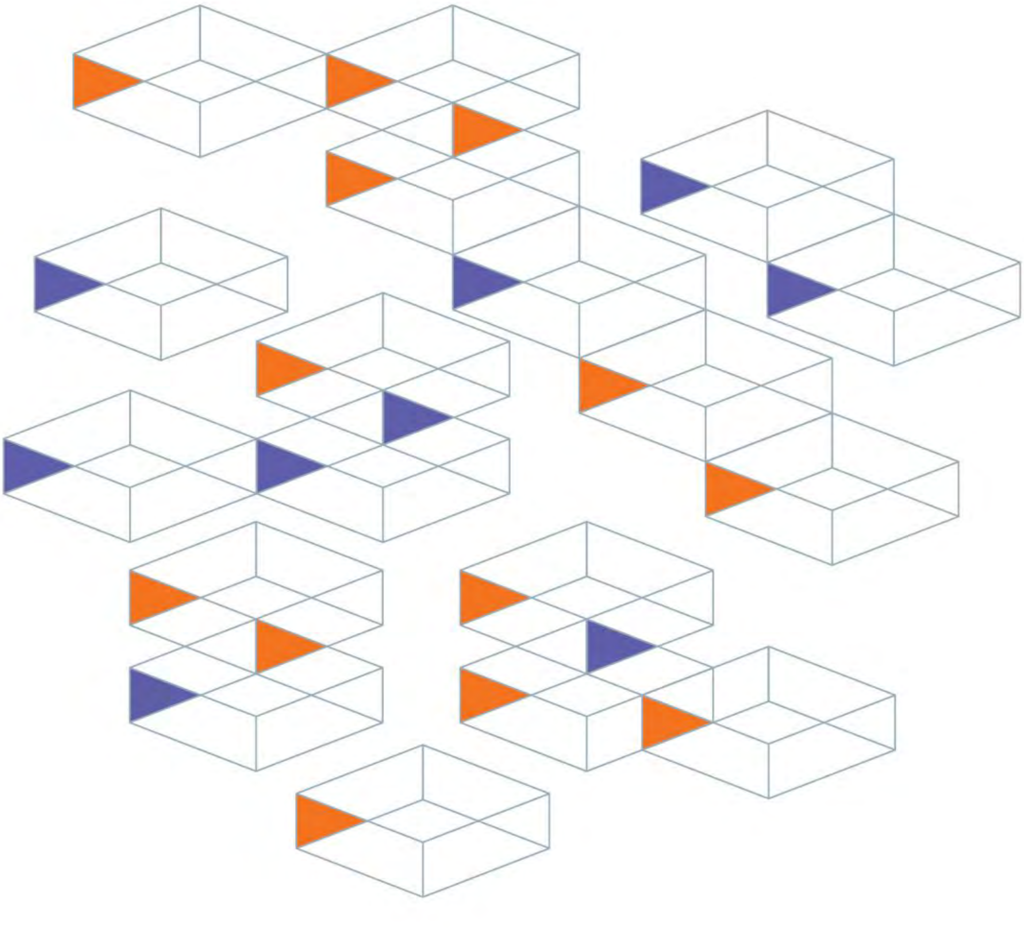
APPENDIX C
GEOTECHNICAL INVESTIGATION

ACT Government – Commerce and Works

Parkes Way Geotechnical Profiling (Linking City to the Lake)

Geotechnical Investigation Report

13 January 2014



Boundaries
are set by those
who are afraid
to push them

13 January 2014

ACT Government - Commerce and Works
Macarthur House
12 Wattle Street
LYNEHAM ACT 2602

Attention: Joanne Makela

Dear Madam,

RE: Parkes Way Geotechnical Profiling (Linking City to the Lake) Geotechnical Investigation Report

Coffey Geotechnics Pty Ltd (Coffey) is pleased to present the results of our geotechnical investigation for the proposed lowering of a section of Parkes Way - required as part of the overall future planned Linking City to the Lake development.

The document following the text of the report entitled "Important Information about Your Coffey Report" forms an integral part of this report and presents additional information about the uses and limitations of the report.

If you have any questions related to the report, or we can be of any further assistance, please contact Bernice Cahill or the undersigned on (02) 6260 7288.

For and on behalf of Coffey

Sch 2.2(a)(ii)

Sch 2.2(a)(ii)

Project Engineering Geologist / Canberra Manager

Distribution:	Original held by Coffey
	Three hard copies and Electronic copy to ACT Government - Commerce and Works

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Figures

Appendices

References

Building Seismic Safety Council (BSSC), 2001. *2000 Edition, NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, FEMA-368*, Part 1

(Provisions): developed for the Federal Emergency Management Agency, Washington, D.C.

1 INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Coffey Geotechnics Pty Ltd (Coffey) on behalf of ACT Government – Commerce and Works for the proposed lowering of Parkes Way as part of the overall future planned Linking City to the Lake development.

The investigation was undertaken in general accordance with the alternative scope of work presented in our initial proposal submission; reference GEOTFYSH09693AA-AA, dated 3 December 2013, and subsequent clarifications. The investigation was commissioned by ACT Government – Commerce and Works under an ACT Government Construction Related Services Agreement, dated 7 November 2013 between ACT Government and Coffey.

This report presents the results of the investigation including borehole logs, core photographs, laboratory test results and a description of subsurface conditions.

In addition to information obtained during our recent field investigations, the following documents were referred to in preparation of this report:

- Shared Services Procurement, "Project Brief", 16 September 2013;
- Shared Services Procurement, "Tender Addendum 1", 27 September 2013;
- Shared Services Procurement, "Tender Addendum 2", 27 March 2012; and
- Various existing geotechnical reports held by Coffey.

The overall objectives for the geotechnical profiling works were to provide information on the following:

- Assessment of subsurface conditions along the alignment in terms of:
    - Presence, nature and thickness of soils (alluvium / fill / residual)
    - Depth and nature of bedrock
    - Groundwater conditions
- Identify features such as major faulting and/or deep alluvial channels (where observed);
- Provide information to assist with an assessment of excavatability.

2 PROJECT APPRECIATION

We understand that the Linking City to Lake Project is a key initiative for the City Plan and a powerful catalyst for transforming Central Canberra. The project is seen as a way to bring the lake and city together, and in the process create a memorable and robust public domain and facilities so that it can evolve to become a place that is more attractive to residents and visitors alike. Pivotal to the success of the overall City to Lake Project is the lowering of Parkes Way which is the subject of this study.

The Parkes Way project requires extensive relocation of buried services, a deep cut and cover tunnel and successful interaction with existing infrastructure. There is currently no specific or approved concept design; however it is envisaged that the project will involve the following main elements/requirements:

- Excavations in the order of up to 8m below existing surface levels;
- Protection of adjacent structures/assets;

- Relocation of buried services within the road corridor; and
- Potential tanking of the excavation to prevent groundwater inflow.

3 SITE CONDITIONS

3.1 The Site

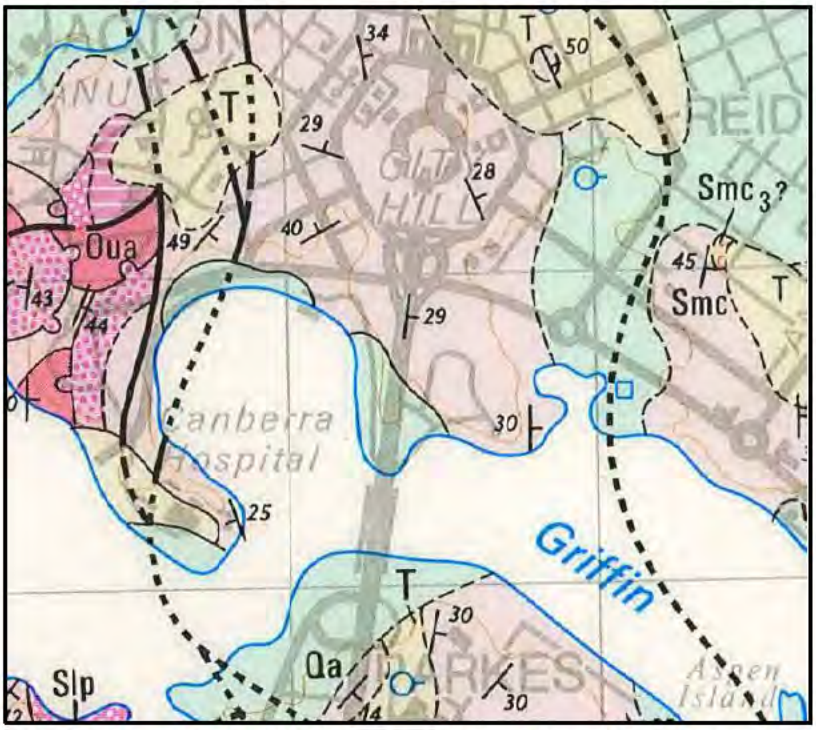
The section of Parkes Way subject of this investigation is located immediately to the south of Canberra CBD, extending approximately 450m to the east and west of the Commonwealth Avenue overpass, with a total length of approximately 900m (refer Figure 1). The site is generally level over the length of the alignment, with a slight fall observed towards to the east and west of Commonwealth Avenue. Two pedestrian footbridges pass over the Parkes Way alignment towards the eastern and western site extents in addition the Commonwealth Avenue.

3.2 Local Geology

The 1:50,000 Geological Map of Canberra (refer extract 1 below) indicates that the site is generally bound by two major faults orientated north south, comprising the Acton Fault beyond the western alignment extent and the Oakes Fault beyond the eastern alignment extent. Further unmapped minor faulting is expected within the study area with a similar orientation.

The majority of the Parkes Way alignment area is expected to be within the Canberra Formation with a high possibility of alluvial soils towards the eastern and western extents.

The geological sheet indicates a general dip of the bedrock to the south-east, with the sedimentary Canberra Formation dipping at approximately 30°.



Extract 1: 1:50,000 Geological Map of Canberra

Table 1 – Geological Map Legend

Legend	Era	Period	Epoch	Lithology
Qa	Cenezoic	Quaternary	-	Gravel, sand, silty clay and black organic clay.
Smc	Paleozoic	Silurian	Wenlock	Canberra Formation – Calcareous shale, limestone, sandstone and tuff.
Qua	Paleozoic	Ordovician	Late Ordovician	Pittman Formation, Acton Shale Member – Grey to black, siliceous, graptolitic, laminated shale.

3.3 Groundwater

Groundwater levels are expected to reflect water levels within Lake Burley Griffin adjacent to the south of the Parkes Way alignment at an approximate reduced level of 556m AHD.

4 METHOD OF INVESTIGATION

4.1 Fieldwork

All fieldwork was carried out within the grassed median between the existing eastbound and westbound traffic lanes of Parkes Way. Traffic control measures were provided in accordance with the project Traffic Management Plan (TMP), reviewed and approved by Roads ACT ahead of the works.

4.1.1 Geophysical Investigation

The geophysics fieldwork was conducted during the day from 25 November to 28 November 2013.

This fieldwork involved non-destructive seismic testing and was completed in accordance with industry practice and Coffey's Quality System (ISO 9001 accredited). Field operations were supported by approved Environmental and Safe Work Method Statements and Operational Health and Safety Plans.

Fieldwork was carried out in the presence of an experienced geophysicist. All reasonable measures were undertaken to ensure the acquisition of good quality data that were adequate for analysis and interpretation. In general, these measures included:

- Daily assessment and monitoring of short term and long term weather forecasts;
- Adherence to QA procedures and QC checks on all acquired geophysical and position data;
- OHS reporting of all incidents and near misses; and
- Completion of daily toolbox meeting, vehicle prestart checklists and client work permit procedures.

No reportable incidents occurred during the geophysical fieldwork.

Once onsite, the Coffey geophysicist assessed the seismic line locations. The start and end of the seismic line and each seismic source location were positioned using a Navcom DGPS attached to the vehicle with a nominal -/+ 1 metre accuracy. All relevant positional offsets were measured and applied during the processing of the positioning data.

Figure 1 shows the seismic line location along Parkes Way with the boreholes and relative chainages. Surface elevations along the alignment were provided by an independent surveyor.

Table 2 lists the geographic co-ordinates of the seismic line.

Table 2 Seismic line start and end points

Seismic Line ID	Start Chainage (m)	Easting (m)	Northing (m)	End Chainage (m)	Easting (m)	Northing (m)
Seismic line	0	693080	6093216	924	693990	6093053

4.1.1.1 Rapid Seismic Refraction (RSR) and Rapid Seismic Shear-wave Testing (RSST)

Both P-wave and S-wave seismic data were acquired using Coffey's Rapid Seismic Testing Method (RSTM). This involves both RSR and RSST testing and was completed concurrently in accordance with Coffey accepted practices. The data were acquired with two Geometrics Geode 24 channel seismographs and was digitally recorded using Geometrics Multiple Geode Operating Software (MGOS) using a sampling rate of 31.5 microseconds and 0.25 milliseconds for RSR and RSST respectively.

The seismic array comprised 48 geophones at 1 metre spacing. As such, the overall length of each RSTM array spread was 47 metres. An 11 geophone overlap was used between adjoining 48-channel seismic spreads. For RSR acquisition seismic sources were at 8m intervals with an offset off each end of the seismic spread in accordance with accepted practice to provide full reverse coverage. During RSST acquisition, seismic sources were offset from one end of the array at each spread location.

Seismic energy was provided using a metal plate placed on the ground surface and impacted by a sledge-hammer. The successive hammer impacts were stacked by the seismograph until clear P-wave seismic first arrivals were observed on the digital display of the seismograph.

Photos 1 and 2 show the field system in use on Parkes Way.

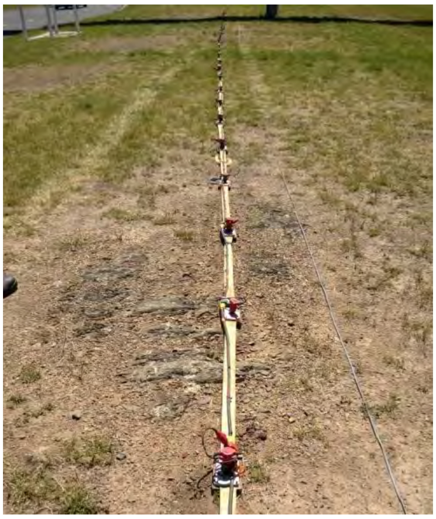


Photo 1 Onsite Geophone array showing individual geophones

Photo 2 Onsite seismic array with sledgehammer

4.1.2 Borehole Investigation

Fieldwork for the borehole investigation was carried out between 2 and 6 December 2013 and comprised the drilling of ten boreholes (BH01 to BH10) to depths of between 7.5m and 15m. Boreholes were positioned to target areas of potential geotechnical uncertainty based on initial review of the geophysical data, such as the possible presence of alluvial soils, and/or areas of deeper weathering within bedrock. The approximate borehole locations are shown on the Investigation Location Plan presented as Figure 1.

All boreholes were drilled using a Multi-drill truck trailer mounted drilling rig. The boreholes were initially advanced using solid flight augers and a Tungsten Carbide (TC) drill bit. Following TC refusal, all boreholes were continued using NQ diamond rock coring techniques to the reported termination depths.

Groundwater inflows and soil moisture content observed during drilling were recorded on the Engineering Borehole Logs.

On completion of auger/core drilling, standpipe piezometers were installed within each borehole to allow subsequent monitoring of groundwater levels. Details regarding borehole termination and standpipe piezometer installation are provided in Table 2 below.

Table 3 – Borehole Termination and Piezometer Installation Details

Borehole ID	Termination Depth (m)	Screen Interval (m)	Filter Pack Interval (m)
BH01	13.5	4.5 - 13.5	3.5 - 13.5
BH02	13	4 - 13	3 - 13
BH03	11.7	3 - 12	2 - 12
BH04	13.5	4.5 - 13.5	3.5 - 13.5
BH05	13.5	4.5 - 13.5	3.5 - 13.5
BH06	15	6 - 15	5 - 15
BH07	13.5	4.5 - 13.5	3.5 - 13.5
BH08	12	3 - 12	2 - 12
BH09	7.5	1.5 - 7.5	0.5 - 7.5
BH10	15	6-15	5 - 15

All piezometers were constructed using a combination of slotted and blank PVC casing, with generally between 3m to 6m of slotted PVC from the base of the borehole, extended to surface using blank PVC casing. The annulus between the PVC casing and the well bore was filled with graded sand and bentonite.

Borehole drilling was observed by a Coffey Geotechnical Engineer who was present throughout the drilling operations to undertake sampling and testing, record test results and log materials encountered. The Engineering Logs of the boreholes are provided in Appendix A, together with Coffey soil and rock explanation sheets which describe the terms and symbols used in log preparation.

The approximate ground levels at the borehole locations have been inferred based on review of client supplied survey data for the site.

Following completion of fieldwork, recovered rock core was photographed and Point Load Strength testing undertaken at approximately 1m intervals to assess rock strength. The Point Load Strength Index testing results are presented on the Engineering Borehole Logs in Appendix A.

4.1.3 Groundwater Monitoring

All groundwater monitoring wells were purged 1 week after installation to remove drilling fluids from the casing and surrounding formation as much as practicable. A subsequent groundwater monitoring event was carried out on 16 December 2013, the results of which are presented within Section 5.2.

4.2 Geophysical Data Processing and Analysis

The acquired digital seismic data were of good quality and adequate for analysis and interpretation. Each digital seismic record was examined on computer and analysed and interpreted in accordance with accepted industry practice.

First arrival times for the RSR data were determined interactively using FBPICK software (RMA, NSW) and interpreted using tomographic inversion software (RAYFRACT) assuming a continuous vertical seismic velocity variation with depth wavefront eikonal tomography with a smoothed initial model. The continuous model is appropriate for soils and weathered rocks that have seismic velocities gradually increasing with depth.

The RSST data analysis was completed using in-house software and in accordance with accepted practice. This data was transformed using dispersion analysis and S-wave velocities were determined by interactively interpreting individual primary mode dispersion curves using a numerical Rayleigh wave modelling procedure and linearised optimisations with SurfSeis™ software. This produced a 1D S-wave velocity-depth section at the centre of each RSST spread location. These results are then combined to create 2D S-wave velocity sections.

5 RESULTS OF INVESTIGATION

5.1 Subsurface Conditions

Table 4 below provides a summary of subsurface conditions observed at the site. For specific detail on encountered subsurface conditions reference should be made to the attached Engineering Borehole Logs (Appendix A).

Table 4 – Summary of Subsurface Conditions

Unit ID	Origin	Material Description	RL Range Top of Unit (m AHD)	Depth Range to Top of Unit (m)	Range of Unit Thickness (m)
1	Fill - Topsoil	Sandy/Silty CLAY or Clayey SILT, low to medium plasticity	557.3 - 560	0	0.1 - 0.6 (Where observed)
2	Fill	Variable, comprising: Gravelly/Silty/Sandy CLAY, typically of medium to high plasticity **or** Sandy SILT / Silty SAND, medium grained	556.6 - 559.8	0 - 0.6	0 - 3.7 (Where observed)
3	Residual Soil	Silty/Sandy CLAY, medium to high plasticity, typically of stiff to very stiff consistency	555 - 559.2	0.2 - 4.2	0.5 - 1.7 (Where observed)
4a	Siltstone Bedrock	Extremely to highly weathered	553.3 - 559.5	0.3 - 5.2	0.7 - unproven

Unit ID	Origin	Material Description	RL Range Top of Unit (m AHD)	Depth Range to Top of Unit (m)	Range of Unit Thickness (m)
4b	Siltstone Bedrock	Moderately to slightly weathered (BH05, BH07, BH08 & BH10 only)	547.7 - 557.2	1.6 - 11.5	1.6 - unproven
4c	Siltstone Bedrock	Slightly weathered to fresh (BH08, BH09 & BH10 only)	547 - 556.4	1.9 - 10.3	Unproven

The depths and layer thicknesses of the geological units provided in Table 4 are based on subsurface conditions at the borehole locations only and may not represent all areas of the site.

In summary, a relatively deep weathering profile was observed within bedrock over the majority of the alignment, with lesser weathered and higher strength bedrock observed towards the eastern site extent.

The geological sheet indicates that the site is generally bound by two major faults orientated north south, comprising the Acton Fault beyond the western alignment extent and the Oakes Fault beyond the eastern alignment extent. Further unmapped minor faulting is expected within the study area with a similar orientation.

5.2 Results of Groundwater Monitoring

Table 5 summarises the results of a groundwater monitoring event carried out by Coffey on 16 December 2013.

Table 5 – Summary of Groundwater Level Monitoring Results

Borehole ID	Borehole Collar Level (RL m AHD)	Monitored Groundwater Level (RL m AHD)	Monitored Depth to Groundwater (m)
BH01	558.3	551.2	7.1
BH02	558.6	554.4	4.2
BH03	558.8	555.7	3.1
BH04	559.5	554.3	5.2
BH05	559.8	552.6	7.2
BH06	560	552.8	7.2
BH07	559.2	553.6	5.6
BH08	558.8	553.5	5.3
BH09	558.3	552.9	5.4
BH10	557.3	551.8	5.5

5.3 Geophysics Results

The results of both the RSR and RSST are presented as an interpreted P-wave velocity section in Figure 2 (RSR) and the RSST results are presented as an interpreted S-wave velocity section in Figure 3 (RSST). These sections extend from the ground surface to well below the initial cut level that is shown as a dashed line on these Figures.

The geotechnical borehole logs are also shown on Figures 2 and 3. The geotechnical boreholes encountered materials at differing depths ranging from soils to extremely weathered soft rock to fresh siltstone rock. These are represented on Figure 2 by P-wave velocities ranging from 600 to 5000 m/s and on Figure 3 by S-wave velocities ranging from 150 to 1500 m/s. These velocities increase with depth and are consistent with the materials encountered in the boreholes.

Table 6 provides a site specific correlation of the P and S wave seismic velocities with the materials in the boreholes. The NEHRP[1] classification of these materials based on the S-wave has been added to this table for completeness should above ground construction be considered along this alignment.

On Figure 2 and 3 the 1600 m/s and 2400 m/s P-wave seismic velocity contours have been highlighted. The 1600 m/s appears to coincide reasonably with the change from EW to MW siltstone. Similarly, the 2400 m/s P-wave velocity appears to follow the approximate change from MW to SW siltstone.

The P-wave seismic velocities are relatively low to considerable depth between Ch. 450 to 600 and this represents a possible shear or fault zone.

Table 6 Correlation of P and S-wave velocities with borehole logs

P-Wave		S-Wave	
P-Wave Velocity (m/s)	**Site Specific Correlation**	**V_s (m/s)**	**NEHRP[1] Classification**
500-1600	Sandy clay, clays, extremely weathered (EW) siltstone	180-360	D
1600-2400	Highly Weathered (HW) to Medium Weathered (MW) siltstone	360-760	C
2400-2900	Medium Weathered (MW) to Slightly Weathered (SW) siltstone	760-1000	B
2900-5000	Fresh (F) Siltstone	>1000	A

---

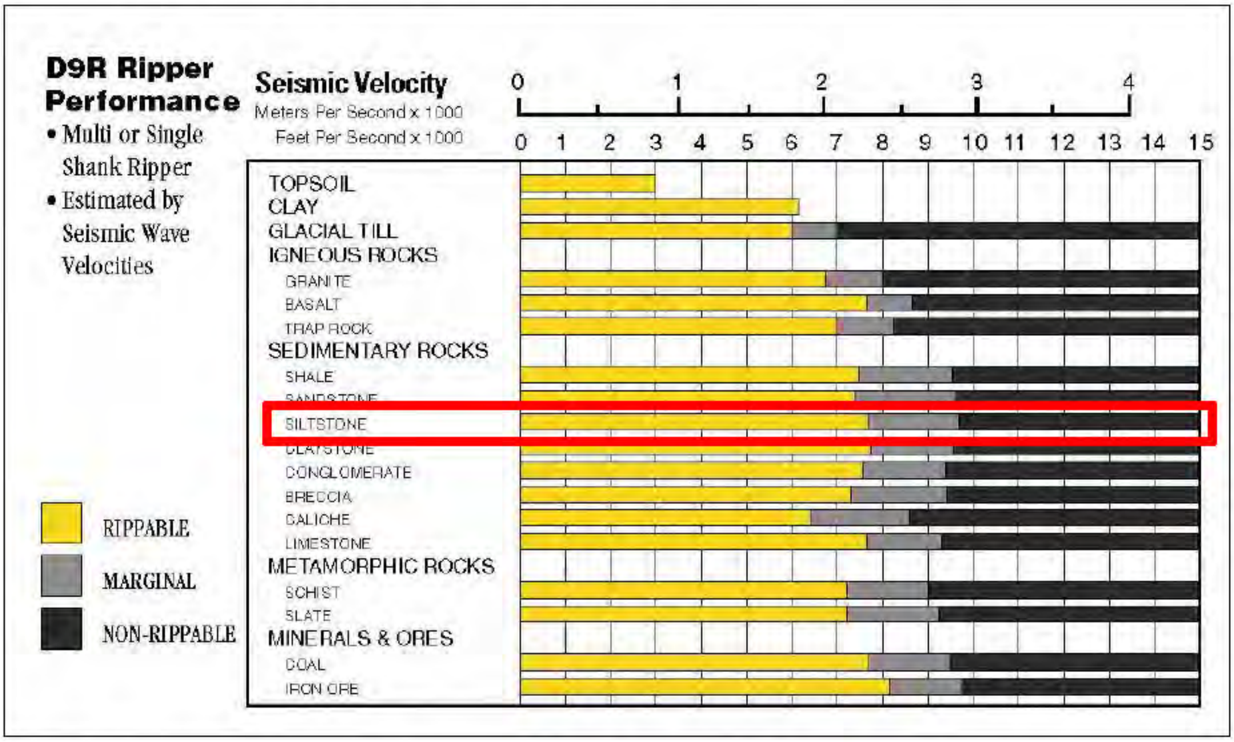
[1] Building Seismic Safety Council (BSSC), 2001. *2000 Edition, NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, FEMA-368*, Part 1

(Provisions): developed for the Federal Emergency Management Agency, Washington, D.C.

5.3.1.1 Rippability Guideline

The excavation characteristics of a given material are controlled by a number of factors. Seismic velocity is only one of the factors. It is beyond the scope of this report to evaluate all these contributing factors and caution should be exercised in applying the following guideline without careful consideration of the actual materials at and within individual cuts.

As we have no knowledge of the excavation method to be undertaken the following is a rippability guideline based on the Caterpillar rippability charts for a D9R dozer and material described as siltstone. This is based on P-wave velocity only and is shown in Extract 2. Please note that the use of this Caterpillar Charts should not be taken as Coffey's endorsement of these charts as additional site assessment is required to provide a rippability assessment.



Extract 2 Ripper performance D9R (from Caterpillar Handbook of Ripping ed.13,2000)

Table 7 provides a rippability guideline to the approximate cut level shown on Figure 4.

Figure 4 provides a "traffic light" P-wave velocity section within the various velocity ranges i.e. rippable, marginal ripping and unrippable for siltstones from Extract 2.

Table 7 Rippability Guideline for a D9R based on P-wave seismic velocities from Extract 1.

Seismic Velocity (m/s)	Inferred Geology from Borehole Logs	Rippability Guideline
<2300	Residual soils, sandy clays, clayey silts and extremely to highly weathered siltstone.	Rippable
2300 - 2900	Medium weathered siltstone	Marginal Ripping
>2900	Slightly weathered to fresh Siltstone	Unrippable

Figure 4 shows the approximate distribution of these velocity ranges and indicates that marginal ripping can be expected for a region at the base of the proposed cut near Ch. 300 and both marginal and unrippable conditions can be expected from relatively shallow depth from about Ch. 650 to 800.

6 FUTURE INVESTIGATIONS AND LIMITATIONS

Subsurface conditions can be complex, vary over relatively short distances and over time. The inferred geotechnical model and recommendations in this report are based on limited subsurface investigations at discrete locations. The engineering logs of boreholes describe subsurface conditions only at the investigation locations.

Additional investigations may be required to support detailed design due to factors such as scope limitations and changes to the nature of the project. A geotechnical engineer should be engaged to assist with detailed design and/or to review designs. During construction a geotechnical engineer should verify that conditions exposed are consistent with design assumptions. Dependent on the limitations of this geotechnical investigation and final excavation depths, a detailed assessment of rippability may be required to assess excavation requirements particularly towards the eastern extent of the alignment.

Additional investigation could include additional boreholes at locations that are currently inaccessible, packer tests for assessing permeability of various rock zones to assist with excavation retention design and inclined boreholes to investigate the potential for minor faulting and sheared zones.

Though not encountered in boreholes drilled during this investigation, the geological sheet for Canberra indicates that limestone, sandstone and tuff is also known to occur with the Canberra Formation. Where present, these rock types could present further issues for excavation in the form of potential voids or bands of higher strength bedrock than that observed for siltstone.

Detailed analysis will be required to assess effective methods of excavation retention, groundwater control and potential effects of any excavation induced ground movements on existing structures and infrastructure.

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Important information about your **Coffey** Report

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction,
speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

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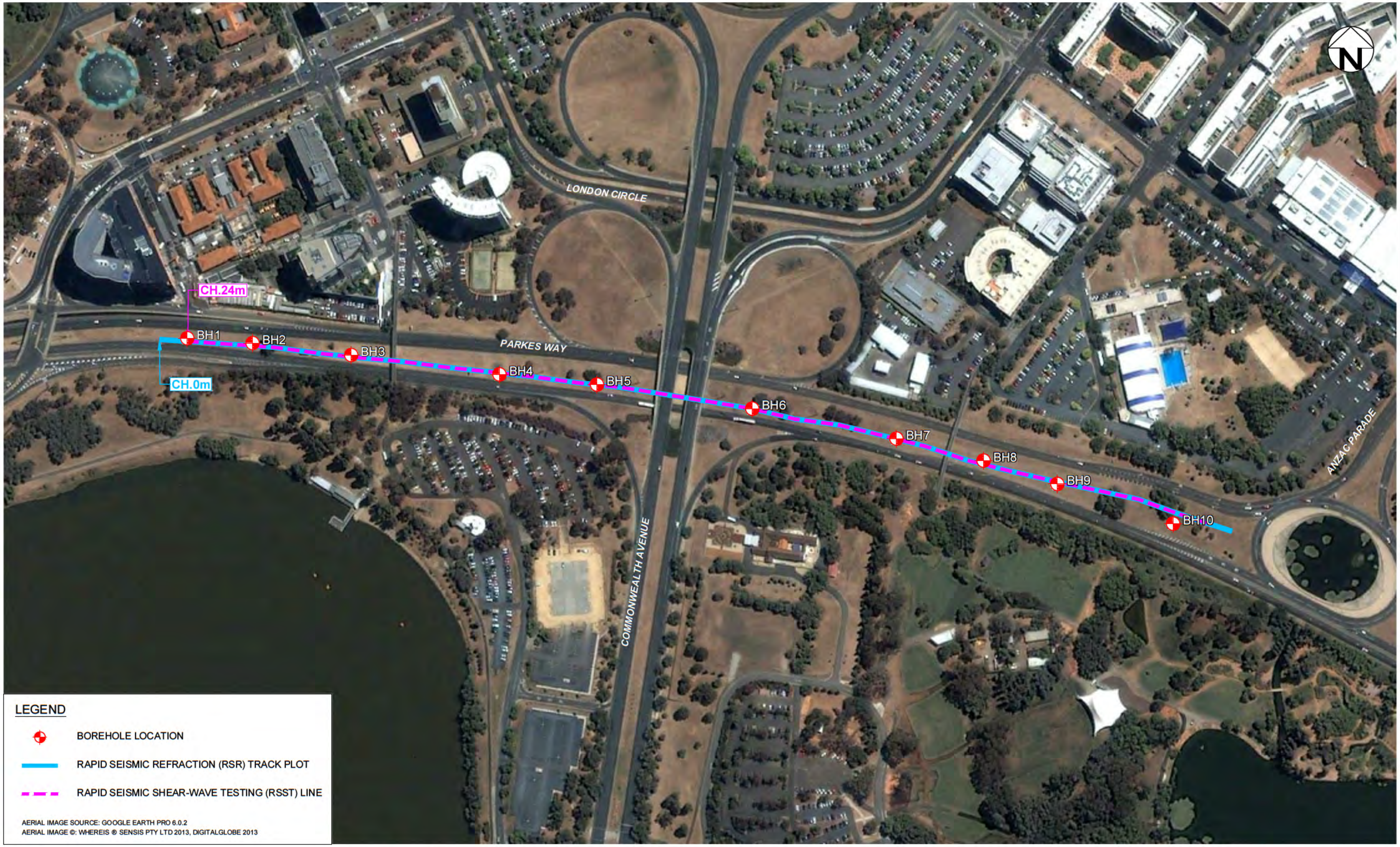
* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

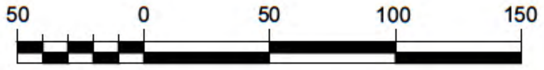
Figures



AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 6.0.2
AERIAL IMAGE ©: WHEREIS ® SENSIS PTY LTD 2013, DIGITALGLOBE 2013

no.	description	drawn	approved	date

revision



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approved	DB
date	19 / 12 / 13
scale	1:3000
original size	A3

coffey

client: ACT GOVERNMENT SHARED SERVICES

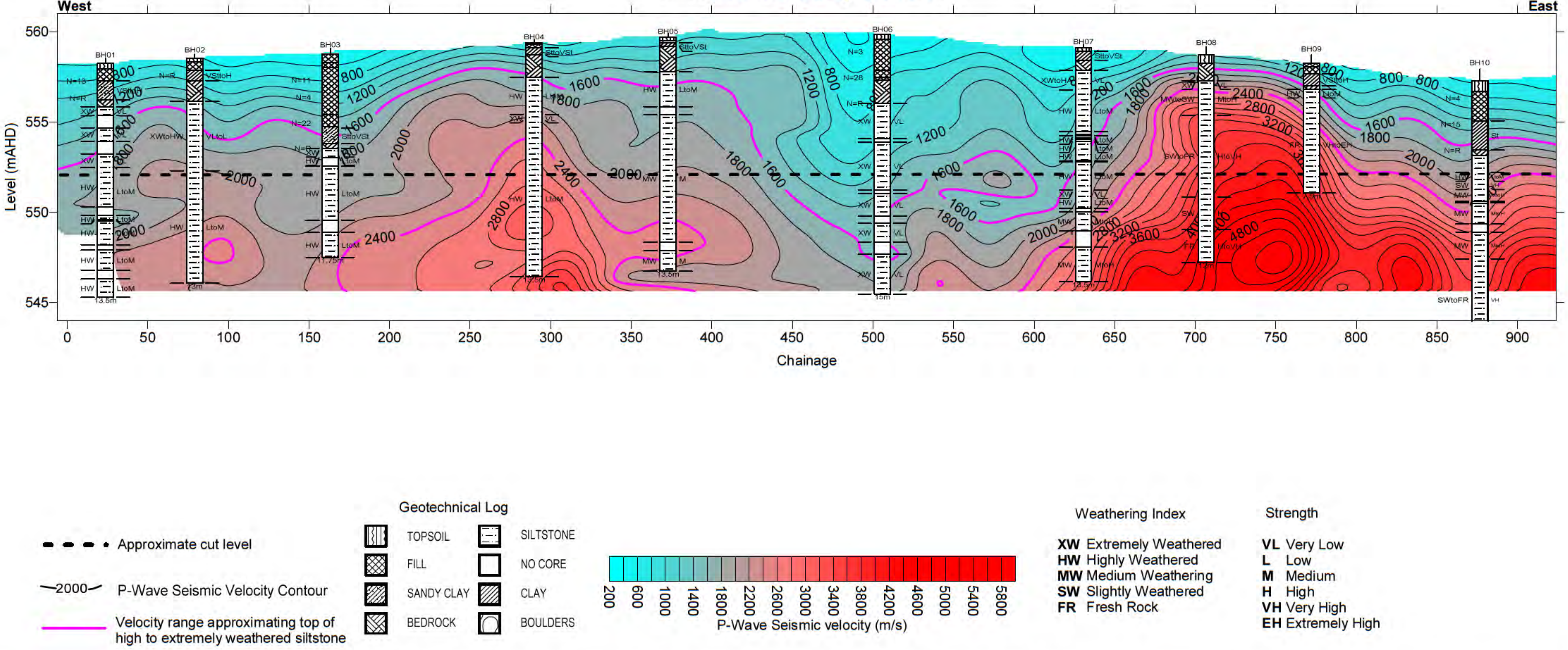
project: PARKES WAY GEOTECHNICAL PROFILING
PARKES WAY, PARKES, ACT

title: GEOPHYSICAL INVESTIGATION LOCATION PLAN

project no: GEOTFYSH09693AA
figure no: FIGURE 1
rev: A

PLOT DATE: 19/12/2013 4:48:45 PM DWG FILE: F:\GEOTECHNICS\1.PROJECTS\OTHER OFFICE JOBS\CANBERRA\GEOTFYSH09693AA PARKES WAY\FIGURES\CAD\GEOTFYSH09693AA-GEOP.DWG

P-Wave Velocity Section



revision	description	drawn	approved	date

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Horizontal Scale

0 5 10 15
Vertical Scale

drawn	PH
approved	RJW
date	16/12/2013
scale	AS SHOWN
original size	A3

coffey

client: AUSTRALIAN CAPITAL TERRITORY

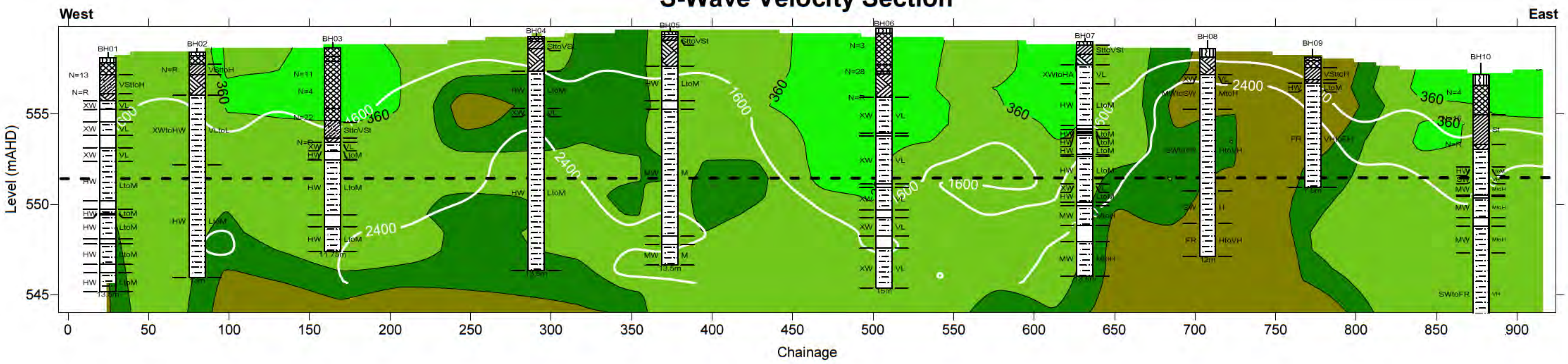
project: PARKES WAY GEOTECHNICAL PROFILING
(LINKING CITY TO THE LAKE)

title: P-WAVE SECTION

project no: GEOTFYSH09693AA

figure no: FIGURE 2

S-Wave Velocity Section



- - - - Approximate cut level

— 600 — S-Wave Seismic Velocity Contour

—2000— P-Wave Seismic Velocity Contours

Geotechnical Log

▥	TOPSOIL	▤	SILTSTONE
▩	FILL	☐	NO CORE
▨	SANDY CLAY	▨	CLAY
▩	BEDROCK	◯	BOULDERS

NEHRP CLASSIFICATION*

D	C	B	A
🟩	🟩	🟩	🟫

180 360 760 1000

S-Wave Seismic Velocity (m/s)

Weathering Index

XW Extremely Weathered
HW Highly Weathered
MW Medium Weathering
SW Slightly Weathered
FR Fresh Rock

Strength

VL Very Low
L Low
M Medium
H High
VH Very High
EH Extremely High

* Refer to table 5 in report GEOTFYSH09693AA-AD for inferred geology

revision	description	drawn	approved	date

0 50 100 150
Horizontal Scale

0 5 10 15
Vertical Scale

drawn	PH
approved	RJW
date	16/12/2013
scale	AS SHOWN
original size	A3

coffey

client: AUSTRALIAN CAPITAL TERRITORY

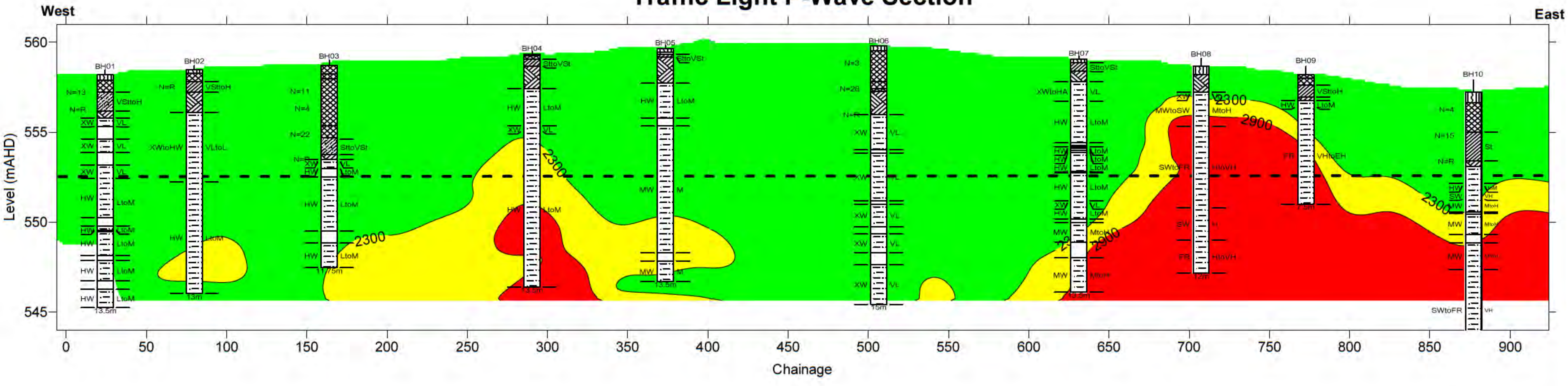
project: PARKES WAY GEOTECHNICAL PROFILING (LINKING CITY TO THE LAKE)

title: S-WAVE SEISMIC SECTION

project no: GEOTFYSH09693AA

figure no: FIGURE 3

Traffic Light P-Wave Section



- - - - Approximate cut level

—2000— P-Wave Seismic Velocity Contour

🟩 Rippable (<2300m/s)*

🟨 Marginal (2300-2900m/s)*

🟥 Non-Rippable (>2900)*

Geotechnical Log

TOPSOIL	SILTSTONE
FILL	NO CORE
SANDY CLAY	CLAY
BEDROCK	BOULDERS

Weathering Index

XW Extremely Weathered
HW Highly Weathered
MW Medium Weathering
SW Slightly Weathered
FR Fresh Rock

Strength

VL Very Low
L Low
M Medium
H High
VH Very High
EH Extremely High

*Rippabilty assessment based on a D9R (Rippability Assessment from Caterpillar Handbook of Ripping ed. 12 (2000))

revision	description	drawn	approved	date

Horizontal Scale: 0 50 100 150

Vertical Scale: 0 5 10 15

drawn	PH
approved	RJW
date	16/12/2013
scale	AS SHOWN
original size	A3

coffey

client:	AUSTRALIAN CAPITAL TERRITORY		
project:	PARKES WAY GEOTECHNICAL PROFILING (LINKING CITY TO THE LAKE)		
title:	TRAFFIC LIGHT P-WAVE SECTION		
project no:	GEOTFYSH09693AA	figure no:	FIGURE 4

Appendix A

Engineering Borehole Logs, Core Photographs and Explanation Sheets

coffey

Soil Description Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 μm to 2.36 mm
	medium	200 μm to 600 μm
	fine	75 μm to 200 μm

MOISTURE CONDITION

Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH S_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	–	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous layers of lenticular shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

GEOLOGICAL ORIGIN

WEATHERED IN PLACE SOILS

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil	Deposited by wind.
Alluvial soil	Deposited by streams and rivers.
Colluvial soil	Deposited on slopes (transported downslope by gravity).
Fill	Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
Lacustrine soil	Deposited by lakes.
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.

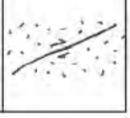
Soil Description Explanation Sheet (2 of 2)

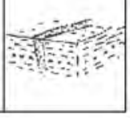
SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and basing fractions on estimated mass)							USC	PRIMARY NAME
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.			GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.			GP	GRAVEL
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)			GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes			SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.			SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).			SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm				IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.				
				DRY STRENGTH	DILATANCY	TOUGHNESS		
		SILTS & CLAYS Liquid limit less than 50		None to Low	Quick to slow	None	ML	SILT
				Medium to High	None	Medium	CL	CLAY
				Low to medium	Slow to very slow	Low	OL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50		Low to medium	Slow to very slow	Low to medium	MH	SILT
				High	None	High	CH	CLAY
				Medium to High	None	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS				Readily identified by colour, odour, spongy feel and frequently by fibrous texture.			Pt	PEAT

- Low plasticity – Liquid Limit w_L less than 35%. • Medium plasticity – w_L between 35% and 50%. • High plasticity – w_L greater than 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.

DEFINITIONS: Rock substance, defect and mass are defined as follows:

Rock Substance	In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic.
Defect	Discontinuity or break in the continuity of a substance or substances.
Mass	Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

SUBSTANCE DESCRIPTIVE TERMS:

ROCK NAME	Simple rock names are used rather than precise geological classification.
PARTICLE SIZE	Grain size terms for sandstone are:
Coarse grained	Mainly 0.6mm to 2mm
Medium grained	Mainly 0.2mm to 0.6mm
Fine grained	Mainly 0.06mm (just visible) to 0.2mm
FABRIC	Terms for layering of penetrative fabric (eg. bedding, cleavage etc.) are:
Massive	No layering or penetrative fabric.
Indistinct	Layering or fabric just visible. Little effect on properties.
Distinct	Layering or fabric is easily visible. Rock breaks more easily parallel to layering of fabric.

CLASSIFICATION OF WEATHERING PRODUCTS

Term	Abbreviation	Definition
Residual Soil	**RS**	Soil derived from the weathering of rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely Weathered Material	**XW**	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric still visible.
Highly Weathered Rock	**HW**	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.
Moderately Weathered Rock	**MW**	The whole of the rock substance is discoloured, usually by iron staining or bleaching , to the extent that the colour of the fresh rock is no longer recognisable.
Slightly Weathered Rock	**SW**	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Fresh Rock	**FR**	Rock substance unaffected by weathering.

Notes on Weathering:

1. AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no advantage in making such a distinction. DW may be used with the definition given in AS1726.
2. Where physical and chemical changes were caused by hot gasses and liquids associated with igneous rocks, the term "altered" may be substituted for "weathering" to give the abbreviations XA, HA, MA, SA and DA.

ROCK SUBSTANCE STRENGTH TERMS

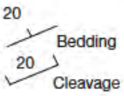
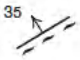
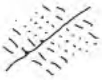
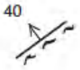
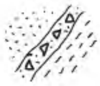
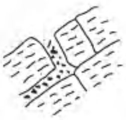
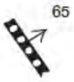
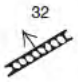
Term	Abbrev-iation	Point Load Index, $I_{s(50)}$ (MPa)	Field Guide
Very Low	**VL**	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.
Low	**L**	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	**M**	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	**H**	1 to 3	A piece of core 150mm long by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	**VH**	3 to 10	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.
Extremely High	**EH**	More than 10	Specimen requires many blows with geological pick to break; rock rings under hammer.

Notes on Rock Substance Strength:

1. In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy.
2. The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.
3. The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index $I_{s(50)}$. The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.

Rock Description Explanation Sheet (2 of 2)

COMMON DEFECTS IN ROCK MASSES

Term	Definition	Diagram	Map Symbol	Graphic Log (Note 1)
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering (eg bedding) or a planar anisotropy in the rock substance (eg, cleavage). May be open or closed.			 (Note 2)
Joint	A surface or crack across which the rock has little or no tensile strength. but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.			 (Note 2)
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.			
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.			
Crushed Seam (Note 3)	Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties.			
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.			
Extremely Weathered Seam	Seam of soil substance, often with gradational boundaries. Formad by weathering of the rock substance in place.			

DEFECT SHAPE

	TERMS
Planar	The defect does not vary in orientation
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps
Irregular	The defect has many sharp changes of orientation

Note: The assessment of defect shape is partly influenced by the scale of the observation.

ROUGHNESS TERMS

Slickensided	Grooved or striated surface, usually polished
Polished	Shiny smooth surface
Smooth	Smooth to touch. Few or no surface irregularities
Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.

COATING TERMS

Clean	No visible coating
Stained	No visible coating but surfaces are discoloured
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Coating	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.

BLOCK SHAPE TERMS

Blocky	Approximately equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greate than cross section

Notes on Defects:

1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.
2. Partings and joints are not usually shown on the graphic log unless considered significant.
3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.

coffey

Engineering Log - Borehole

Borehole ID.	***BH01***
sheet:	1 of 3
project no.	***GEOTFYSH09693AA***
date started:	***04 Dec 2013***
date completed:	***04 Dec 2013***
logged by:	***SB***
checked by:	***DB***

client: ***ACT Government - Commerce and Works***

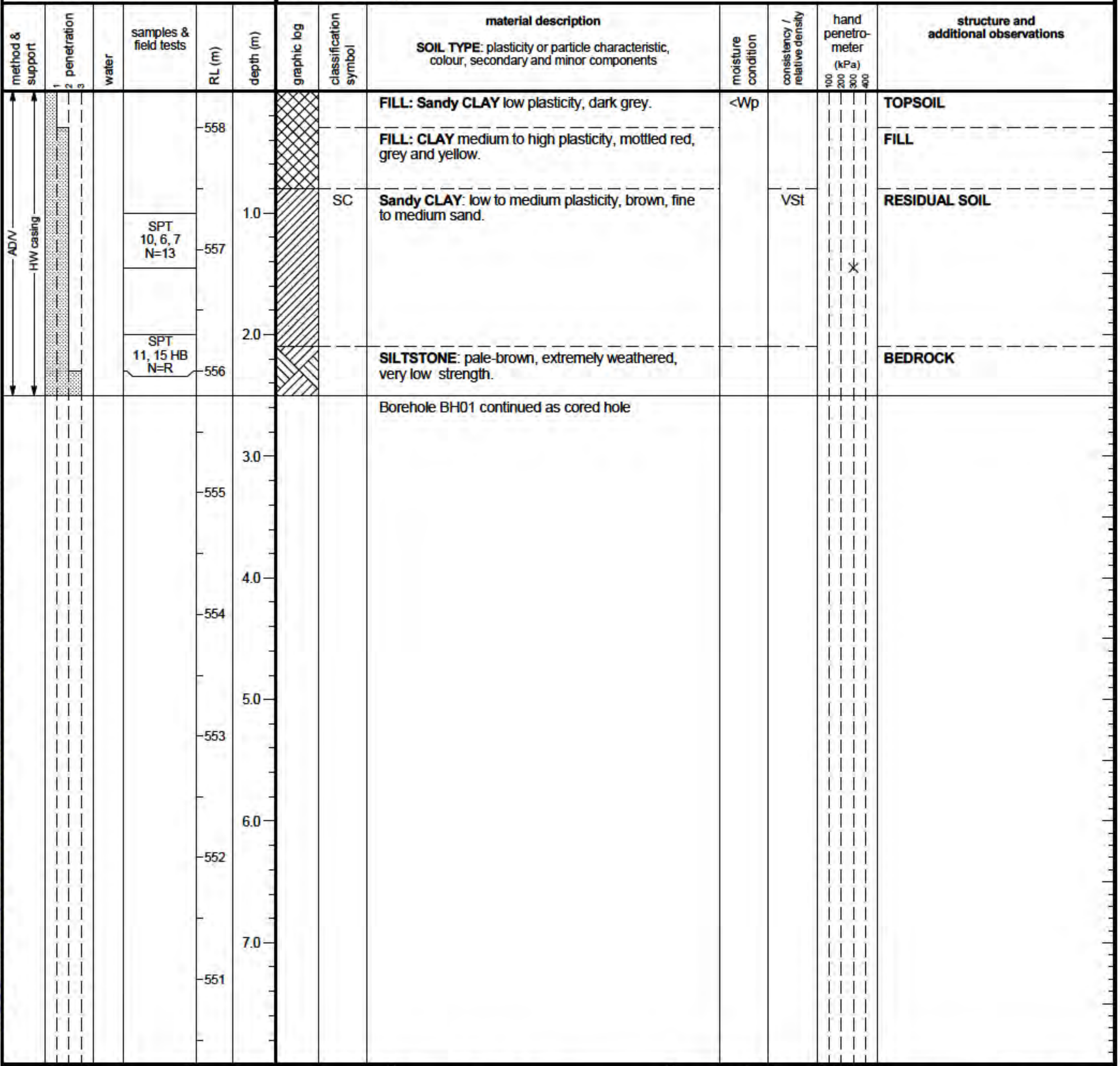
principal:

project: ***Parkes Way Geotechnical Profiling***

location: ***Refer to Figure 1***

position: E: 693103; N: 6093209 (WGS84 Zone 55)   surface elevation : 558.30m (AHD)   angle from horizontal: 90°

drill model: Multidrill   mounting: Trailer   Casing Diameter : HW



drilling information						material substance						
method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetro-meter (kPa)	structure and additional observations
AD/V HW casing				558				**FILL: Sandy CLAY** low plasticity, dark grey.	<Wp			**TOPSOIL**
								FILL: CLAY medium to high plasticity, mottled red, grey and yellow.				**FILL**
			SPT 10, 6, 7 N=13	557	1.0		SC	**Sandy CLAY**: low to medium plasticity, brown, fine to medium sand.		VSt		**RESIDUAL SOIL**
			SPT 11, 15 HB N=R	556	2.0			**SILTSTONE**: pale-brown, extremely weathered, very low strength.				**BEDROCK**
				555	3.0			Borehole BH01 continued as cored hole				
				554	4.0							
				553	5.0							
				552	6.0							
				551	7.0							

method
- AD auger drilling*
- AS auger screwing*
- RR roller/tricone
- W washbore
- CT cable tool
- HA hand auger
- DT diatube
- B blank bit
- V V bit
- T TC bit
- * bit shown by suffix
- e.g. AD/T

support
- M mud
- N nil
- C casing

penetration

no resistance ranging to refusal

water

10-Oct-12 water level on date shown

water inflow

water outflow

samples & field tests

U##	undisturbed sample ##mm diameter
D	disturbed sample
B	bulk disturbed sample
E	environmental sample
HP	hand penetrometer (kPa)
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
VS	vane shearpeak/remouded (uncorrected kPa)
R	refusal

classification symbol & soil description

based on Unified Classification System

moisture
- D dry
- M moist
- W wet

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Cored Borehole

Borehole ID.	**BH01**
sheet:	2 of 3
project no.	**GEOTFYSH09693AA**
date started:	**04 Dec 2013**
date completed:	**04 Dec 2013**
logged by:	**SB**
checked by:	**DB**

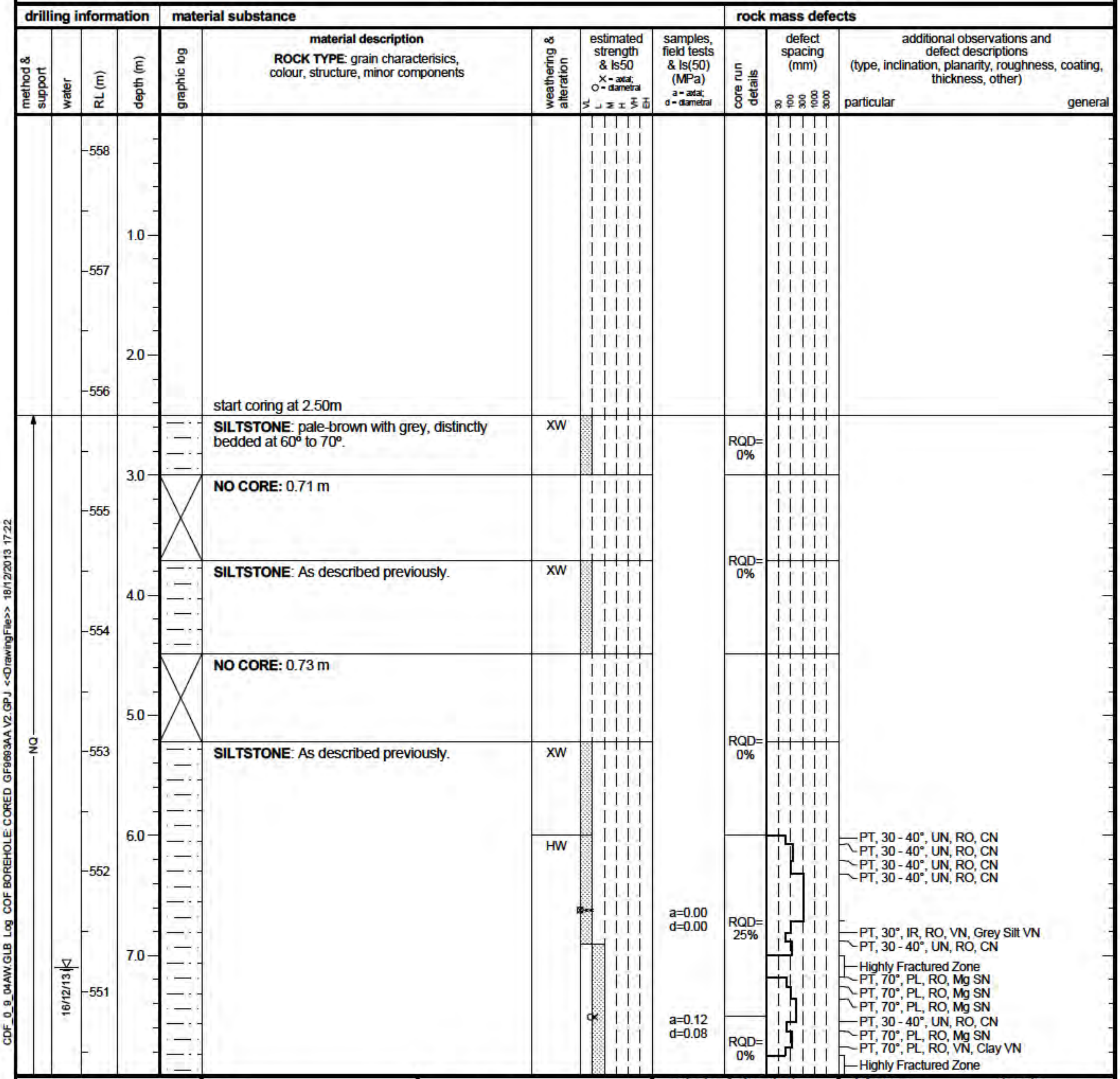
client: **ACT Government - Commerce and Works**

principal:

project: **Parkes Way Geotechnical Profiling**

location: **Refer to Figure 1**

position: E: 693103; N: 6093209 (WGS84 Zone 55)
surface elevation : 558.30m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW



depth (m)	RL (m)	method & support	water	graphic log	material description	weathering & alteration	samples, field tests & Is(50) (MPa)	core run details	additional observations and defect descriptions
0.0 – 2.50	558 – 556				start coring at 2.50m				
2.50 – 3.00	556 – 555	NQ			**SILTSTONE**: pale-brown with grey, distinctly bedded at 60° to 70°.	XW		RQD= 0%	
3.00 – 3.71	555	NQ		☒	**NO CORE:** 0.71 m				
3.71 – 4.50	554	NQ			**SILTSTONE**: As described previously.	XW		RQD= 0%	
4.50 – 5.23	553	NQ		☒	**NO CORE:** 0.73 m				
5.23 – 6.00	553 – 552	NQ			**SILTSTONE**: As described previously.	XW		RQD= 0%	
6.00 – 7.50	552 – 551	NQ	16/12/13			HW	a=0.00 d=0.00	RQD= 25%	PT, 30 - 40°, UN, RO, CN PT, 30 - 40°, UN, RO, CN PT, 30 - 40°, UN, RO, CN PT, 30 - 40°, UN, RO, CN PT, 30°, IR, RO, VN, Grey Silt VN PT, 30 - 40°, UN, RO, CN Highly Fractured Zone PT, 70°, PL, RO, Mg SN PT, 70°, PL, RO, Mg SN PT, 70°, PL, RO, Mg SN
7.50 – 8.00	551	NQ				HW	a=0.12 d=0.08	RQD= 0%	PT, 30 - 40°, UN, RO, CN PT, 70°, PL, RO, Mg SN PT, 70°, PL, RO, VN, Clay VN Highly Fractured Zone

CDF_0_9_04AW.GLB Log COF BOREHOLE: CORED GF9693AA V2.GPJ <<DrawingFile>> 18/12/2013 17:22

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- ☒ no core recovered

core run details

- barrel withdrawn

TCR = Total Core Recovery (%)
SCR = Solid Core Recovery (%)
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

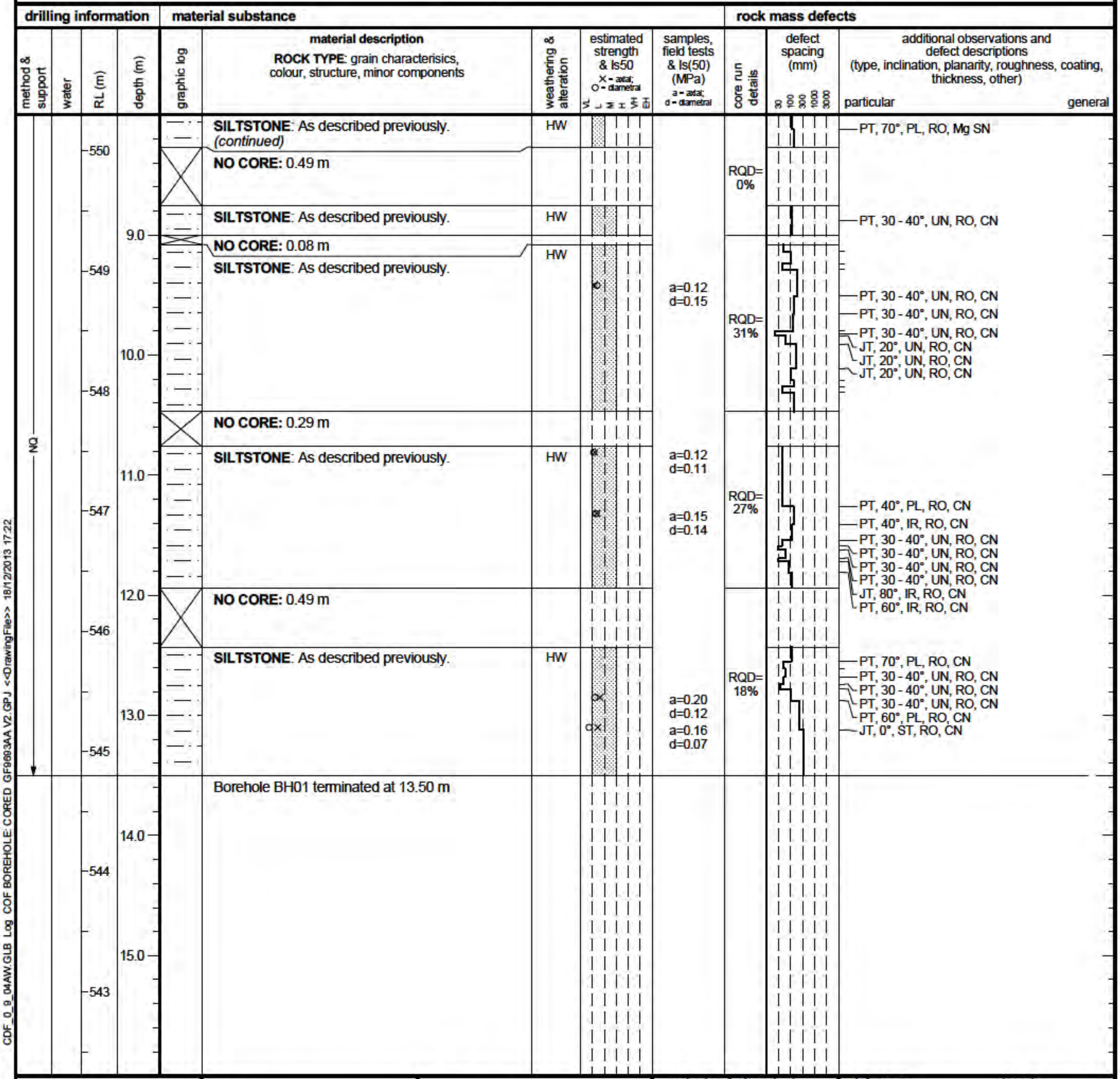
coffey

Engineering Log - Cored Borehole

Borehole ID.	**BH01**
sheet:	3 of 3
project no.	**GEOTFYSH09693AA**
date started:	**04 Dec 2013**
date completed:	**04 Dec 2013**
logged by:	**SB**
checked by:	**DB**

client: **ACT Government - Commerce and Works**
principal:
project: **Parkes Way Geotechnical Profiling**
location: **Refer to Figure 1**

position: E: 693103; N: 6093209 (WGS84 Zone 55)
surface elevation : 558.30m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW



method & support	water	RL (m)	depth (m)	material description ROCK TYPE: grain characterisics, colour, structure, minor components	weathering & alteration	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run details	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NQ				**SILTSTONE**: As described previously. *(continued)*	HW			PT, 70°, PL, RO, Mg SN
		550						
				NO CORE: 0.49 m			RQD= 0%	
				SILTSTONE: As described previously.	HW			PT, 30 - 40°, UN, RO, CN
			9.0					
				NO CORE: 0.08 m	HW			
		549		**SILTSTONE**: As described previously.				
						a=0.12 d=0.15		PT, 30 - 40°, UN, RO, CN
							RQD= 31%	PT, 30 - 40°, UN, RO, CN
								PT, 30 - 40°, UN, RO, CN
								JT, 20°, UN, RO, CN
			10.0					JT, 20°, UN, RO, CN
								JT, 20°, UN, RO, CN
		548						
				NO CORE: 0.29 m				
				SILTSTONE: As described previously.	HW	a=0.12 d=0.11		
			11.0					
							RQD= 27%	PT, 40°, PL, RO, CN
		547				a=0.15 d=0.14		PT, 40°, IR, RO, CN
								PT, 30 - 40°, UN, RO, CN
								PT, 30 - 40°, UN, RO, CN
								PT, 30 - 40°, UN, RO, CN
								PT, 30 - 40°, UN, RO, CN
								JT, 80°, IR, RO, CN
			12.0	**NO CORE:** 0.49 m				PT, 60°, IR, RO, CN
		546						
				SILTSTONE: As described previously.	HW			PT, 70°, PL, RO, CN
							RQD= 18%	PT, 30 - 40°, UN, RO, CN
								PT, 30 - 40°, UN, RO, CN
						a=0.20 d=0.12		PT, 30 - 40°, UN, RO, CN
			13.0					PT, 60°, PL, RO, CN
						a=0.16 d=0.07		JT, 0°, ST, RO, CN
		545						
				Borehole BH01 terminated at 13.50 m				
			14.0					
		544						
			15.0					
		543						

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

core recovered (graphic symbols indicate material)
no core recovered

core run details

barrel withdrawn
TCR = Total Core Recovery (%)
SCR = Solid Core Recovery (%)
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

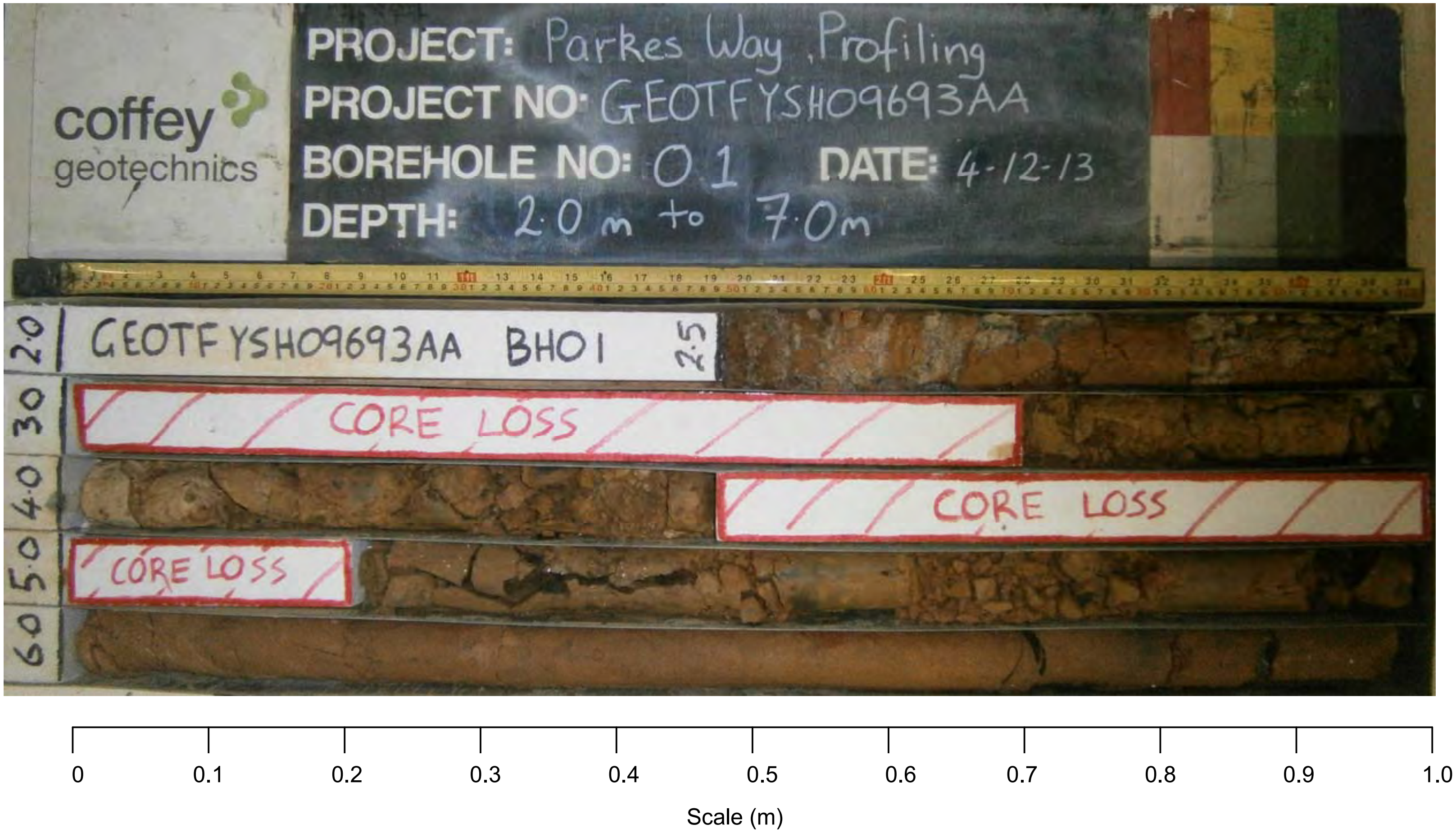
SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

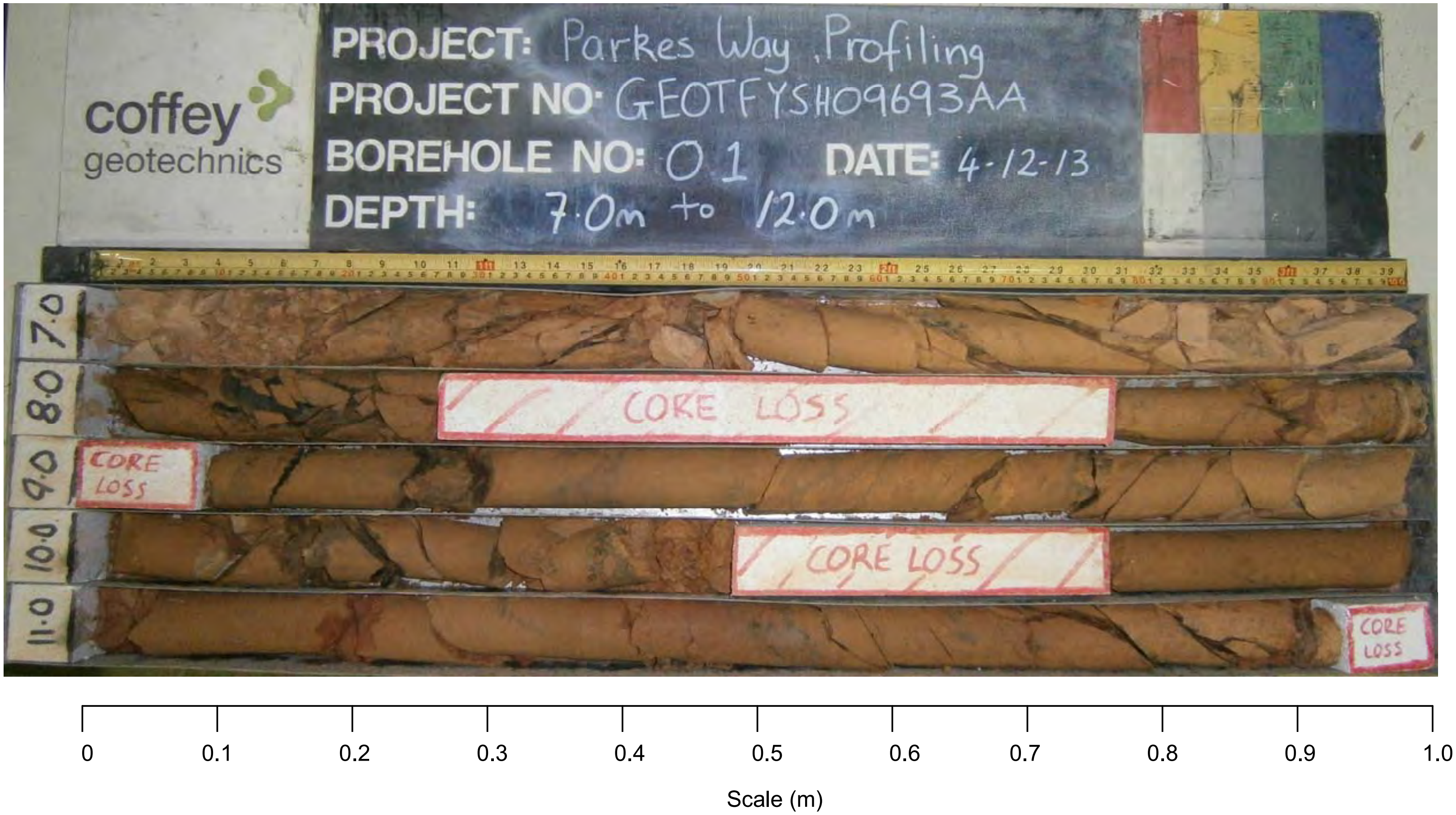
PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

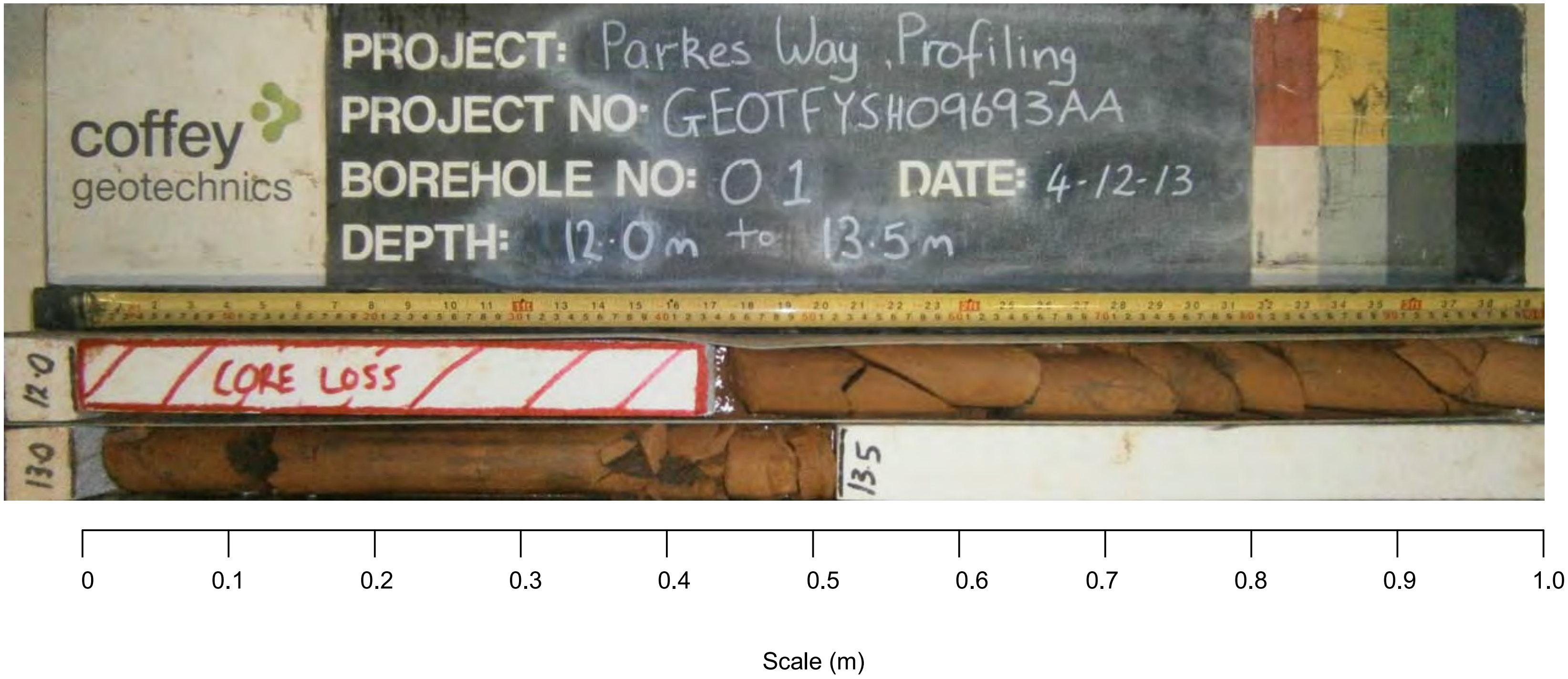
CN	clean
SN	stain
VN	veneer
CO	coating



drawn	SB	client:	ACT Government – Commerce and Works	
approved	DB	project:	Parkes Way Geotechnical Profiling	
date	17/12/2013			
scale	NTS	title:	CORE PHOTO BH01: 2.0 - 7.0m	
original size	A4	project no:	GEOTFYSH09693AA	Photo no: 1 of 3



drawn	SB	coffey	client:	ACT Government – Commerce and Works
approved	DB		project:	Parkes Way Geotechnical Profiling
date	17/12/2013			
scale	NTS		title:	CORE PHOTO BH01: 7.0 - 12.0m
original size	A4		project no: GEOTFYSH09693AA	Photo no: 2 of 3



drawn	SB	coffey	client:	ACT Government – Commerce and Works
approved	DB		project:	Parkes Way Geotechnical Profiling
date	17/12/2013			
scale	NTS		title:	CORE PHOTO BH01: 12.0 - 13.5m
original size	A4		project no: GEOTFYSH09693AA	Photo no: 3 of 3

coffey

Engineering Log - Borehole

Borehole ID.	**BH02**
sheet:	1 of 3
project no.	**GEOTFYSH09693AA**

client:	***ACT Government - Commerce and Works***	date started:	***04 Dec 2013***
principal:		date completed:	***04 Dec 2013***
project:	***Parkes Way Geotechnical Profiling***	logged by:	***SB***
location:	***Refer to Figure 1***	checked by:	***DB***

position: E: 693164; N: 6093203 (WGS84 Zone 55) surface elevation : 558.60m (AHD) angle from horizontal: 90°

drill model: Multidrill mounting: Trailer Casing Diameter : HW

drilling information						material substance						
method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V HW casing								**FILL: Silty CLAY** low plasticity, dark grey.	<Wp			**TOPSOIL**
								FILL: CLAY medium plasticity, reddish-brown.				**FILL**
				558			CH	**CLAY**: medium to high plasticity, yellowish-brown.		VSt		**RESIDUAL SOIL**
			SPT 10, 15/135mm HB N=R		1.0						>>X	
				557				**SILTSTONE**: pale-brown, extremely weathered, very low to low strength.				**BEDROCK**
					2.0							
				556				Borehole BH02 continued as cored hole				
					3.0							
				555								
					4.0							
				554								
					5.0							
				553								
					6.0							
				552								
					7.0							
				551								

method

AD	auger drilling*
AS	auger screwing*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*	bit shown by suffix
e.g.	AD/T

support

M	mud	N	nil
C	casing		

penetration

1 2 3

no resistance ranging to refusal

water

10-Oct-12 water level on date shown

water inflow

water outflow

samples & field tests

U##	undisturbed sample ##mm diameter
D	disturbed sample
B	bulk disturbed sample
E	environmental sample
HP	hand penetrometer (kPa)
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
VS	vane shearpeak/remouded (uncorrected kPa)
R	refusal

classification symbol & soil description

based on Unified Classification System

moisture

D	dry
M	moist
W	wet

consistency / relative density

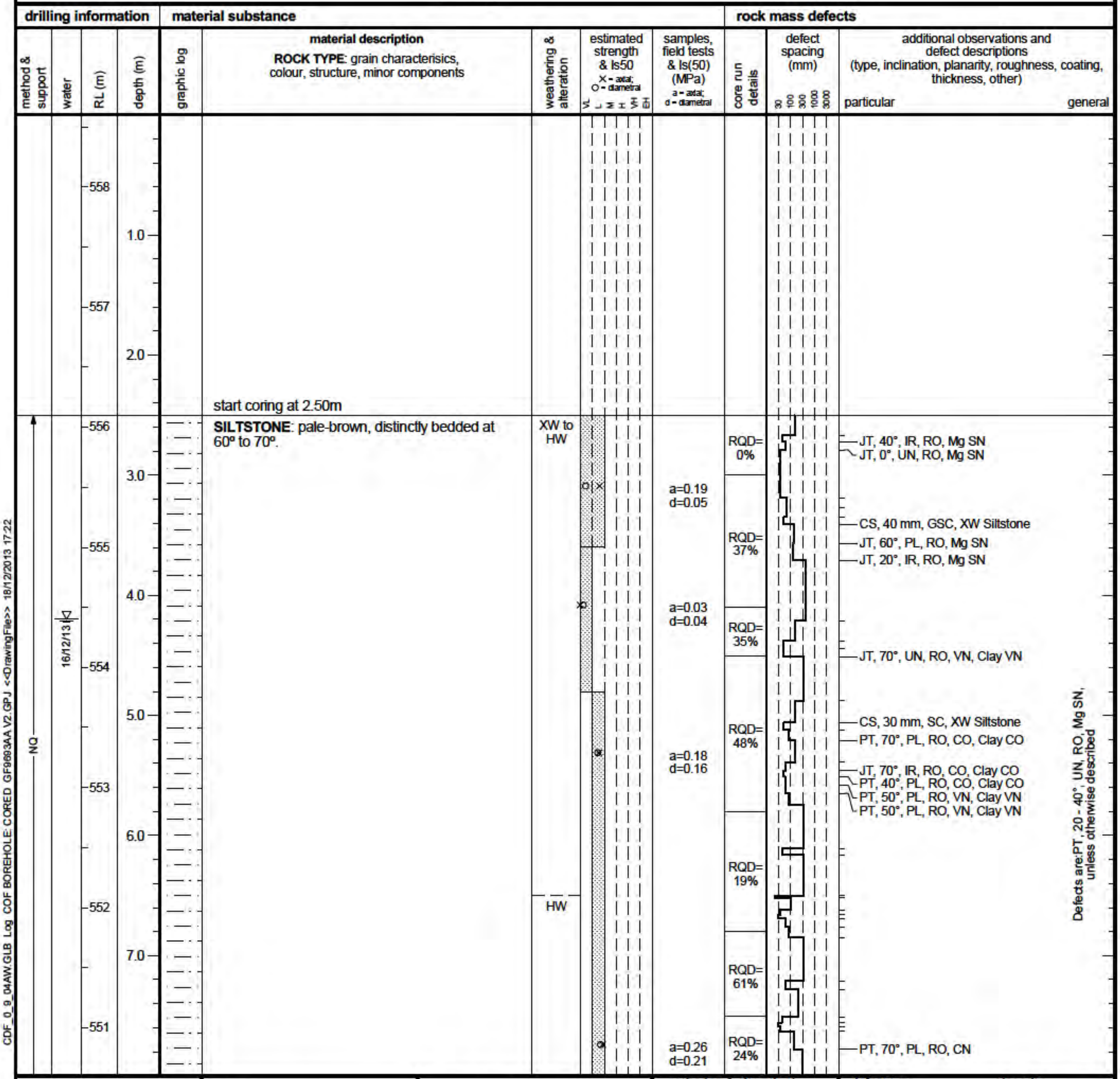
VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering Log - Cored Borehole

Borehole ID.	**BH02**
sheet:	2 of 3
project no.	**GEOTFYSH09693AA**
date started:	**04 Dec 2013**
date completed:	**04 Dec 2013**
logged by:	**SB**
checked by:	**DB**

client: **ACT Government - Commerce and Works**
principal:
project: **Parkes Way Geotechnical Profiling**
location: **Refer to Figure 1**

position: E: 693164; N: 6093203 (WGS84 Zone 55)
surface elevation : 558.60m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW



start coring at 2.50m

SILTSTONE: pale-brown, distinctly bedded at 60º to 70º.

a=0.19
d=0.05

a=0.03
d=0.04

a=0.18
d=0.16

a=0.26
d=0.21

RQD= 0%
RQD= 37%
RQD= 35%
RQD= 48%
RQD= 19%
RQD= 61%
RQD= 24%

JT, 40°, IR, RO, Mg SN
JT, 0°, UN, RO, Mg SN
CS, 40 mm, GSC, XW Siltstone
JT, 60°, PL, RO, Mg SN
JT, 20°, IR, RO, Mg SN
JT, 70°, UN, RO, VN, Clay VN
CS, 30 mm, SC, XW Siltstone
PT, 70°, PL, RO, CO, Clay CO
JT, 70°, IR, RO, CO, Clay CO
PT, 40°, PL, RO, CO, Clay CO
PT, 50°, PL, RO, VN, Clay VN
PT, 50°, PL, RO, VN, Clay VN
PT, 70°, PL, RO, CN

Defects are:PT, 20 - 40°, UN, RO, Mg SN, unless otherwise described

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

core recovered (graphic symbols indicate material)
no core recovered

core run details

barrel withdrawn
TCR = Total Core Recovery (%)
SCR = Solid Core Recovery (%)
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

coffey

Engineering Log - Cored Borehole

Borehole ID.	**BH02**
sheet:	3 of 3
project no.	**GEOTFYSH09693AA**
date started:	**04 Dec 2013**
date completed:	**04 Dec 2013**
logged by:	**SB**
checked by:	**DB**

client: **ACT Government - Commerce and Works**

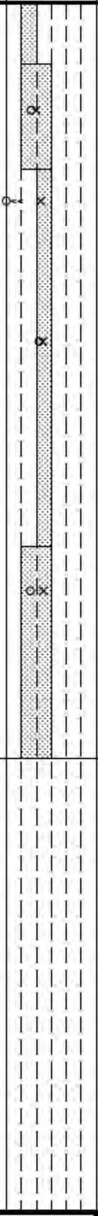
principal:

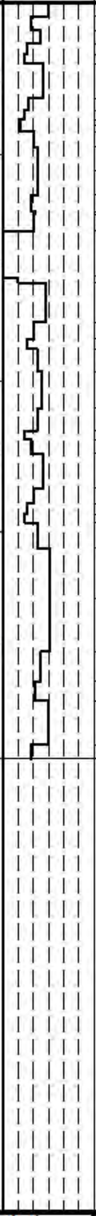
project: **Parkes Way Geotechnical Profiling**

location: **Refer to Figure 1**

position: E: 693164; N: 6093203 (WGS84 Zone 55)
surface elevation : 558.60m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW

method & support	water	RL (m)	depth (m)	material description ROCK TYPE: grain characterisics, colour, structure, minor components	weathering & alteration	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run details	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other)
NQ				**SILTSTONE**: pale-brown, distinctly bedded at 60º to 70º. *(continued)*	HW			PT, 40°, PL, RO, VN, Clay VN PT, 50°, PL, RO, CN
							RQD= 24%	
		550						
						a=0.30 d=0.20		PT, 50°, PL, RO, Mg SN
			9.0					
						a=0.43 d=0.00		
		549						Highly Fractured Zone
							RQD= 16%	PT, 70°, PL, RO, Mg SN
			10.0					JT, 10°, PL, RO, Mg SN JT, 40°, IR, RO, Mg SN
						a=0.49 d=0.37		
		548						PT, 50°, IR, RO, Mg SN JT, 20°, IR, RO, VN, Clay VN
			11.0				RQD= 0%	PT, 70°, PL, RO, Mg SN PT, 70°, PL, RO, Mg SN
								PT, 70°, IR, RO, Mg SN
		547						
			12.0			a=0.52 d=0.19		
							RQD= 11%	PT, 70°, UN, RO, Mg SN
		546						JT, 80 - 90°, UN, RO, Mg SN
			13.0	Borehole BH02 terminated at 13.00 m				
		545						
			14.0					
		544						
			15.0					
		543						





method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

core recovered (graphic symbols indicate material)
no core recovered

core run details

barrel withdrawn
TCR = Total Core Recovery (%)
SCR = Solid Core Recovery (%)
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

drawn	**SB**	coffey	client:	**ACT Government – Commerce and Works**
approved	**DB**		project:	**Parkes Way Geotechnical Profiling**
date	**17/12/2013**			
scale	**NTS**		title:	**CORE PHOTO BH02: 2.5 - 7.0m**
original size	**A4**		project no: **GEOTFYSH09693AA**	Photo no: 1 of 2

drawn	SB	coffey	client:	ACT Government – Commerce and Works
approved	DB		project:	Parkes Way Geotechnical Profiling
date	17/12/2013			
scale	NTS		title:	CORE PHOTO BH02: 7.0 - 13.0m
original size	A4		project no: **GEOTFYSH09693AA**	Photo no: 2 of 2

coffey

Engineering Log - Borehole

Borehole ID.	**BH03**
sheet:	1 of 3
project no.	***GEOTFYSH09693AA***
date started:	***06 Dec 2013***
date completed:	***06 Dec 2013***
logged by:	***SB***
checked by:	***DB***

client: ***ACT Government - Commerce and Works***

principal:

project: ***Parkes Way Geotechnical Profiling***

location: ***Refer to Figure 1***

position: E: 693242; N: 6093195 (WGS84 Zone 55)
surface elevation : 558.80m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW

drilling information | **material substance**

method & support	water	samples & field tests	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	structure and additional observations
AD/V HW casing				**FILL: Silty CLAY** low plasticity, dark grey.	<Wl		**TOPSOIL**
				FILL: Sandy CLAY medium plasticity, pale brownish-grey.	<Wp		**FILL**
		SPT 3, 4, 7 N=11		**FILL: Sandy CLAY** high plasticity, dark brown, trace fine grained angular gravel.	<Wp to =Wp		
	16/12/13	SPT 3, 2, 2 N=4		**FILL: Sandy CLAY** medium plasticity, dark brown, with some fine to medium grained angular gravel.			
		SPT 6, 9, 13 N=22		**FILL: SAND** medium grained, brownish-orange,brown mottled, with some silt.	M to W		
			SC	**Sandy CLAY**: high plasticity, reddish-brown, fine to medium sand.	<Wp	St to VSt	>>X **RESIDUAL SOIL**
				SILTSTONE: pale-brown to yellow, extremely weathered, very low strength.			**BEDROCK**
				Borehole BH03 continued as cored hole			

RL (m): 558, 557, 556, 555, 554, 553, 552, 551

depth (m): 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0

penetration: 1 2 3

hand penetrometer (kPa): 100 200 300 400

graphic log

method	
AD	auger drilling*
AS	auger screwing*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*	bit shown by suffix
e.g.	AD/T

support
M mud N nil
C casing

penetration
1 2 3 no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests	
U##	undisturbed sample ##mm diameter
D	disturbed sample
B	bulk disturbed sample
E	environmental sample
HP	hand penetrometer (kPa)
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
VS	vane shearpeak/remouded (uncorrected kPa)
R	refusal

classification symbol & soil description
based on Unified Classification System

moisture	
D	dry
M	moist
W	wet

consistency / relative density	
VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Cored Borehole

Borehole ID.	**BH03**
sheet:	2 of 3
project no.	**GEOTFYSH09693AA**
date started:	**06 Dec 2013**
date completed:	**06 Dec 2013**
logged by:	**SB**
checked by:	**DB**

client: ***ACT Government - Commerce and Works***

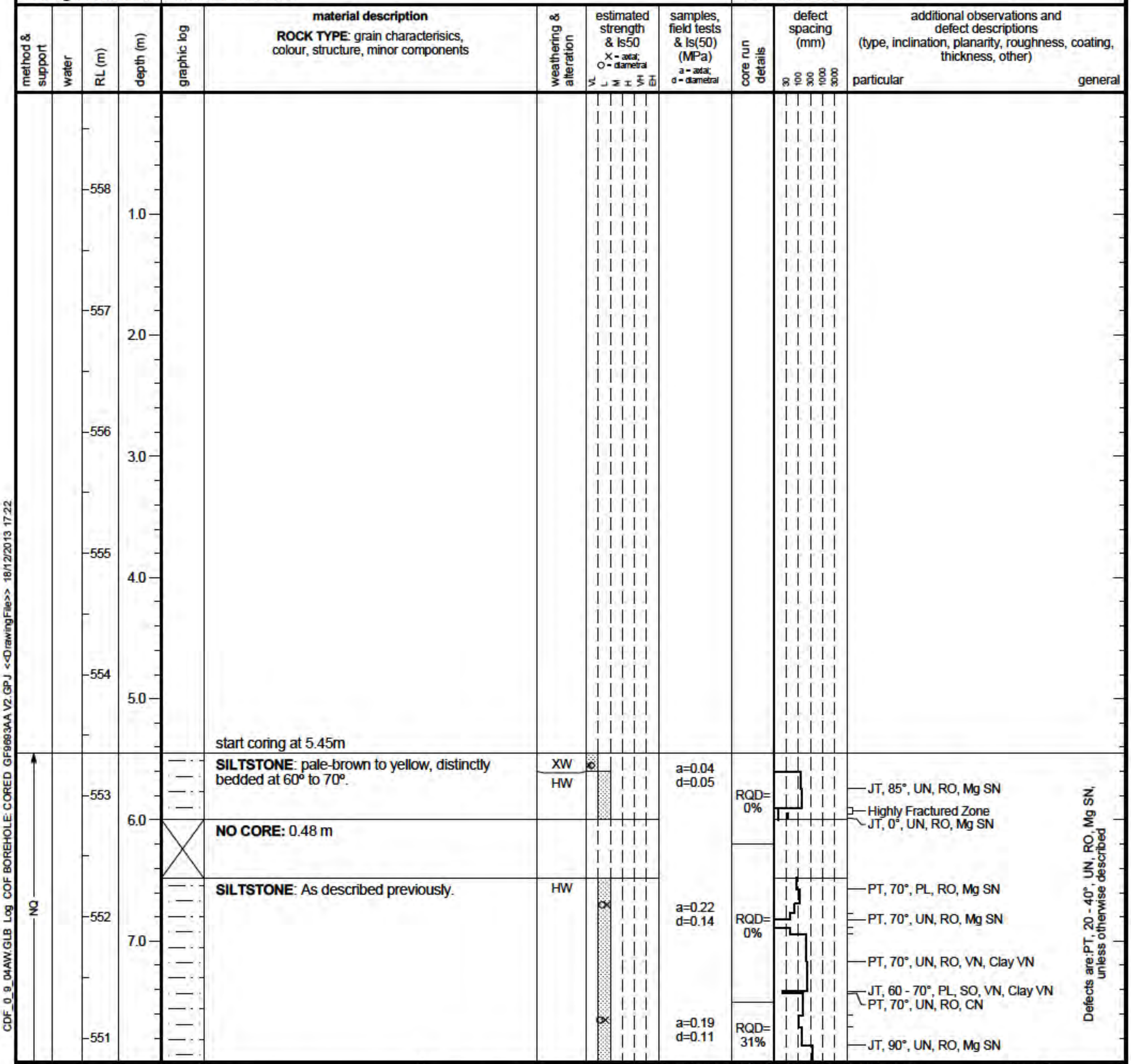
principal:

project: ***Parkes Way Geotechnical Profiling***

location: ***Refer to Figure 1***

position: E: 693242; N: 6093195 (WGS84 Zone 55)
surface elevation : 558.80m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW

drilling information | **material substance** | **rock mass defects**



start coring at 5.45m

SILTSTONE: pale-brown to yellow, distinctly bedded at 60º to 70º. — XW / HW — a=0.04 d=0.05 — RQD= 0%

- JT, 85°, UN, RO, Mg SN
- Highly Fractured Zone
- JT, 0°, UN, RO, Mg SN

NO CORE: 0.48 m

SILTSTONE: As described previously. — HW — a=0.22 d=0.14 — RQD= 0% — a=0.19 d=0.11 — RQD= 31%

- PT, 70°, PL, RO, Mg SN
- PT, 70°, UN, RO, Mg SN
- PT, 70°, UN, RO, VN, Clay VN
- JT, 60 - 70°, PL, SO, VN, Clay VN
- PT, 70°, UN, RO, CN
- JT, 90°, UN, RO, Mg SN

Defects are:PT, 20 - 40°, UN, RO, Mg SN, unless otherwise described

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- no core recovered

core run details

- barrel withdrawn

TCR = Total Core Recovery (%)
SCR = Solid Core Recovery (%)
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

CDF_0_9_04AW.GLB Log COF BOREHOLE: CORED GF9693AA V2.GPJ <<DrawingFile>> 18/12/2013 17:22

Engineering Log - Cored Borehole

Borehole ID.	**BH03**
sheet:	3 of 3
project no.	***GEOTFYSH09693AA***
date started:	***06 Dec 2013***
date completed:	***06 Dec 2013***
logged by:	***SB***
checked by:	***DB***

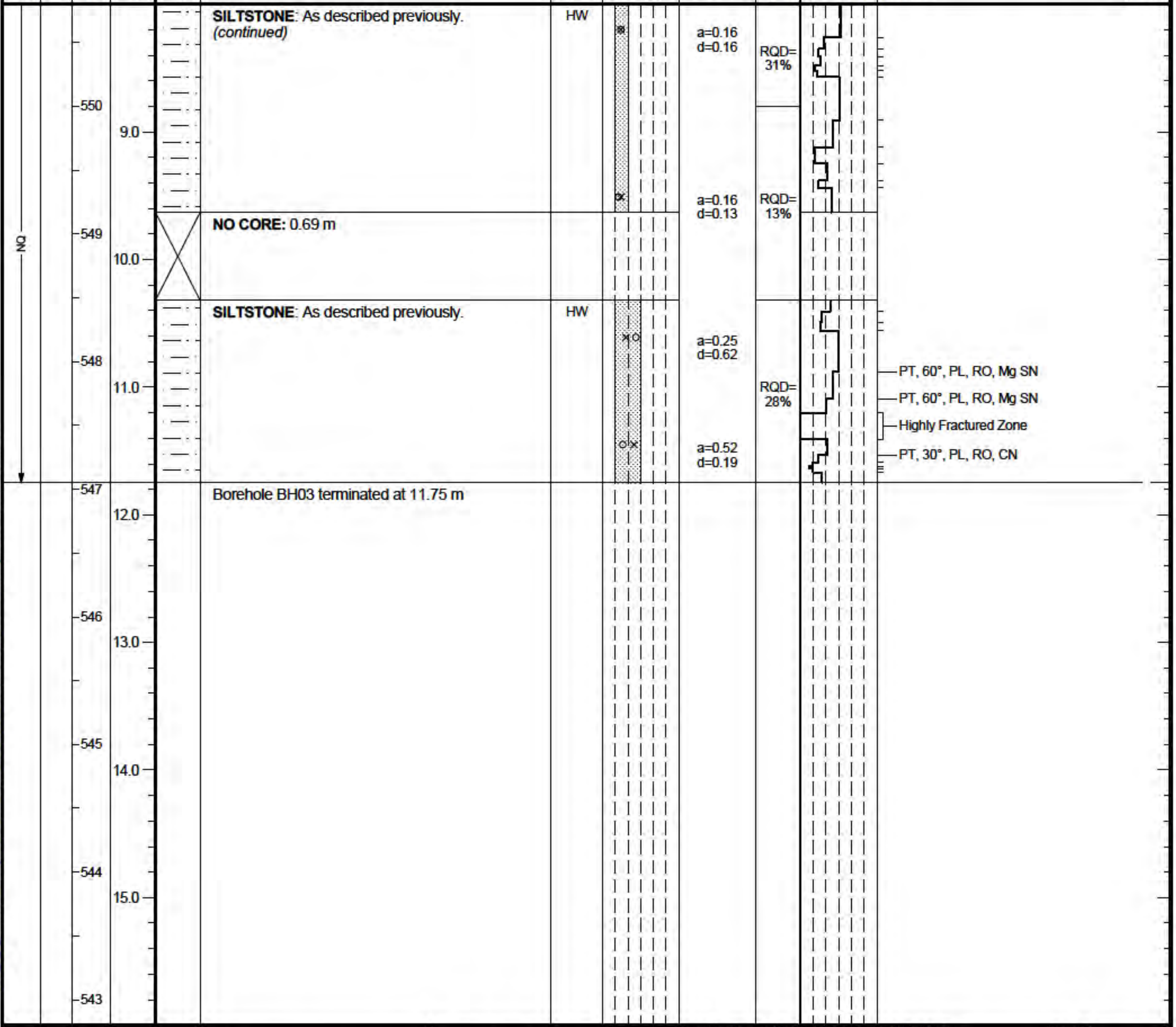
client: ***ACT Government - Commerce and Works***

principal:

project: ***Parkes Way Geotechnical Profiling***

location: ***Refer to Figure 1***

position: E: 693242; N: 6093195 (WGS84 Zone 55)
surface elevation : 558.80m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW



drilling information				material substance					rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 X - axial; O - diametral	samples, field tests & Is(50) (MPa) a - axial; d - diametral	core run details	defect spacing (mm)	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular general
NQ					**SILTSTONE**: As described previously. *(continued)*	HW		a=0.16 d=0.16	RQD= 31%		
								a=0.16 d=0.13	RQD= 13%		
					NO CORE: 0.69 m						
					SILTSTONE: As described previously.	HW		a=0.25 d=0.62	RQD= 28%		PT, 60°, PL, RO, Mg SN PT, 60°, PL, RO, Mg SN Highly Fractured Zone
								a=0.52 d=0.19			PT, 30°, PL, RO, CN
					Borehole BH03 terminated at 11.75 m						

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- ▼ 10/10/12, water level on date shown
- ▶ water inflow
- ◀ complete drilling fluid loss
- ◁ partial drilling fluid loss
- 25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- ▨ core recovered (graphic symbols indicate material)
- ☒ no core recovered

core run details

- barrel withdrawn

TCR = Total Core Recovery (%)
SCR = Solid Core Recovery (%)
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

planarity

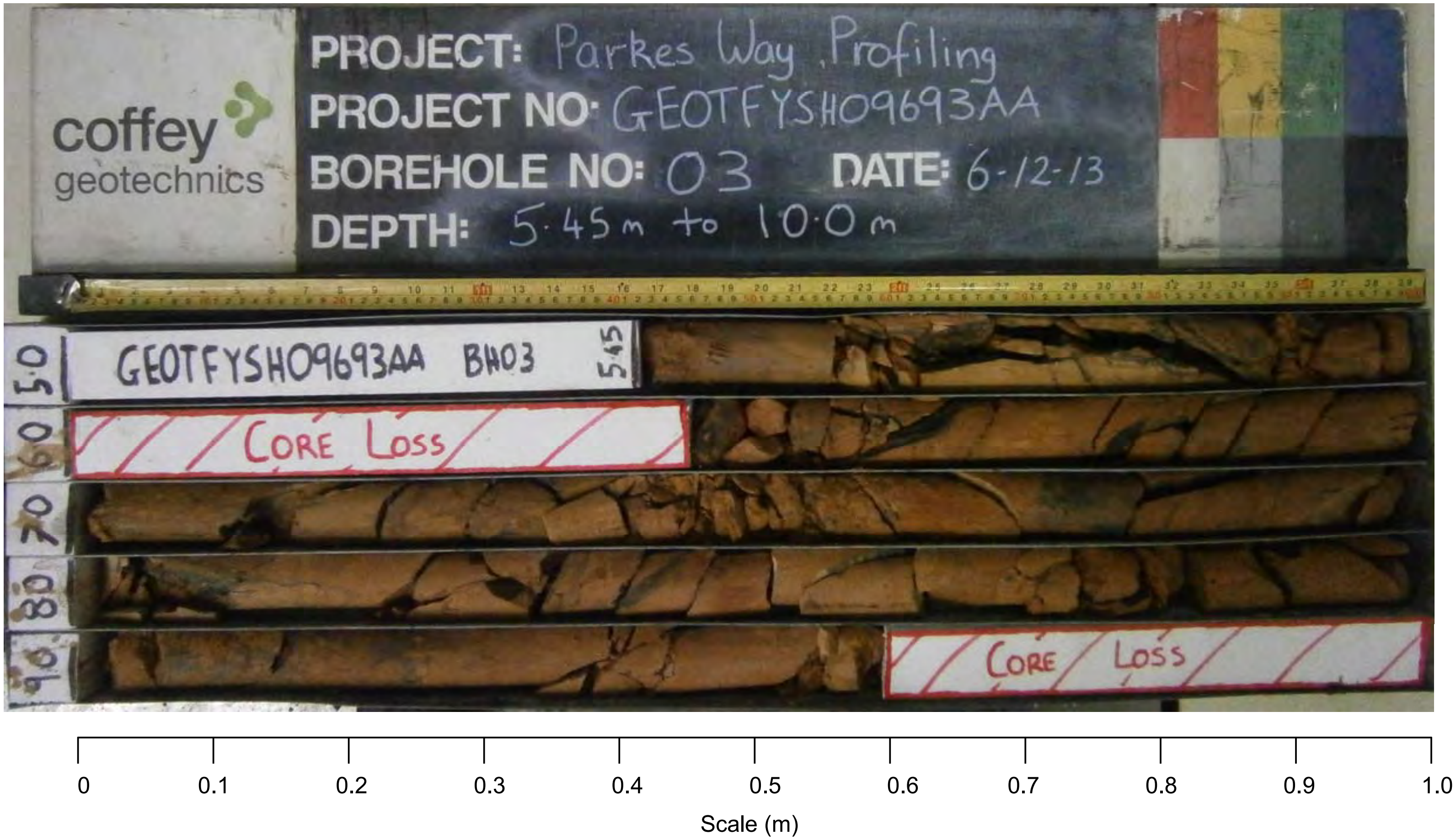
PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

roughness

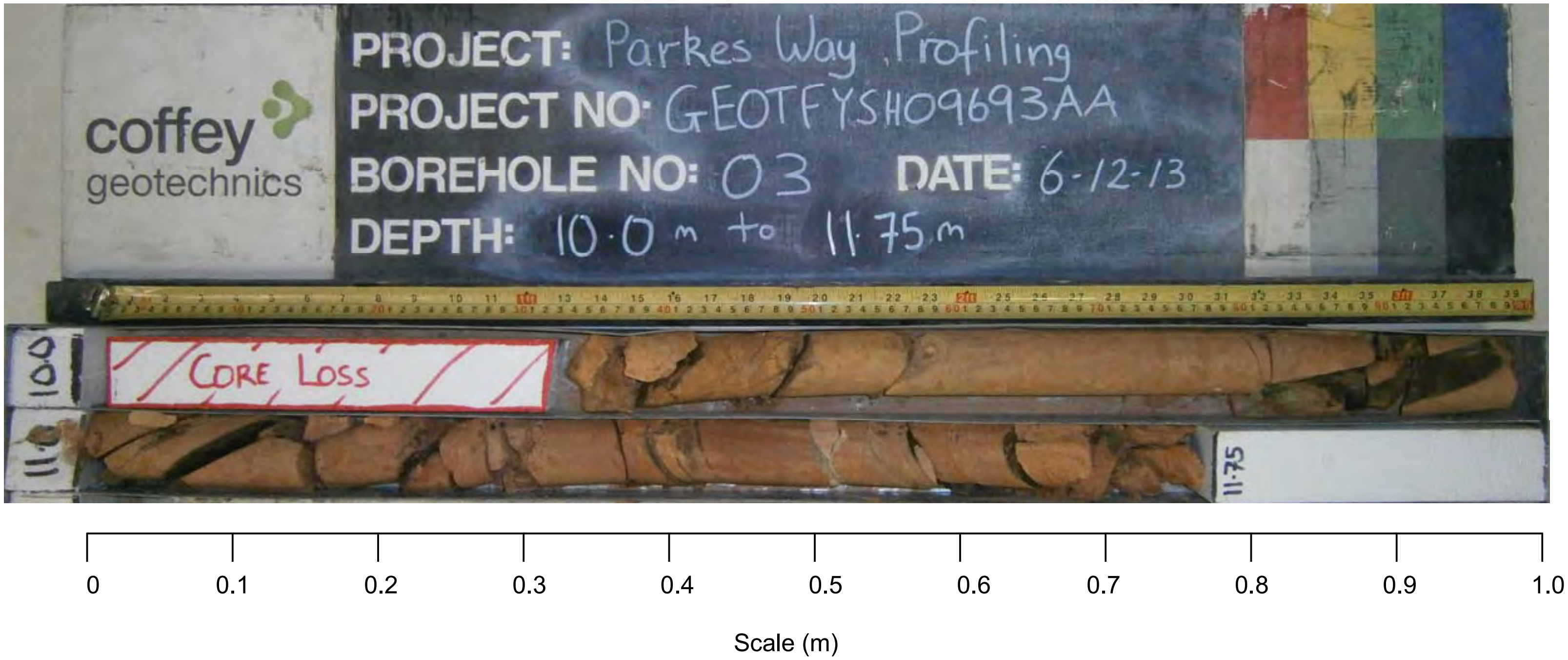
SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

coating

CN	clean
SN	stain
VN	veneer
CO	coating



drawn	SB	coffey	client:	ACT Government – Commerce and Works
approved	DB		project:	Parkes Way Geotechnical Profiling
date	17/12/2013			
scale	NTS		title:	CORE PHOTO BH03: 5.45 - 10.0m
original size	A4		project no: GEOTFYSH09693AA	Photo no: 1 of 2



drawn	**SB**		client:	**ACT Government – Commerce and Works**
approved	**DB**		project:	**Parkes Way Geotechnical Profiling**
date	**17/12/2013**			
scale	**NTS**		title:	**CORE PHOTO BH03: 10.0 - 11.75m**
original size	**A4**		project no: **GEOTFYSH09693AA**	Photo no: 2 of 2

coffey

Engineering Log - Borehole

Borehole ID.	**BH04**
sheet:	1 of 3
project no.	**GEOTFYSH09693AA**
date started:	**06 Dec 2013**
date completed:	**06 Dec 2013**
logged by:	**SB**
checked by:	**DB**

client: **ACT Government - Commerce and Works**

principal:

project: **Parkes Way Geotechnical Profiling**

location: **Refer to Figure 1**

position: E: 693368; N: 6093185 (WGS84 Zone 55)
surface elevation : 559.50m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW

drilling information / **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V HW casing								**FILL: Clayey SILT** low plasticity, dark grey.	<Wl			**TOPSOIL**
								FILL: Silty SAND fine to medium grained sands, dark-grey, mottled brown.	D			**FILL**
				559			CH	**CLAY**: medium to high plasticity, yellowish-brown.	<Wp	St to VSt		**RESIDUAL SOIL**
					1.0			**SILTSTONE**: pale-brown, extremely weathered, low to medium strength.				**BEDROCK**
				558								
					2.0			Borehole BH04 continued as cored hole				
				557								
					3.0							
				556								
					4.0							
				555								
					5.0							
				554								
					6.0							
				553								
					7.0							
				552								

method

AD	auger drilling*
AS	auger screwing*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*	bit shown by suffix
e.g.	AD/T

support

M	mud	N	nil
C	casing		

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown

water inflow

water outflow

samples & field tests

U##	undisturbed sample ##mm diameter
D	disturbed sample
B	bulk disturbed sample
E	environmental sample
HP	hand penetrometer (kPa)
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
VS	vane shearpeak/remouded (uncorrected kPa)
R	refusal

classification symbol & soil description
based on Unified Classification System

moisture

D	dry
M	moist
W	wet

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey

Engineering Log - Cored Borehole

Borehole ID. **BH04**
sheet: 2 of 3
project no. **GEOTFYSH09693AA**

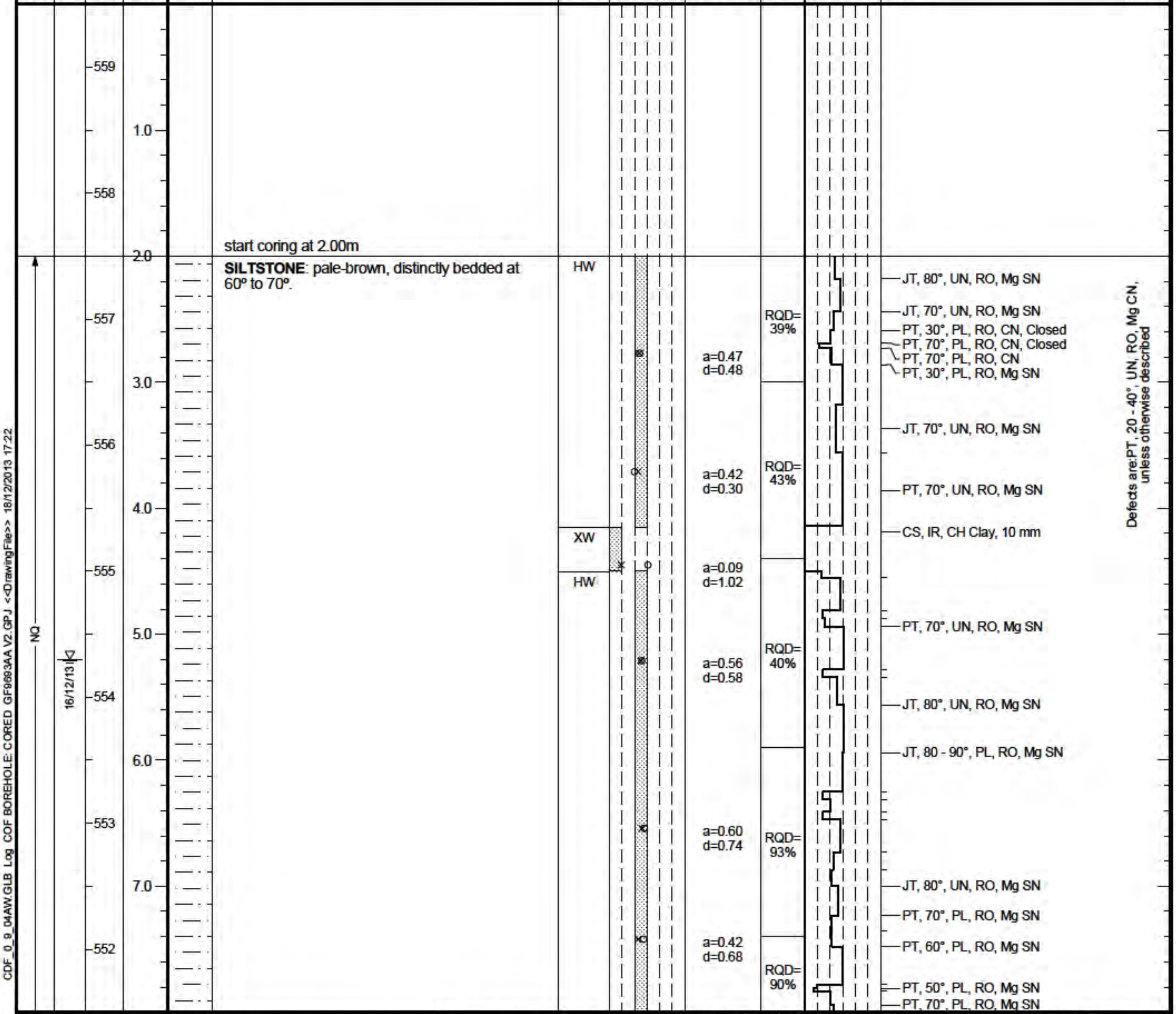
client: **ACT Government - Commerce and Works**
principal:
project: **Parkes Way Geotechnical Profiling**
location: **Refer to Figure 1**

date started: **06 Dec 2013**
date completed: **06 Dec 2013**
logged by: **SB**
checked by: **DB**

position: E: 693368; N: 6093185 (WGS84 Zone 55)
surface elevation : 559.50m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW

drilling information | **material substance** | **rock mass defects**

method & support | water | RL (m) | depth (m) | graphic log | **material description** **ROCK TYPE**: grain characterisics, colour, structure, minor components | weathering & alteration | estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH | samples, field tests & Is(50) (MPa) a = axial; d = diametral | core run details | defect spacing (mm) 30 100 300 1000 3000 | additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general



start coring at 2.00m

SILTSTONE: pale-brown, distinctly bedded at 60º to 70º.

weathering & alteration	samples, field tests & Is(50) (MPa)	core run details	additional observations and defect descriptions
HW	a=0.47 d=0.48	RQD= 39%	JT, 80°, UN, RO, Mg SN JT, 70°, UN, RO, Mg SN PT, 30°, PL, RO, CN, Closed PT, 70°, PL, RO, CN, Closed PT, 70°, PL, RO, CN PT, 30°, PL, RO, Mg SN
	a=0.42 d=0.30	RQD= 43%	JT, 70°, UN, RO, Mg SN PT, 70°, UN, RO, Mg SN CS, IR, CH Clay, 10 mm
XW			
HW	a=0.09 d=1.02 a=0.56 d=0.58	RQD= 40%	PT, 70°, UN, RO, Mg SN JT, 80°, UN, RO, Mg SN JT, 80 - 90°, PL, RO, Mg SN
	a=0.60 d=0.74	RQD= 93%	JT, 80°, UN, RO, Mg SN PT, 70°, PL, RO, Mg SN PT, 60°, PL, RO, Mg SN
	a=0.42 d=0.68	RQD= 90%	PT, 50°, PL, RO, Mg SN PT, 70°, PL, RO, Mg SN

Defects are:PT, 20 - 40°, UN, RO, Mg CN, unless otherwise described

CDF_0_9_04AW.GLB Log COF BOREHOLE: CORED GF9693AA V2.GPJ <<DrawingFile>> 18/12/2013 17:22

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- no core recovered

core run details

- barrel withdrawn

TCR = Total Core Recovery (%)
SCR = Solid Core Recovery (%)
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

coating

CN	clean
SN	stain
VN	veneer
CO	coating

coffey

Engineering Log - Cored Borehole

Borehole ID.	**BH04**
sheet:	3 of 3
project no.	**GEOTFYSH09693AA**
date started:	**06 Dec 2013**
date completed:	**06 Dec 2013**
logged by:	**SB**
checked by:	**DB**

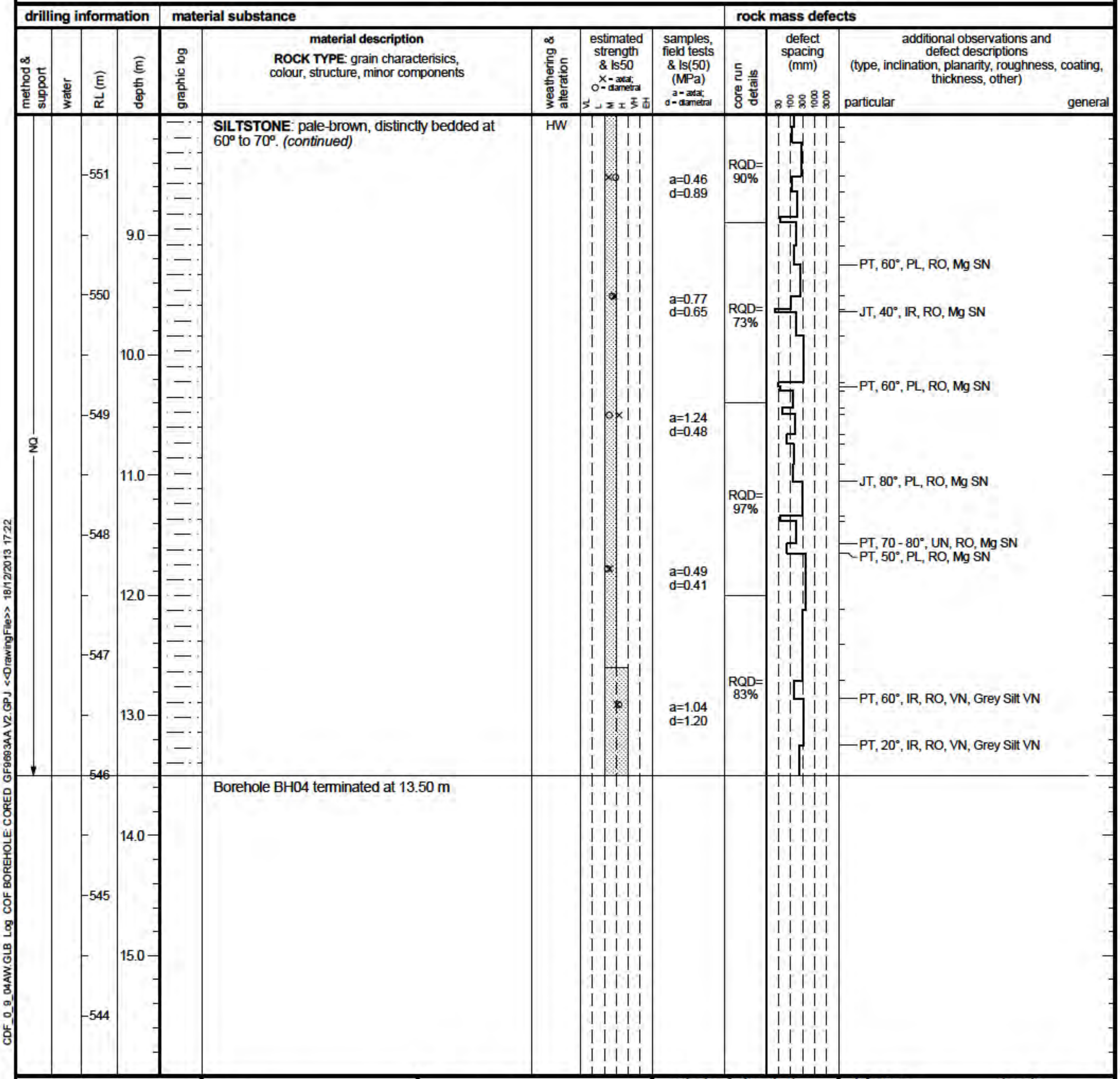
client: **ACT Government - Commerce and Works**

principal:

project: **Parkes Way Geotechnical Profiling**

location: **Refer to Figure 1**

position: E: 693368; N: 6093185 (WGS84 Zone 55)
surface elevation : 559.50m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW



method & support	water	RL (m)	depth (m)	material description ROCK TYPE: grain characterisics, colour, structure, minor components	weathering & alteration	samples, field tests & Is(50) (MPa)	core run details	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular general
NQ				**SILTSTONE**: pale-brown, distinctly bedded at 60º to 70º. *(continued)*	HW			
		551				a=0.46 d=0.89	RQD= 90%	
			9.0					
								PT, 60°, PL, RO, Mg SN
		550				a=0.77 d=0.65	RQD= 73%	JT, 40°, IR, RO, Mg SN
			10.0					
								PT, 60°, PL, RO, Mg SN
		549				a=1.24 d=0.48		
			11.0					JT, 80°, PL, RO, Mg SN
							RQD= 97%	
		548						PT, 70 - 80°, UN, RO, Mg SN PT, 50°, PL, RO, Mg SN
						a=0.49 d=0.41		
			12.0					
		547						
							RQD= 83%	PT, 60°, IR, RO, VN, Grey Silt VN
			13.0			a=1.04 d=1.20		
								PT, 20°, IR, RO, VN, Grey Silt VN
		546		Borehole BH04 terminated at 13.50 m				
			14.0					
		545						
			15.0					
		544						

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
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NMLC	NMLC core (51.9 mm)
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PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
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- core recovered (graphic symbols indicate material)
- no core recovered

core run details

- barrel withdrawn

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*W replaced with A for alteration

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L	low
M	medium
H	high
VH	very high
EH	extremely high

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PT	parting
JT	joint
SZ	shear zone
SS	shear surface
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DB	drilling break

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

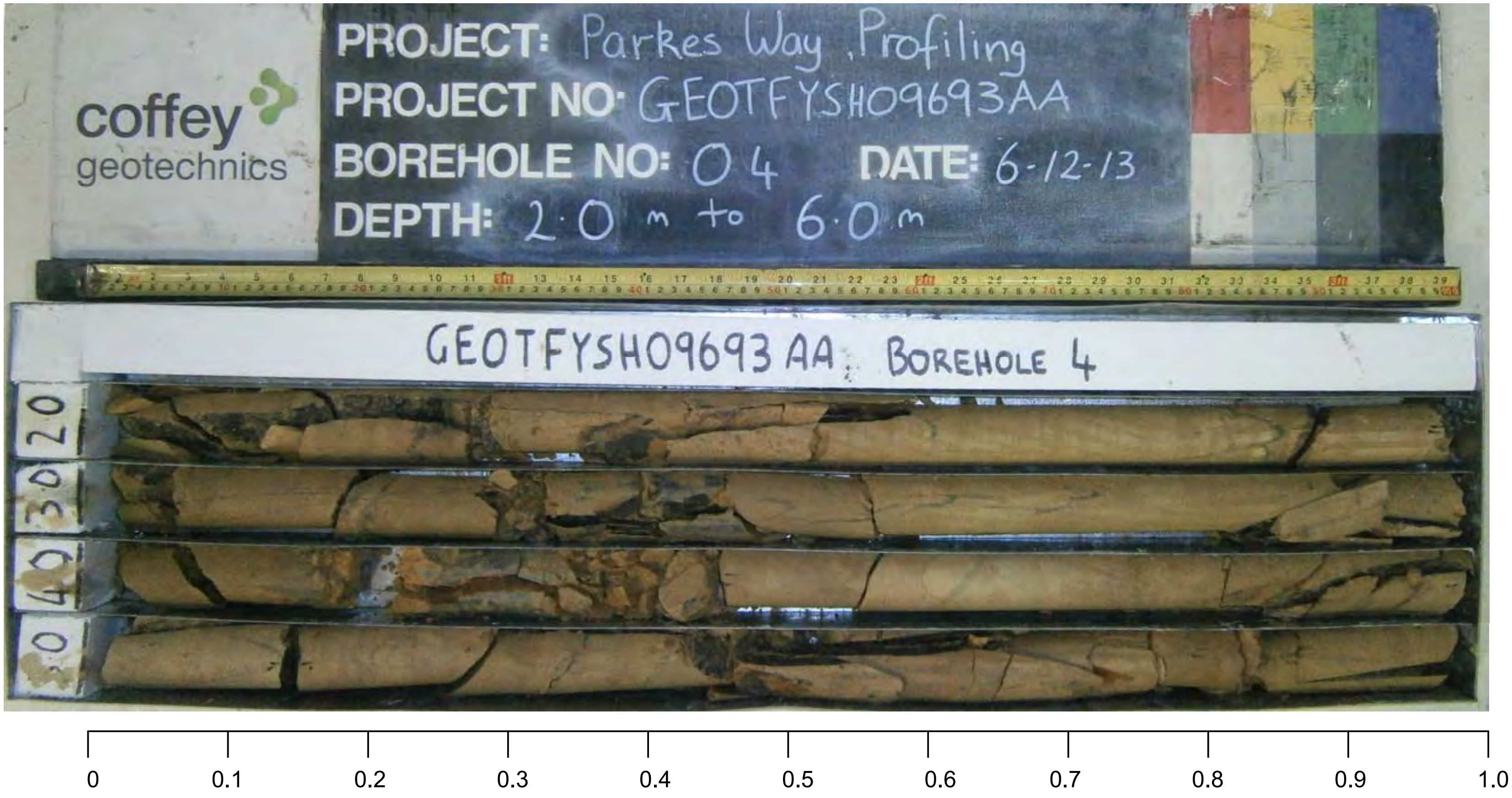
roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

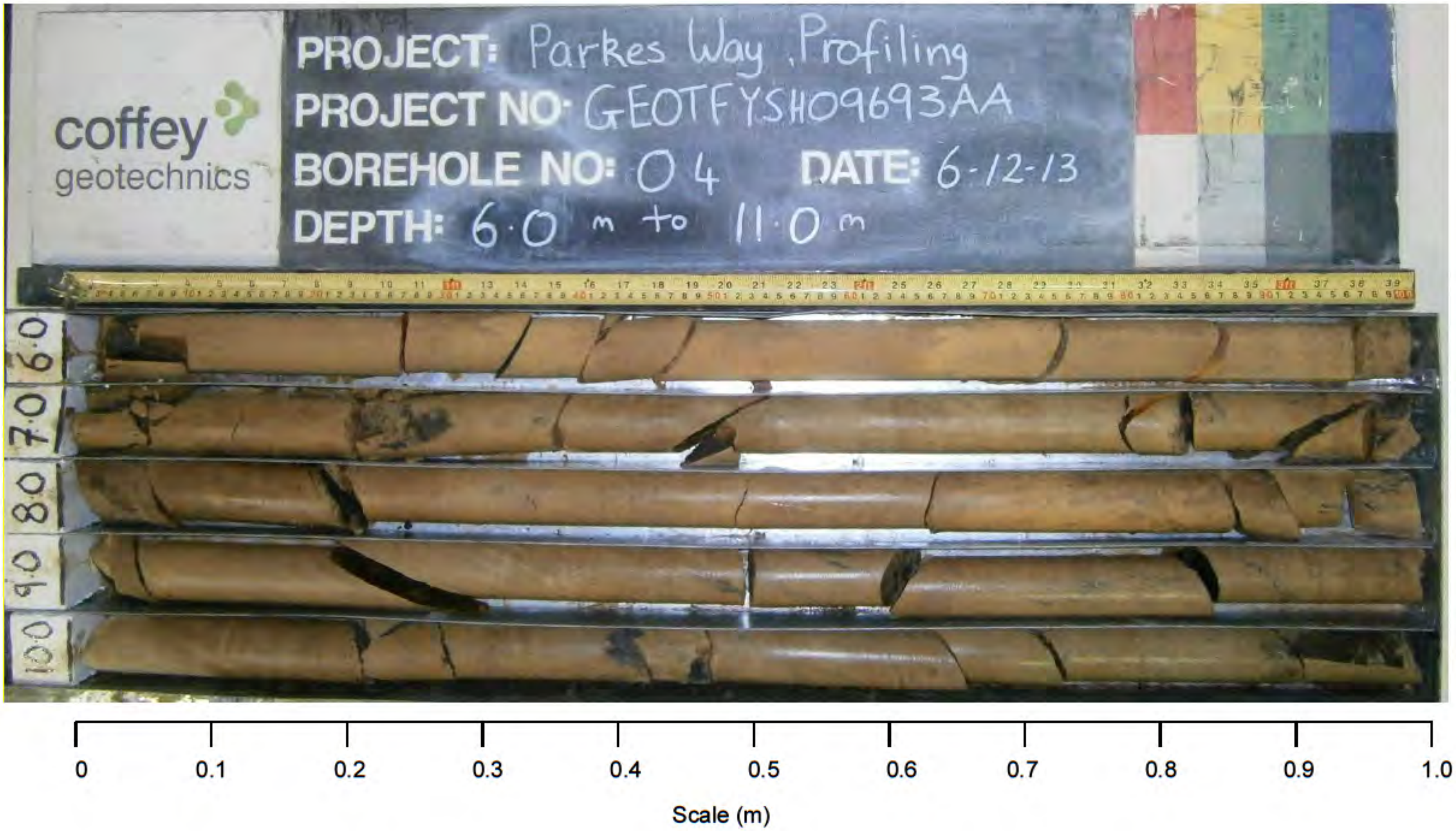
coating

CN	clean
SN	stain
VN	veneer
CO	coating

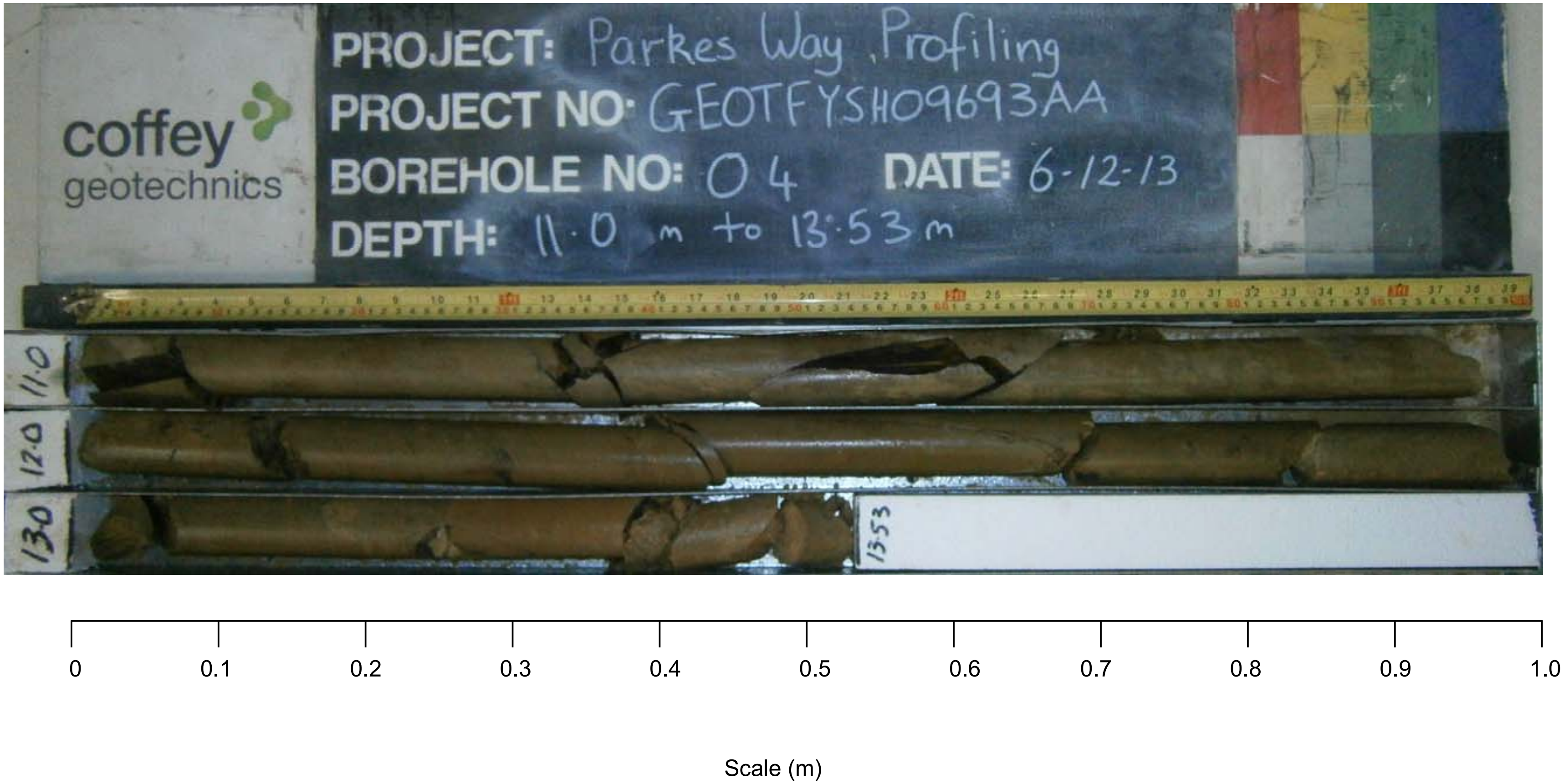
CDF_0_9_04AW.GLB Log COF BOREHOLE: CORED GF9693AA V2.GPJ <<DrawingFile>> 18/12/2013 17:22



drawn	**SB**		client:	**ACT Government – Commerce and Works**
approved	**DB**		project:	**Parkes Way Geotechnical Profiling**
date	**17/12/2013**			
scale	**NTS**		title:	**CORE PHOTO BH04: 2.0 - 6.0m**
original size	**A4**		project no: **GEOTFYSH09693AA**	Photo no: 1 of 3



drawn	SB	coffey	client:	ACT Government – Commerce and Works	
approved	DB		project:	Parkes Way Geotechnical Profiling	
date	17/12/2013				
scale	NTS		title:	CORE PHOTO BH04: 6.0 - 11.0m	
original size	A4		project no:	GEOTFYSH09693AA	Photo no: 2 of 3



drawn	SB	coffey	client:	ACT Government – Commerce and Works
approved	DB		project:	Parkes Way Geotechnical Profiling
date	17/12/2013			
scale	NTS		title:	CORE PHOTO BH04: 11.0 - 13.53m
original size	A4		project no: GEOTFYSH09693AA	Photo no: 3 of 3

Engineering Log - Borehole

Borehole ID.	**BH05**
sheet:	1 of 3
project no.	**GEOTFYSH09693AA**
client:	**ACT Government - Commerce and Works**
date started:	**05 Dec 2013**
principal:	
date completed:	**05 Dec 2013**
project:	**Parkes Way Geotechnical Profiling**
logged by:	**SB**
location:	**Refer to Figure 1**
checked by:	**DB**

position: E: 693451; N: 6093177 (WGS84 Zone 55)
surface elevation : 559.80m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW

drilling information						material substance						
method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description **SOIL TYPE**: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V HW casing								**FILL: Silty CLAY** low plasticity, dark grey, trace of fine sand.	<Wp			**TOPSOIL**
				559 558	1.0 2.0			**SILTSTONE**: pale-brown, extremely to highly weathered, low to medium strength.				**BEDROCK**
				557 556 555 554 553 552	3.0 4.0 5.0 6.0 7.0			Borehole BH05 continued as cored hole				

method

AD	auger drilling*
AS	auger screwing*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit
*	bit shown by suffix
e.g.	AD/T

support

M	mud
N	nil
C	casing

penetration

1 2 3 no resistance ranging to refusal

water

10-Oct-12 water level on date shown

water inflow

water outflow

samples & field tests

U##	undisturbed sample ##mm diameter
D	disturbed sample
B	bulk disturbed sample
E	environmental sample
HP	hand penetrometer (kPa)
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
VS	vane shearpeak/remouded (uncorrected kPa)
R	refusal

classification symbol & soil description

based on Unified Classification System

moisture

D	dry
M	moist
W	wet

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

CDF_0_9_04AW.GLB Log COF BOREHOLE: NON CORED GF9693AA V2.GPJ <<DrawingFile>> 18/12/2013 17:21

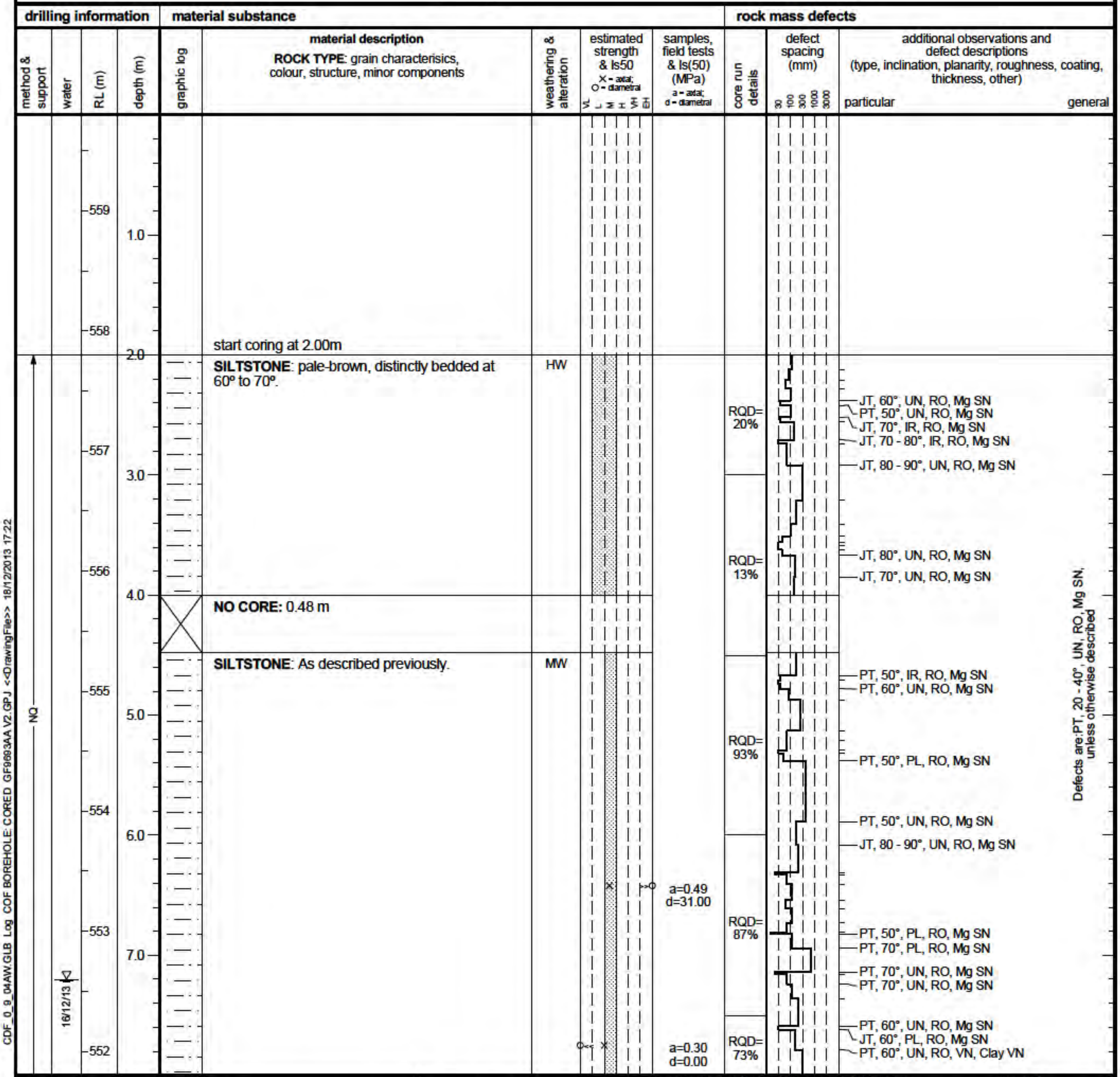
Engineering Log - Cored Borehole

Borehole ID. **BH05**
sheet: 2 of 3
project no. **GEOTFYSH09693AA**

client: **ACT Government - Commerce and Works**
principal:
project: **Parkes Way Geotechnical Profiling**
location: **Refer to Figure 1**

date started: **05 Dec 2013**
date completed: **05 Dec 2013**
logged by: **SB**
checked by: **DB**

position: E: 693451; N: 6093177 (WGS84 Zone 55)
surface elevation : 559.80m (AHD)
angle from horizontal: 90°
drill model: Multidrill
mounting: Trailer
Casing Diameter : HW



start coring at 2.00m

SILTSTONE: pale-brown, distinctly bedded at 60º to 70º. HW

NO CORE: 0.48 m

SILTSTONE: As described previously. MW

a=0.49
d=31.00

a=0.30
d=0.00

RQD= 20%

RQD= 13%

RQD= 93%

RQD= 87%

RQD= 73%

JT, 60°, UN, RO, Mg SN
PT, 50°, UN, RO, Mg SN
JT, 70°, IR, RO, Mg SN
JT, 70 - 80°, IR, RO, Mg SN
JT, 80 - 90°, UN, RO, Mg SN
JT, 80°, UN, RO, Mg SN
JT, 70°, UN, RO, Mg SN
PT, 50°, IR, RO, Mg SN
PT, 60°, UN, RO, Mg SN
PT, 50°, PL, RO, Mg SN
PT, 50°, UN, RO, Mg SN
JT, 80 - 90°, UN, RO, Mg SN
PT, 50°, PL, RO, Mg SN
PT, 70°, PL, RO, Mg SN
PT, 70°, UN, RO, Mg SN
PT, 70°, UN, RO, Mg SN
PT, 60°, UN, RO, Mg SN
JT, 60°, PL, RO, Mg SN
PT, 60°, UN, RO, VN, Clay VN

Defects are:PT, 20 - 40°, UN, RO, Mg SN, unless otherwise described

CDF_0_9_04AW.GLB Log COF BOREHOLE: CORED GF9693AA V2.GPJ <<DrawingFile>> 18/12/2013 17:22

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graphic log / core recovery

▨	core recovered (graphic symbols indicate material)
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core run details

├┤	barrel withdrawn

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SS	shear surface
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