

**RICHMOND ROAD UPGRADE
ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE
INVESTIGATION**

VOLUME 2 - FIGURES

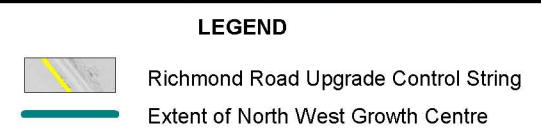
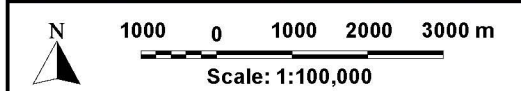
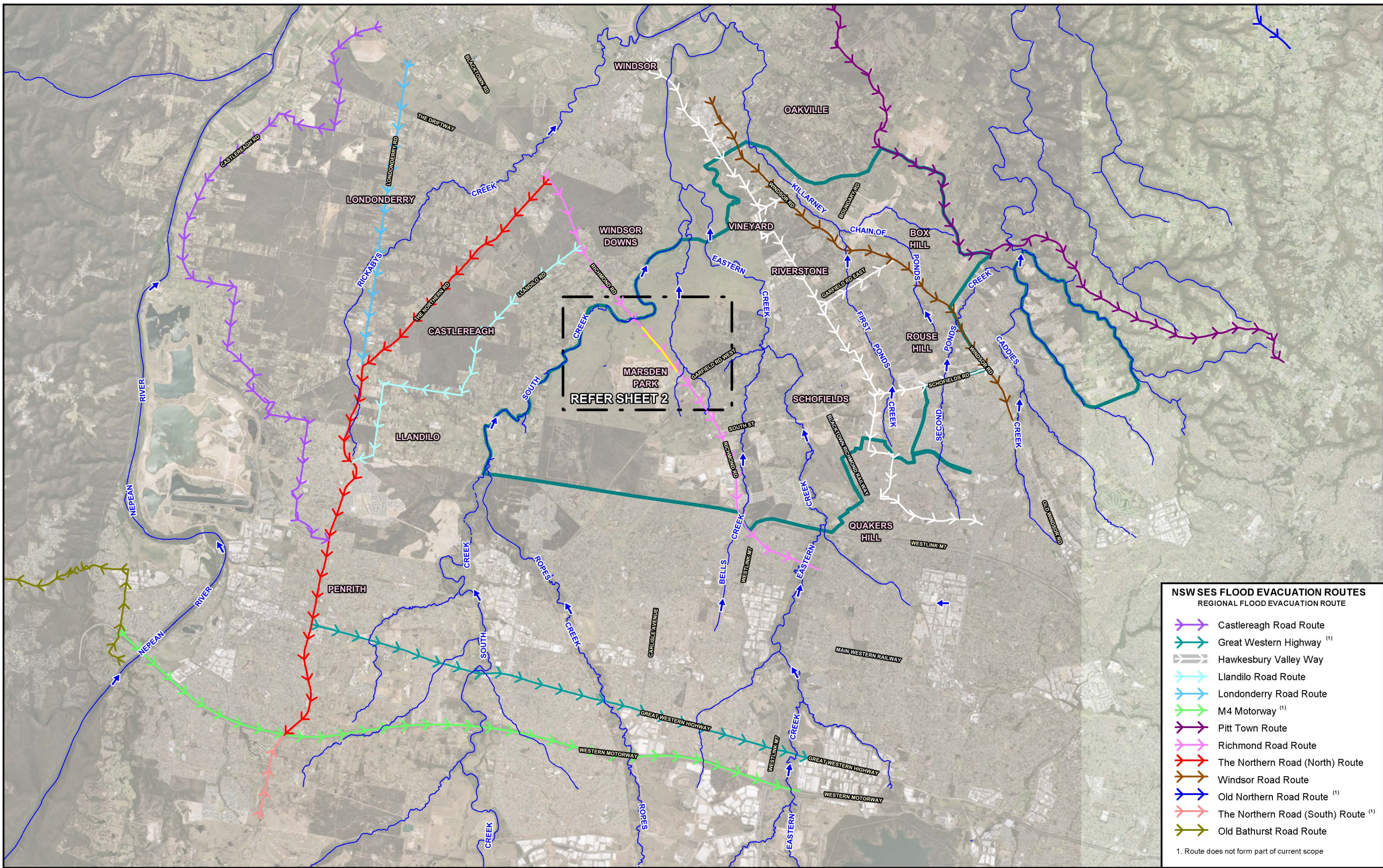
DRAFT FOR CLIENT REVIEW

March 2020

DRAFT REPORT FOR CLIENT REVIEW

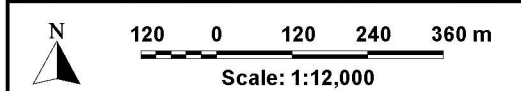
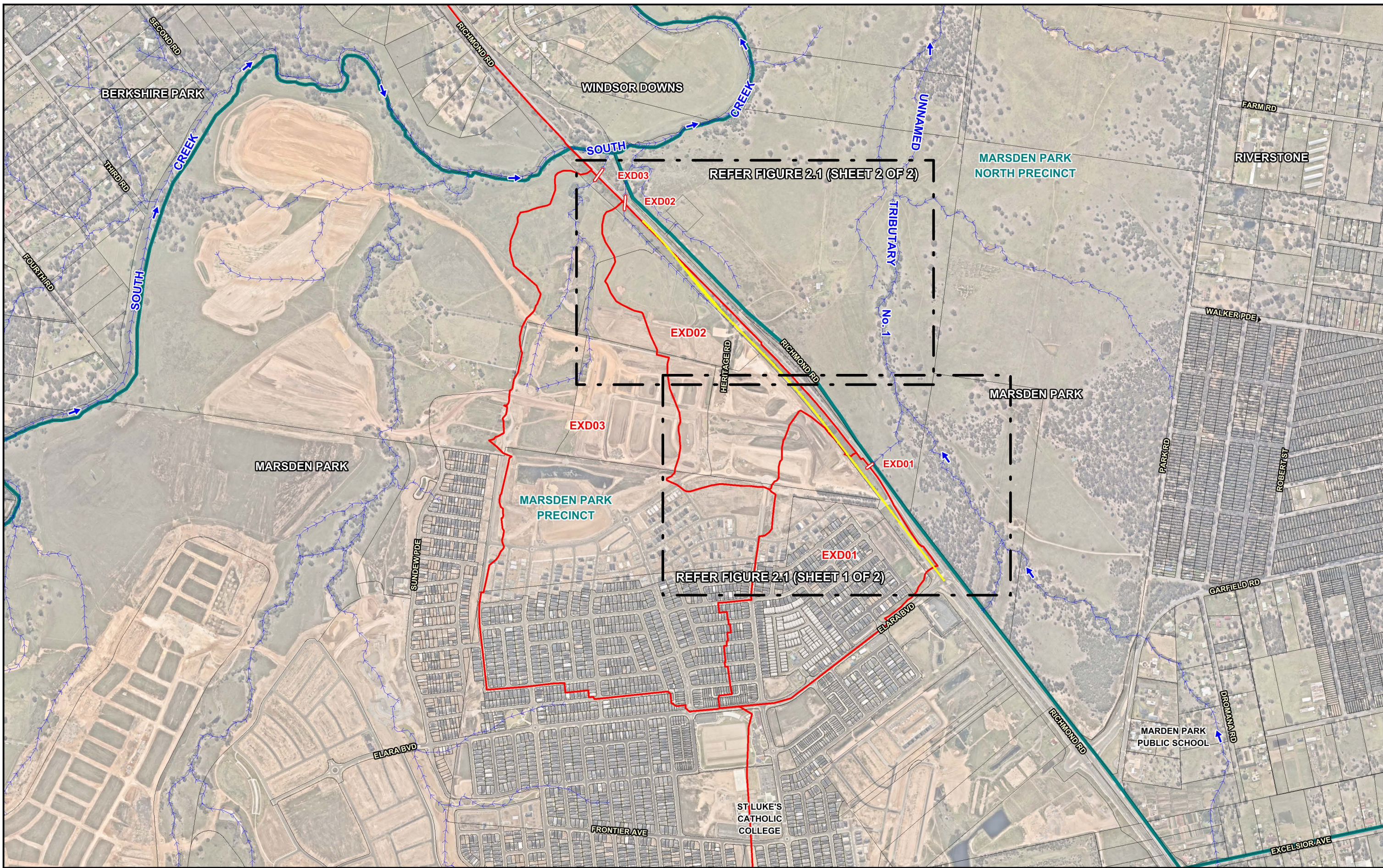
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**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 1.1
(Sheet 1 of 2)

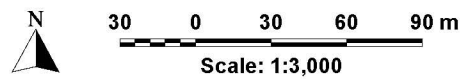


LEGEND

	Richmond Road Upgrade Control String
	Development Precinct Boundary
	Existing Transverse Drainage Structure and Identifier
	Extent of Catchment Draining to Existing Transverse Drainage Structures

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 1.1
(Sheet 2 of 2)



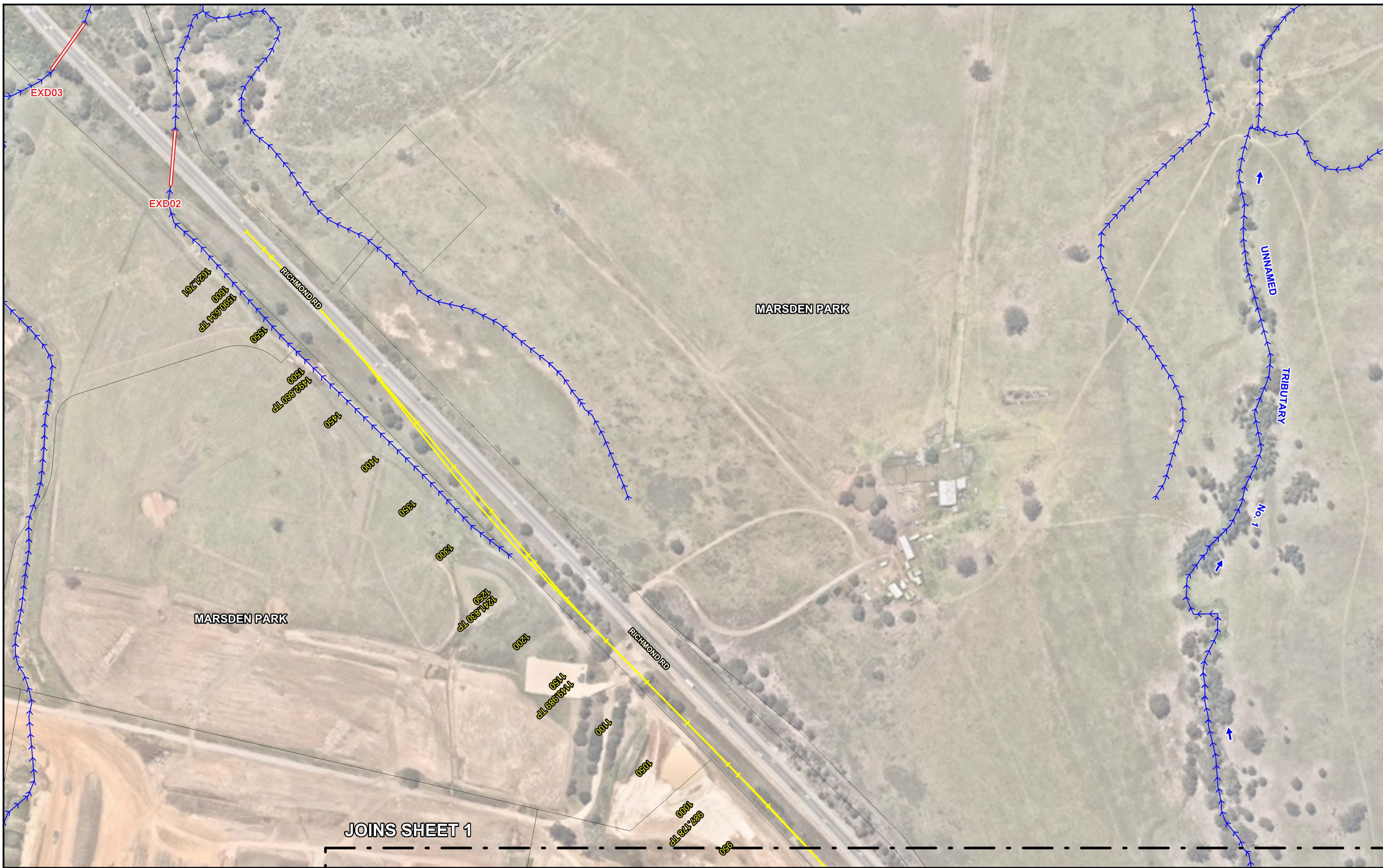
- LEGEND**
- Existing Stormwater Network
 - >>> Existing Drainage Line
 - |— Richmond Road Upgrade String and Chainage
 - EXD01 Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Figure 2.1
(Sheet 1 of 2)

EXISTING DRAINAGE SYSTEM IN VICINITY OF ROAD CORRIDOR



**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

N

30 0 30 60 90 m

Scale: 1:3,000

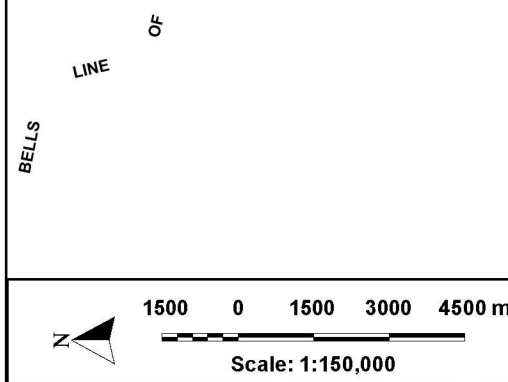
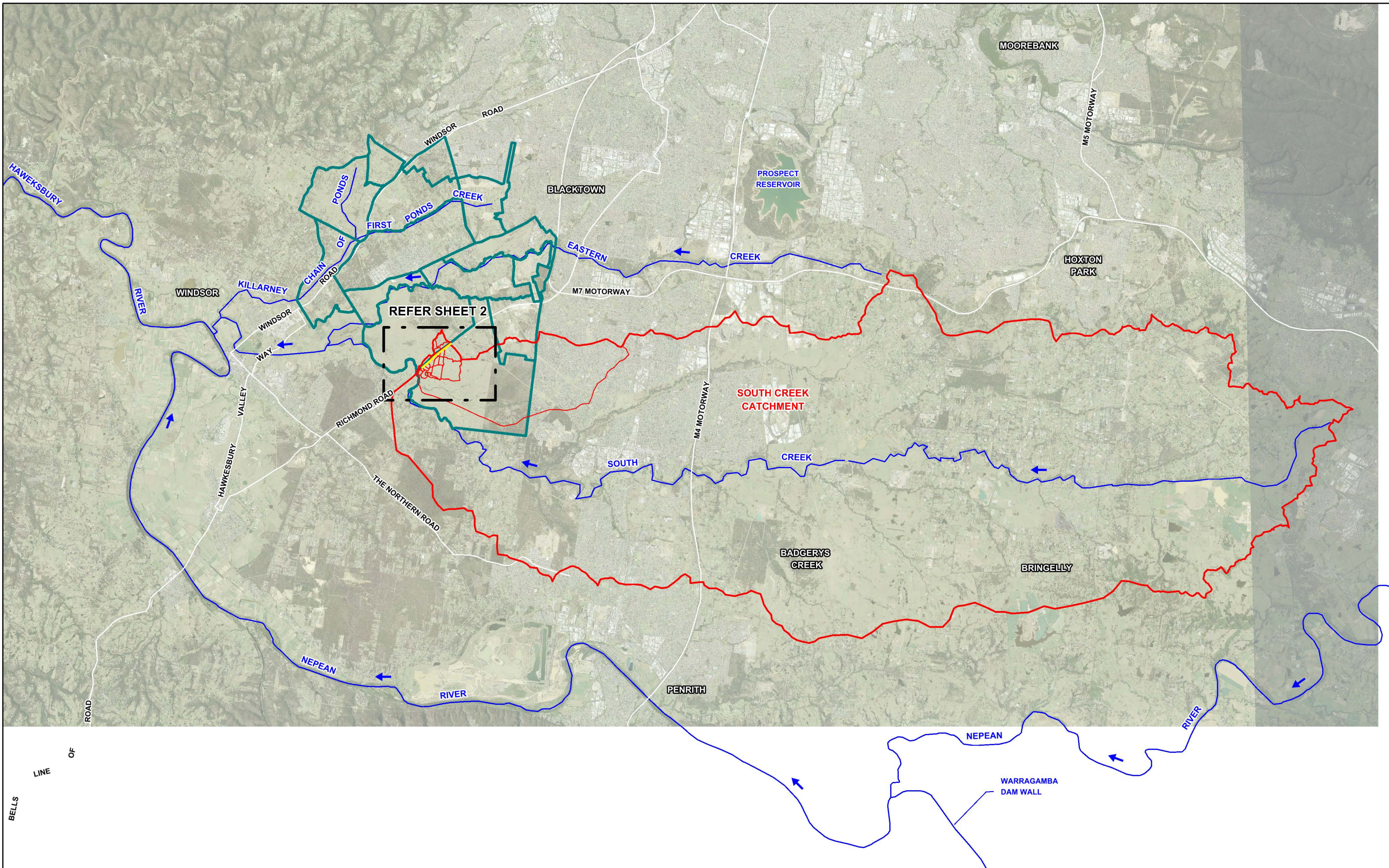
LEGEND

- Existing Stormwater Network
- >>> Existing Drainage Line
- +— Richmond Road Upgrade String and Chainage
- EXD02 Existing Transverse Drainage Structure and Identifier

Figure 2.1
(Sheet 2 of 2)

EXISTING DRAINAGE SYSTEM IN VICINITY OF ROAD CORRIDOR

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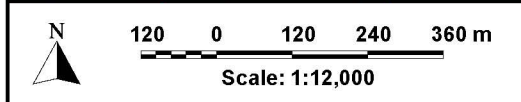
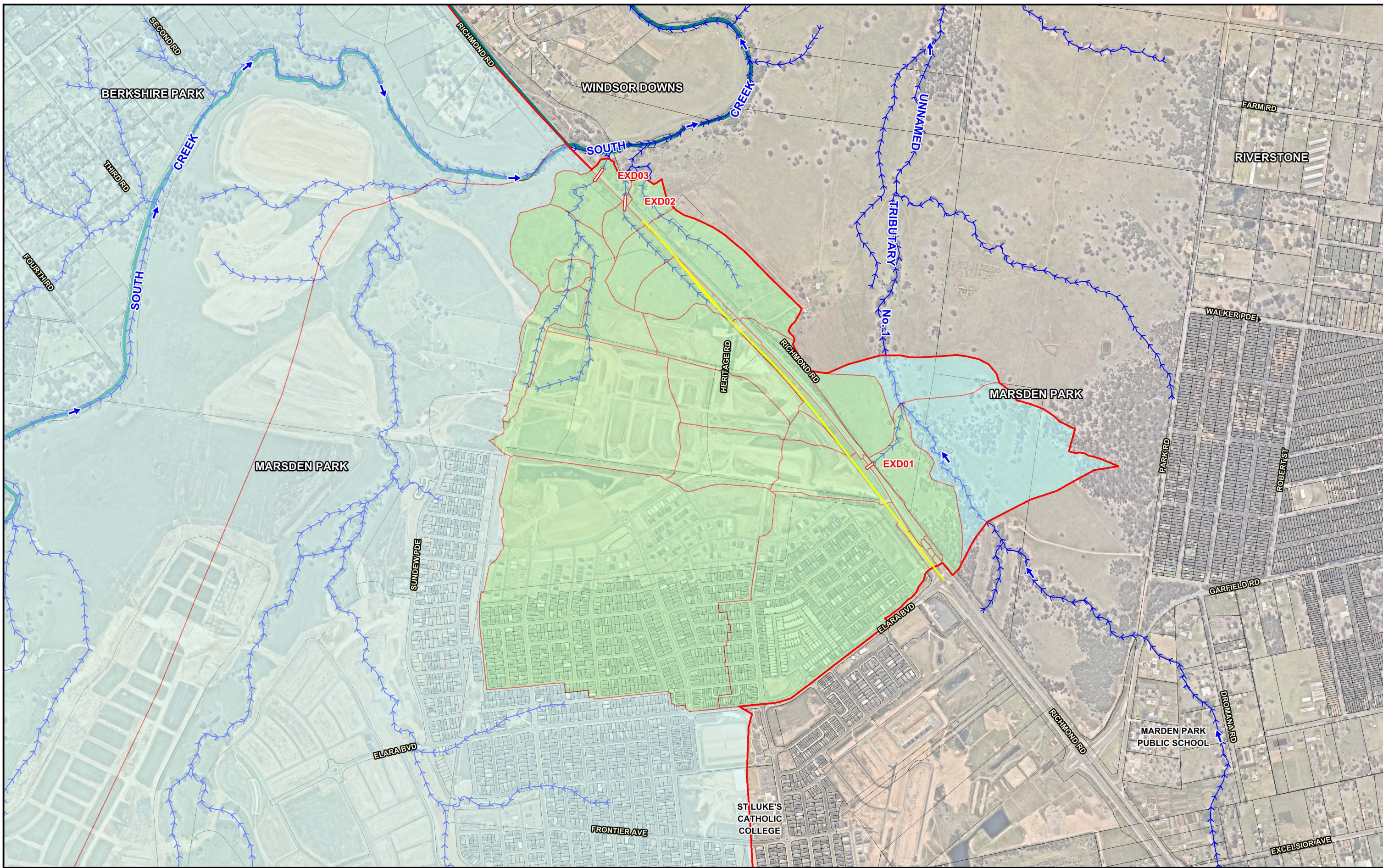


- LEGEND**
- Major Overland Flow Path
 - Development Precinct Boundary
 - Catchment Boundary
 - Sub-Catchment Boundary
 - Richmond Road Upgrade Control String

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

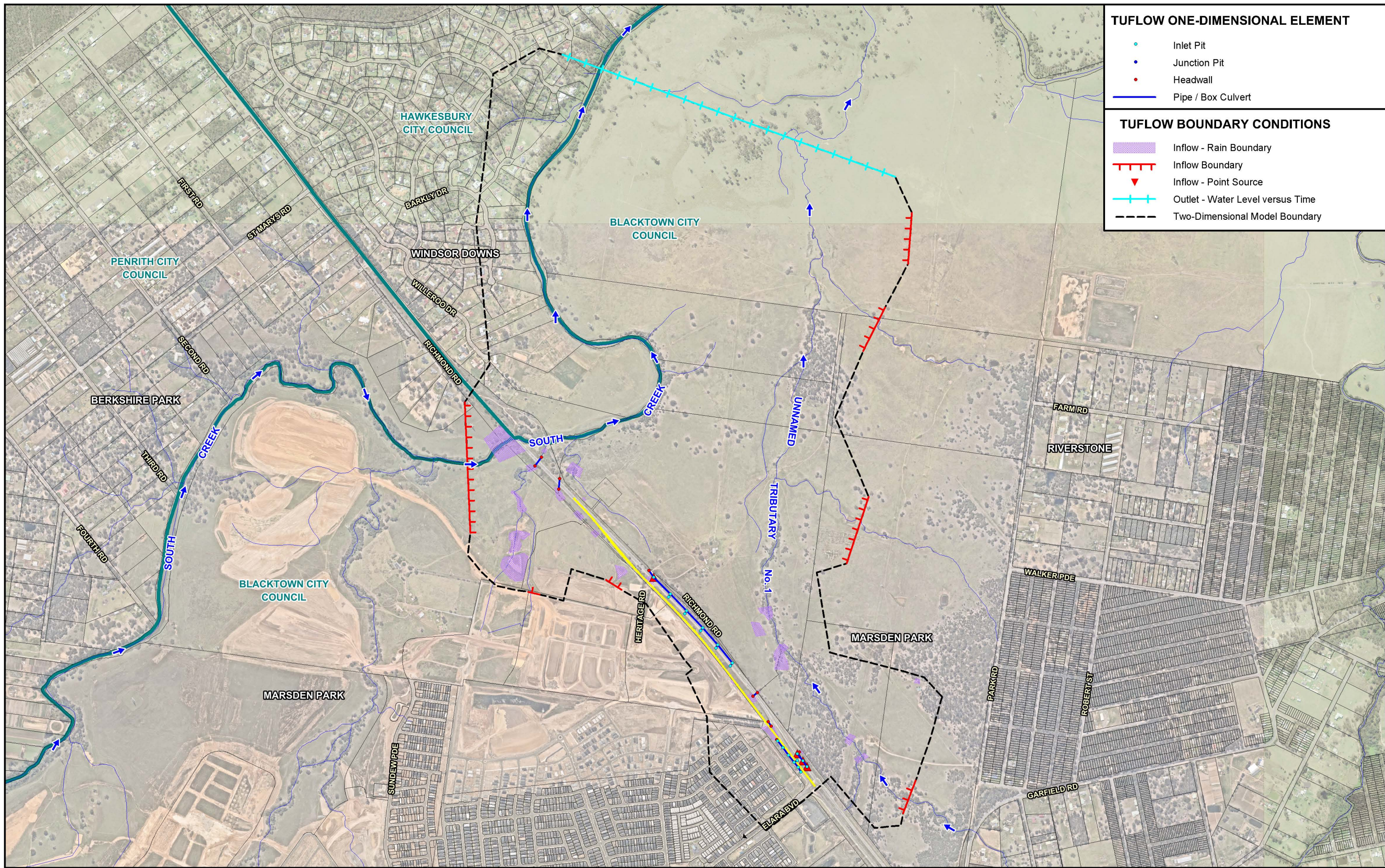


Figure 3.1
(Sheet 1 of 2)



LEGEND	
	Existing Transverse Drainage Structure and Identifier
	Drainage Line
	Richmond Road Upgrade Control String
	ILSAX Sub-catchment
	RAFTS Sub-catchment

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

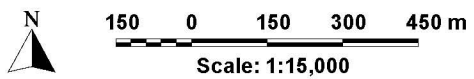


TUFLOW ONE-DIMENSIONAL ELEMENT

- Inlet Pit
- Junction Pit
- Headwall
- Pipe / Box Culvert

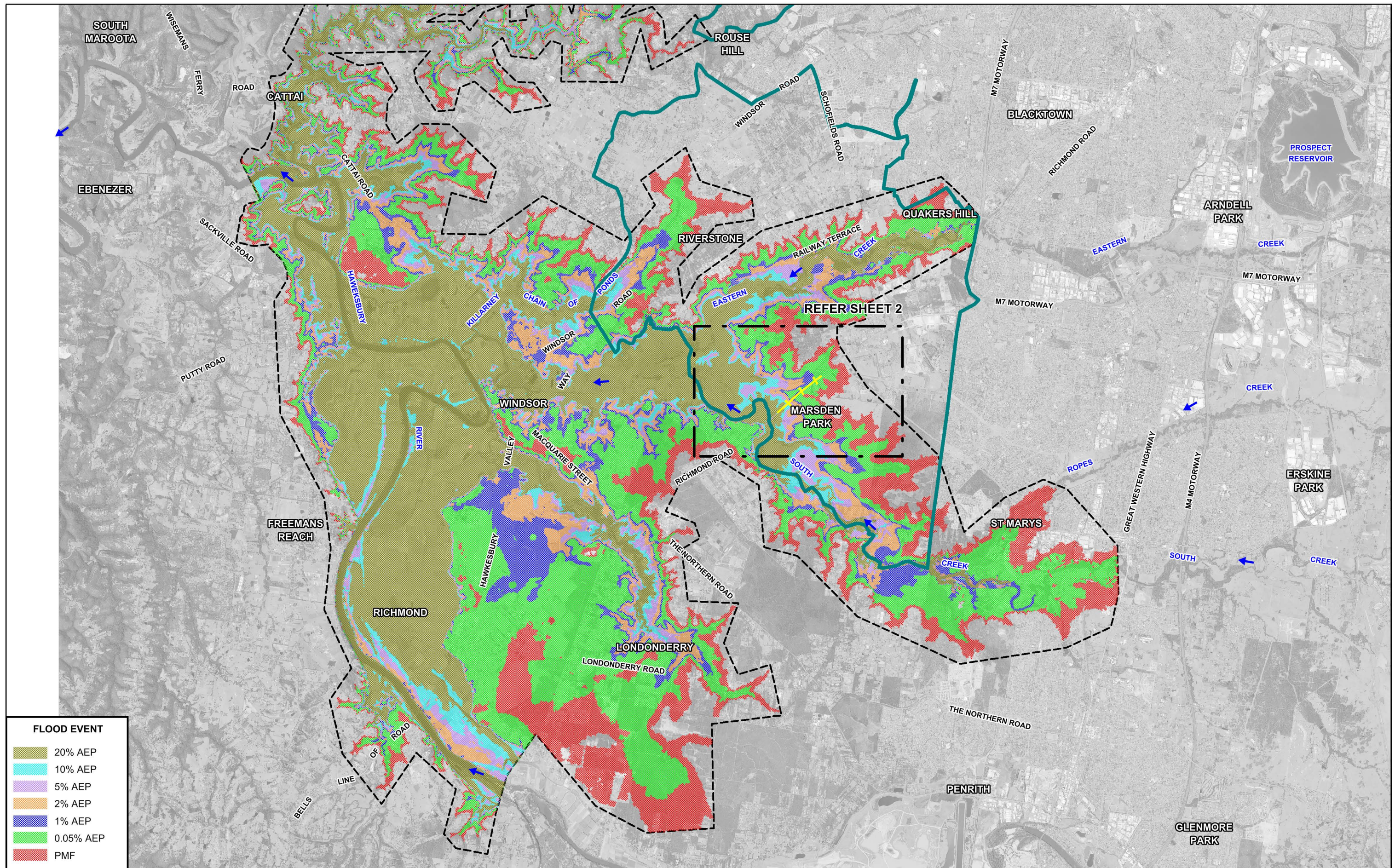
TUFLOW BOUNDARY CONDITIONS

- Inflow - Rain Boundary
- Inflow Boundary
- ▼ Inflow - Point Source
- Outlet - Water Level versus Time
- Two-Dimensional Model Boundary

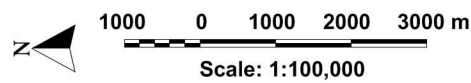


- LEGEND**
- Richmond Road Upgrade Control String
 - LGA Boundary

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



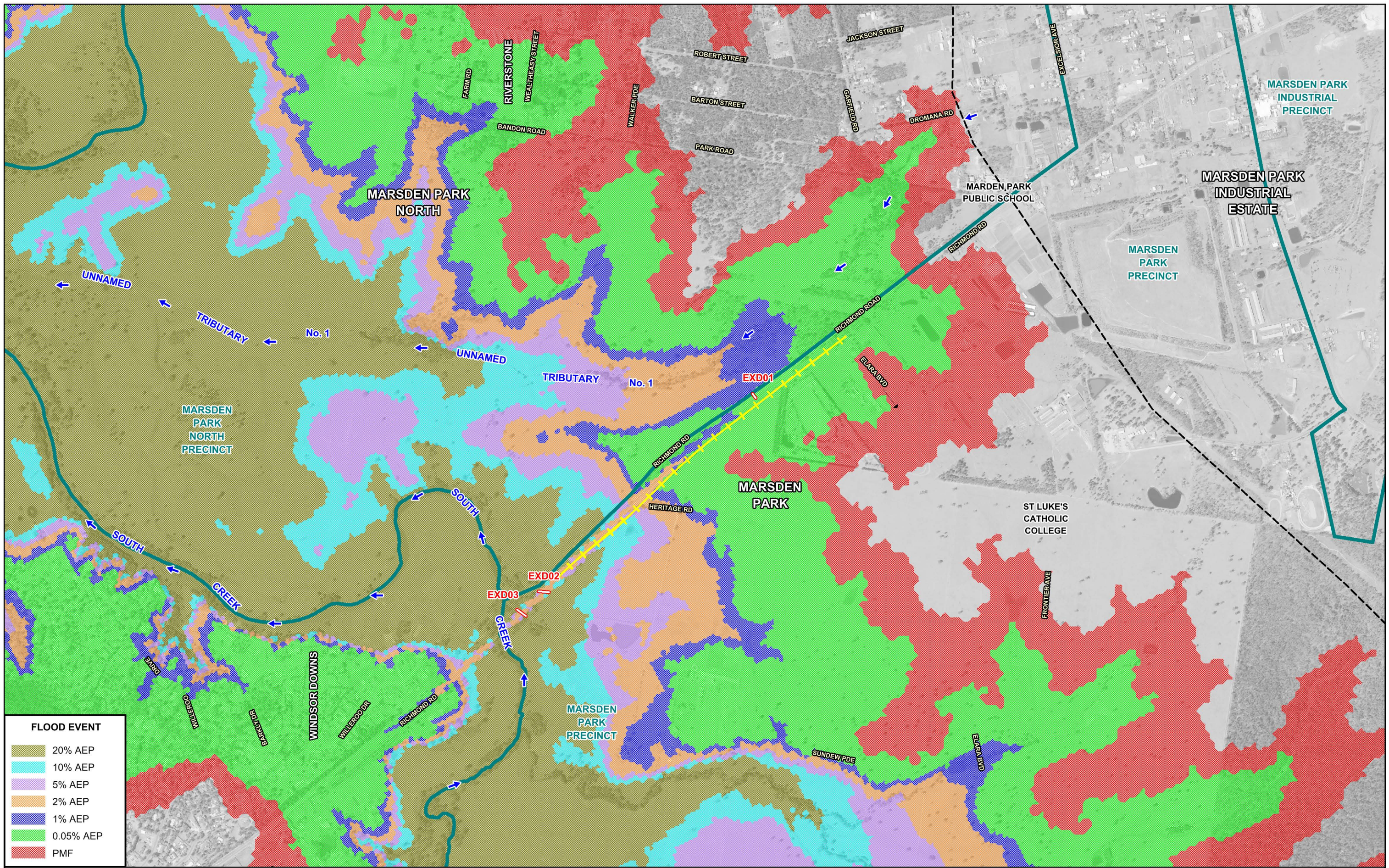
FLOOD EVENT	
	20% AEP
	10% AEP
	5% AEP
	2% AEP
	1% AEP
	0.05% AEP
	PMF



LEGEND	
	TUFLOW Model Extent
	Extent of North West Growth Centre
	Richmond Road Upgrade Control String

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**





FLOOD EVENT	
	20% AEP
	10% AEP
	5% AEP
	2% AEP
	1% AEP
	0.05% AEP
	PMF

LEGEND	
	TUFLOW Model Extent
	Development Precinct Boundary
	Richmond Road Upgrade Control String
	Existing Transverse Drainage Structure and Identifier

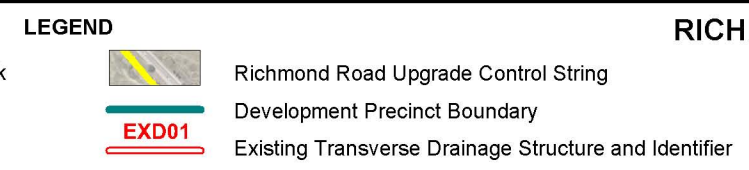
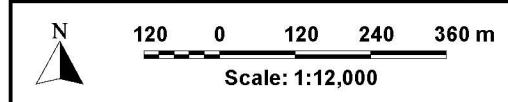
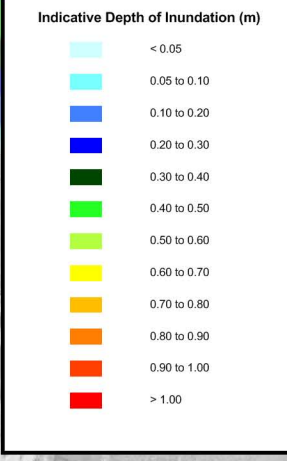
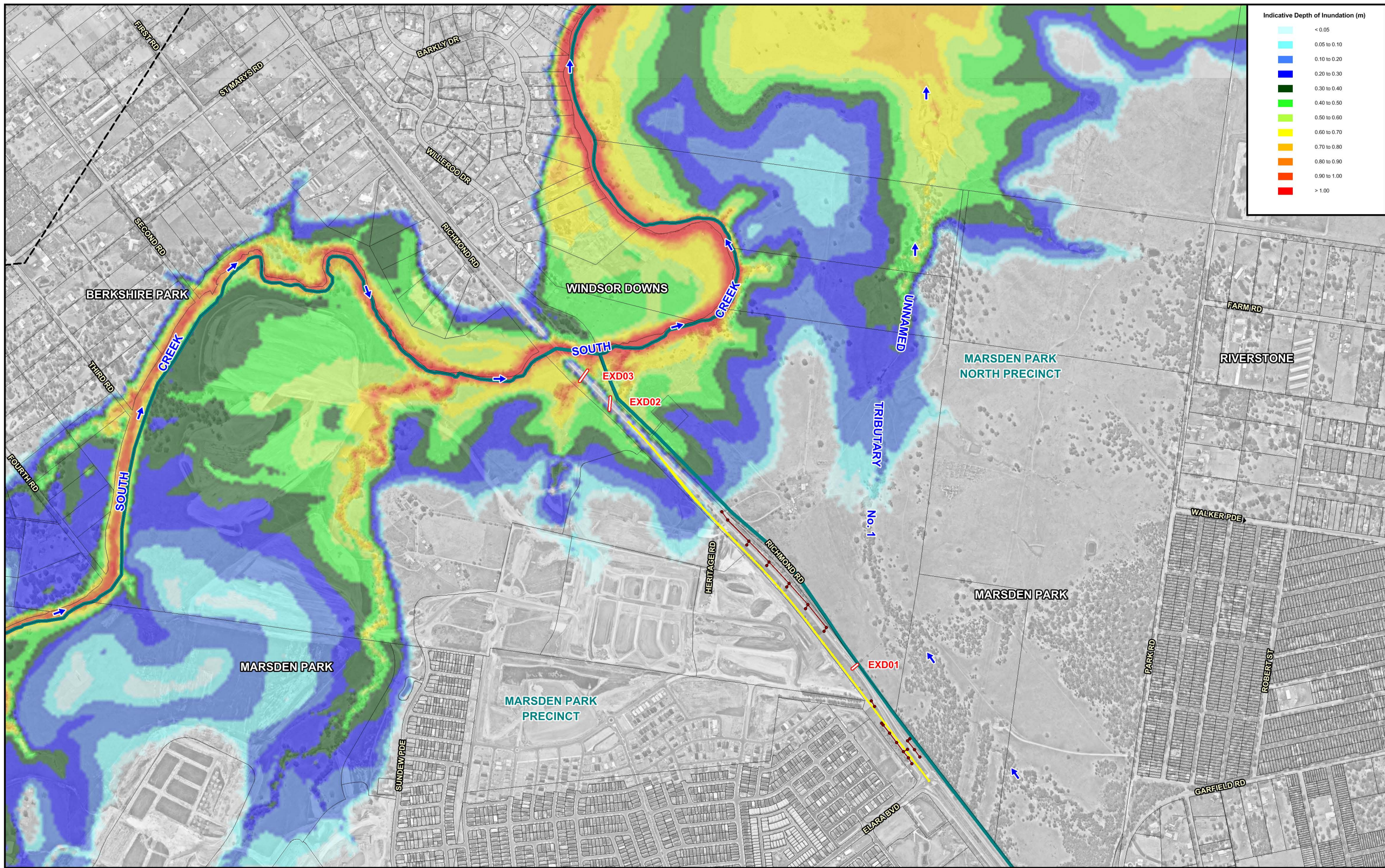
**GARFIELD ROAD WEST UPGRADE
FLOODING AND DRAINAGE INVESTIGATION**

Scale: 1:15,000



Figure 4.2
(Sheet 2 of 2)

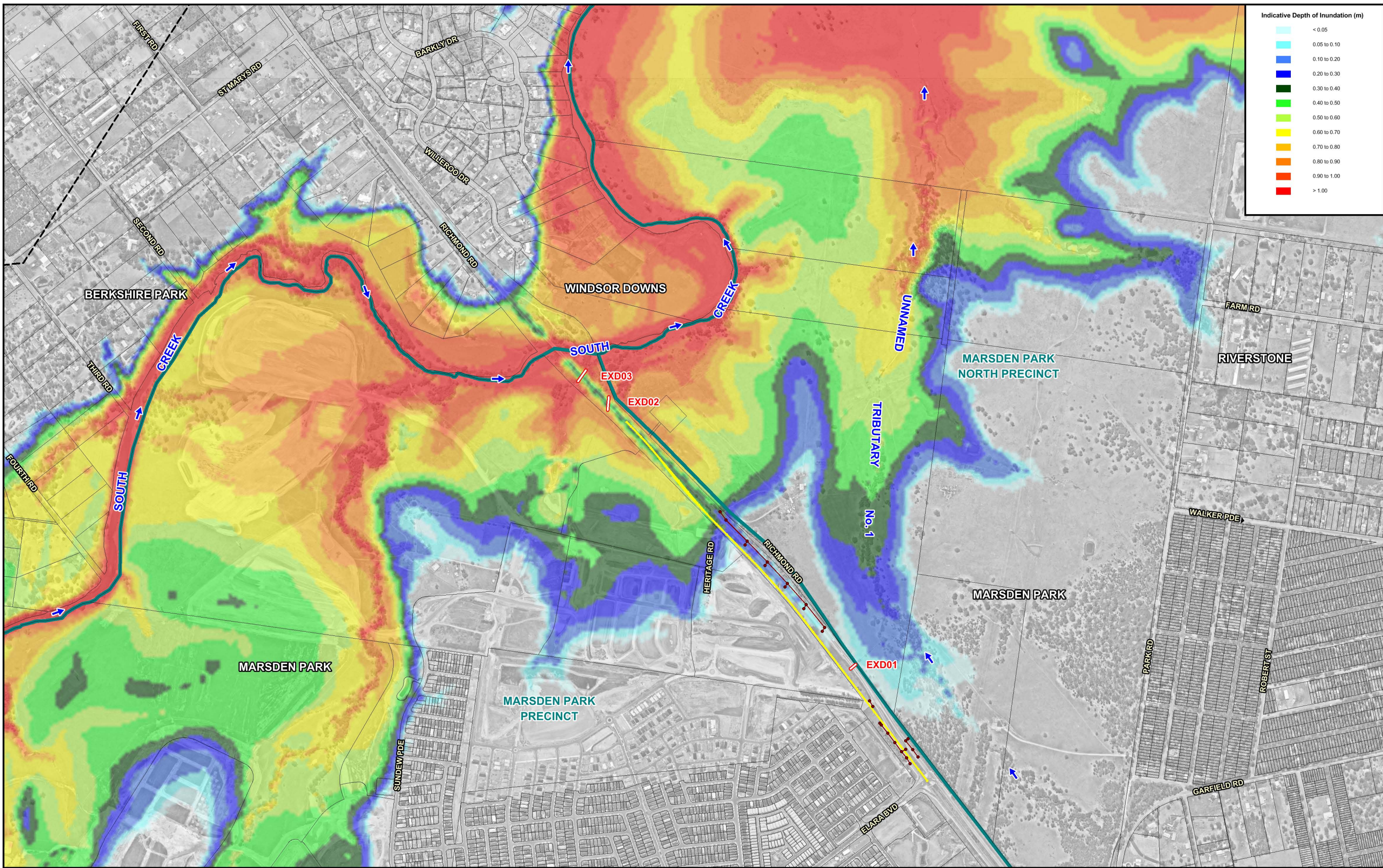
INDICATIVE EXTENT OF HAWKESBURY-NEPEAN RIVER FLOODING IN VICINITY OF PROJECT CORRIDOR



**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

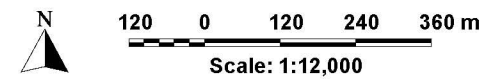
Figure 4.3

TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
5% AEP - HAWKESBURY-NEPEAN RIVER FLOODING



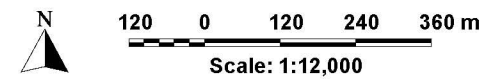
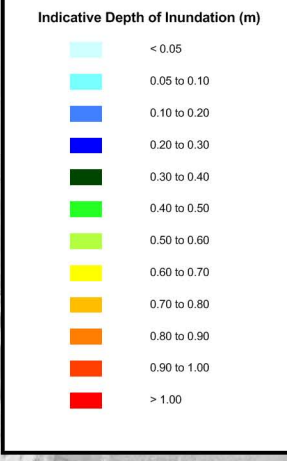
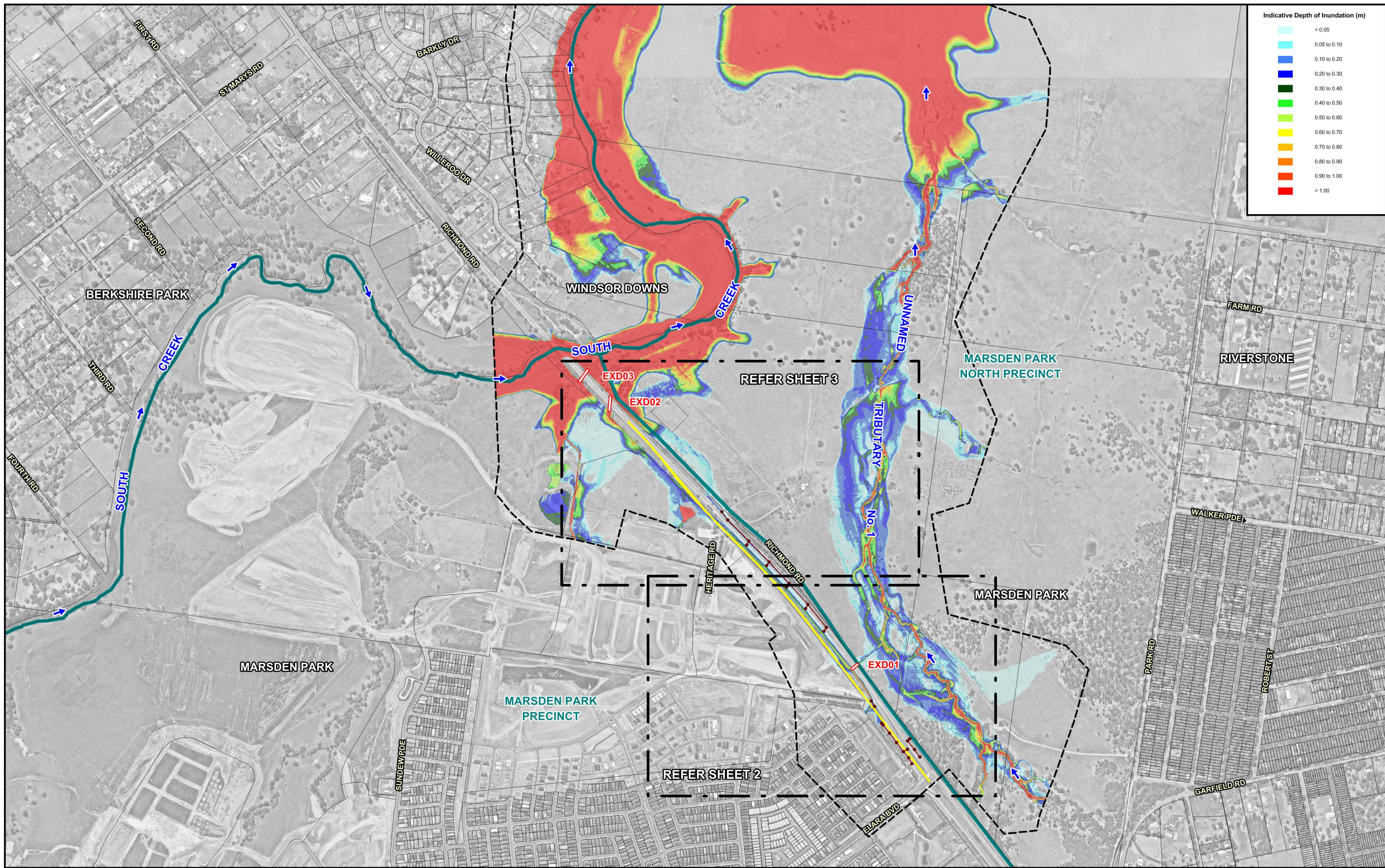
Indicative Depth of Inundation (m)

<0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00



- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Control String
 - Development Precinct Boundary
 - Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

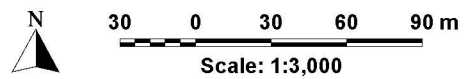
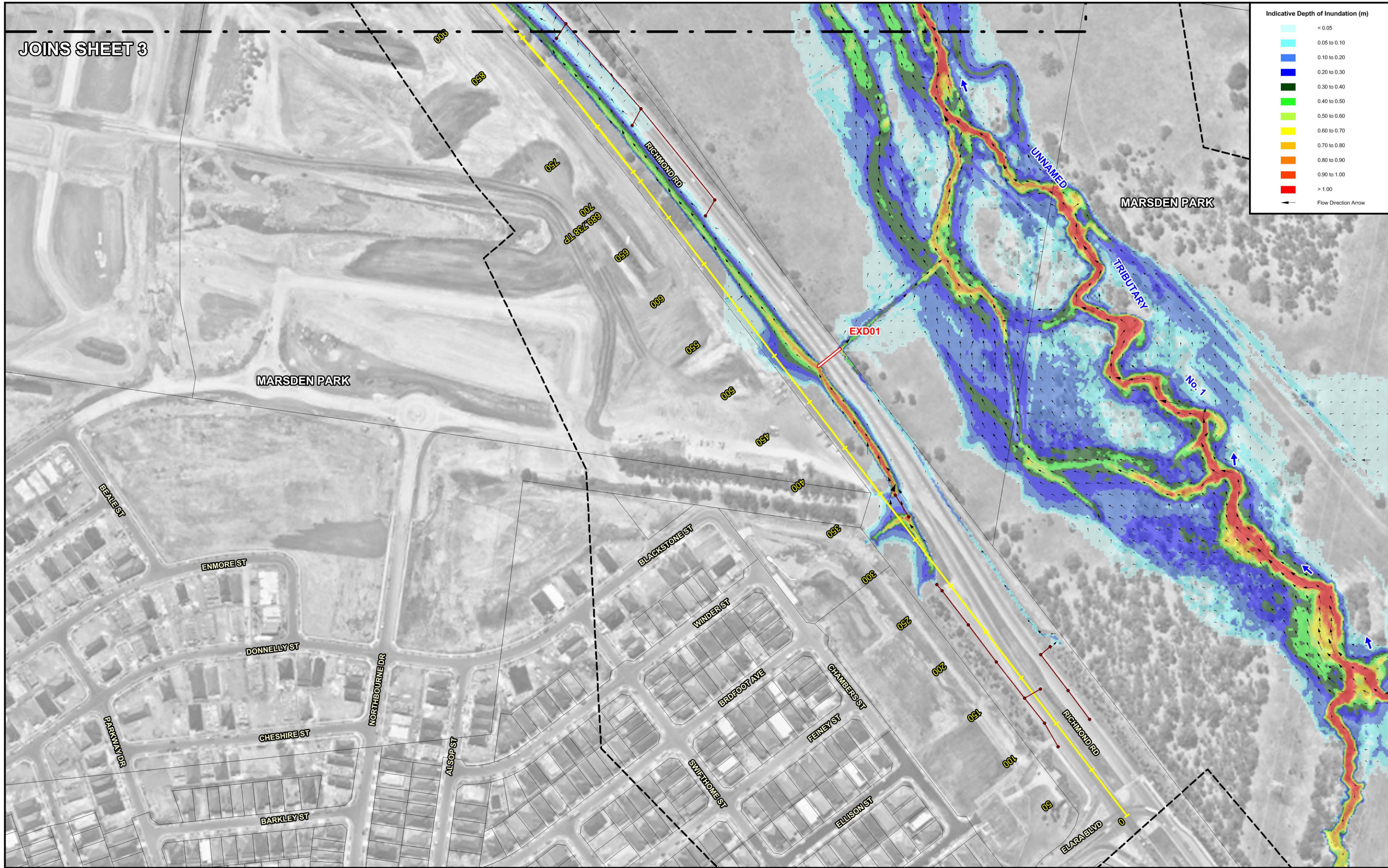
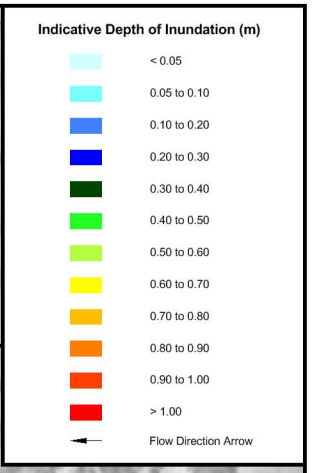


- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Control String
 - Development Precinct Boundary
 - EXD01 Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Figure 4.5
(Sheet 1 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
20% AEP - MINOR AND MAJOR TRIBUTARY FLOODING

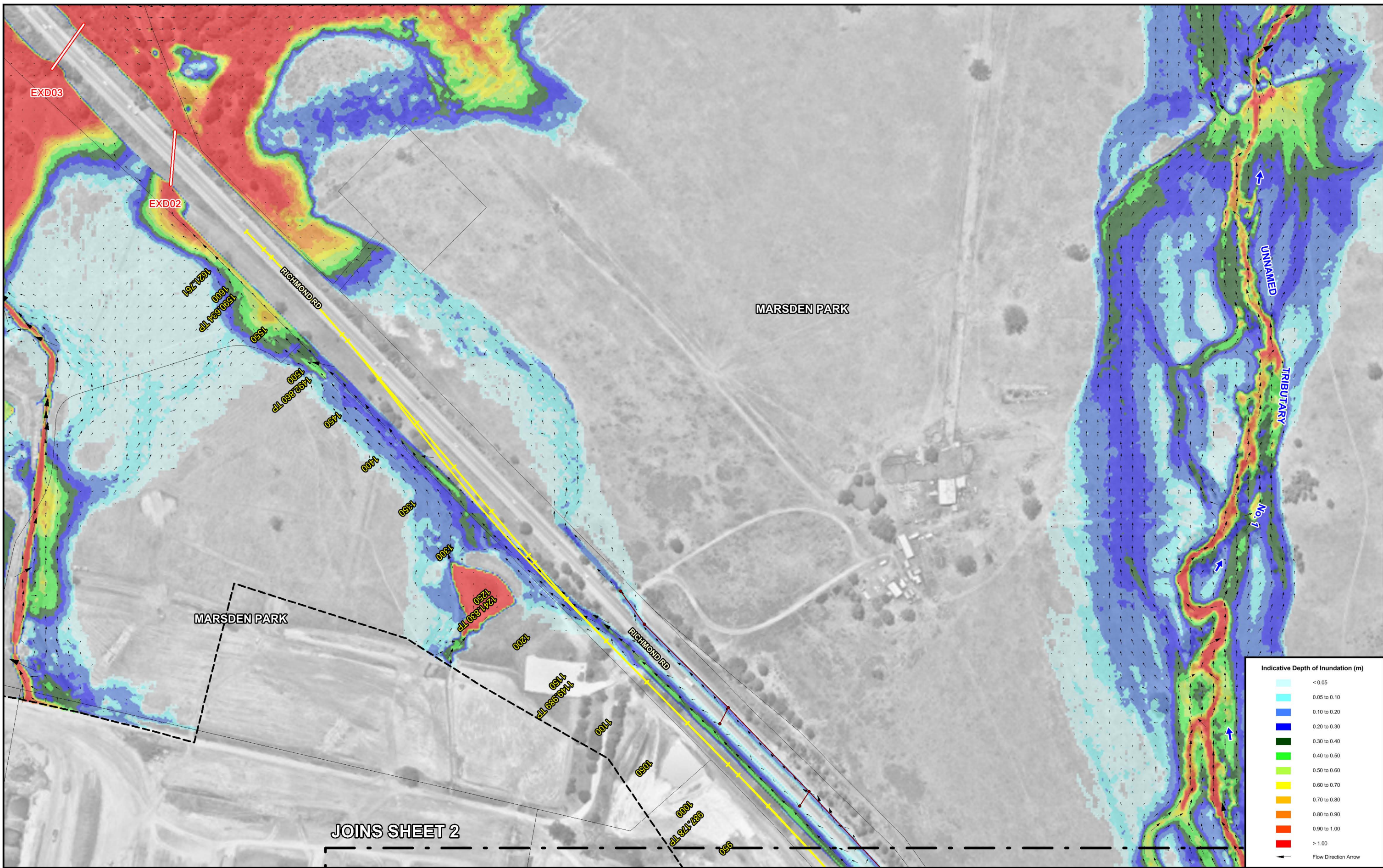


- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



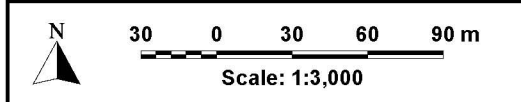
Figure 4.5
(Sheet 2 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
20% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



Indicative Depth of Inundation (m)

< 0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00

Flow Direction Arrow



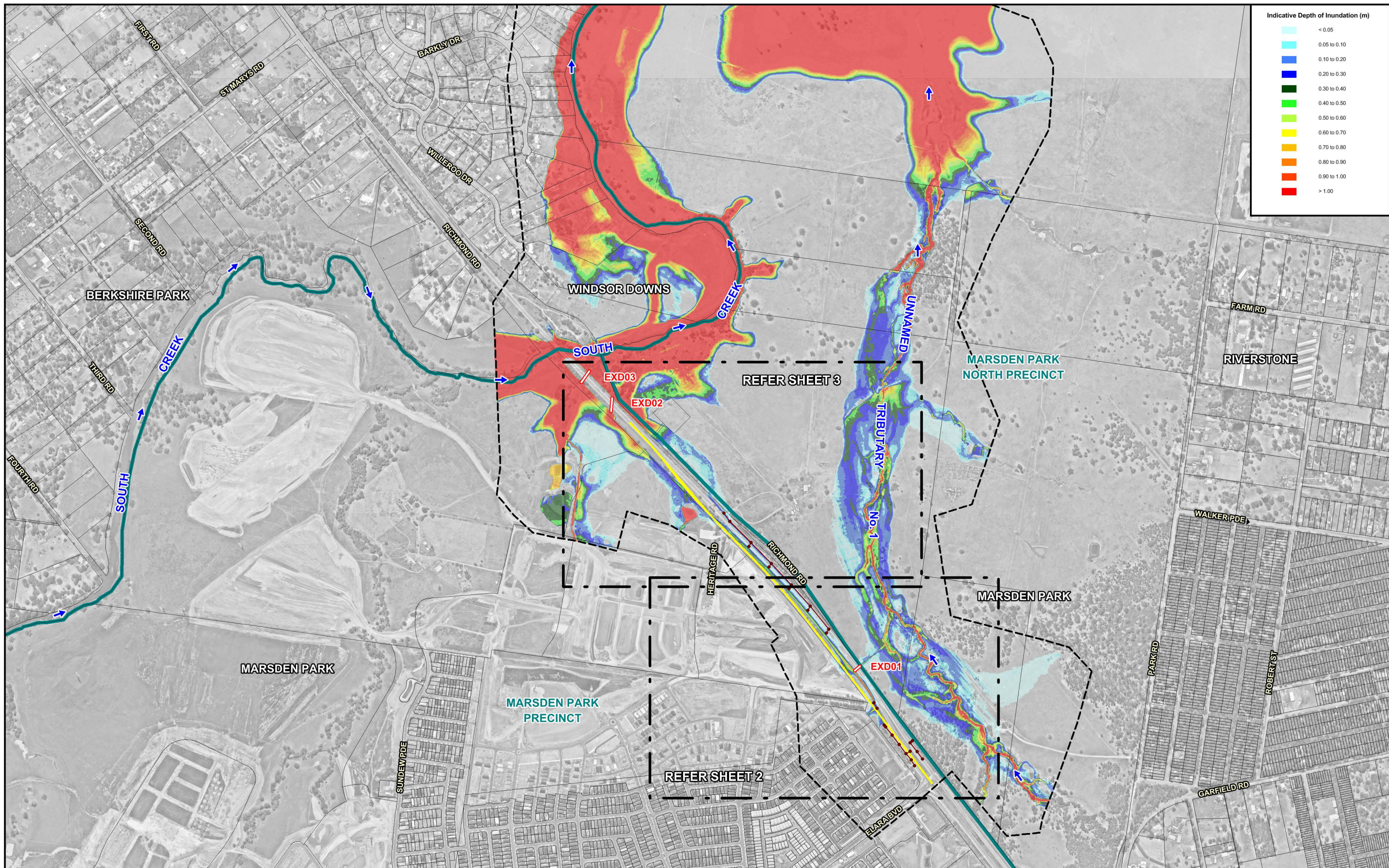
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- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - EXD02 Existing Transverse Drainage Structure and Identifier

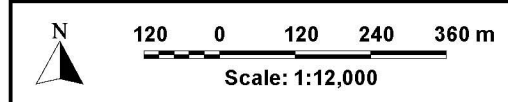
**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 4.5
(Sheet 3 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
20% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



Indicative Depth of Inundation (m)

<math><0.05</math>
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00



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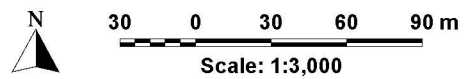
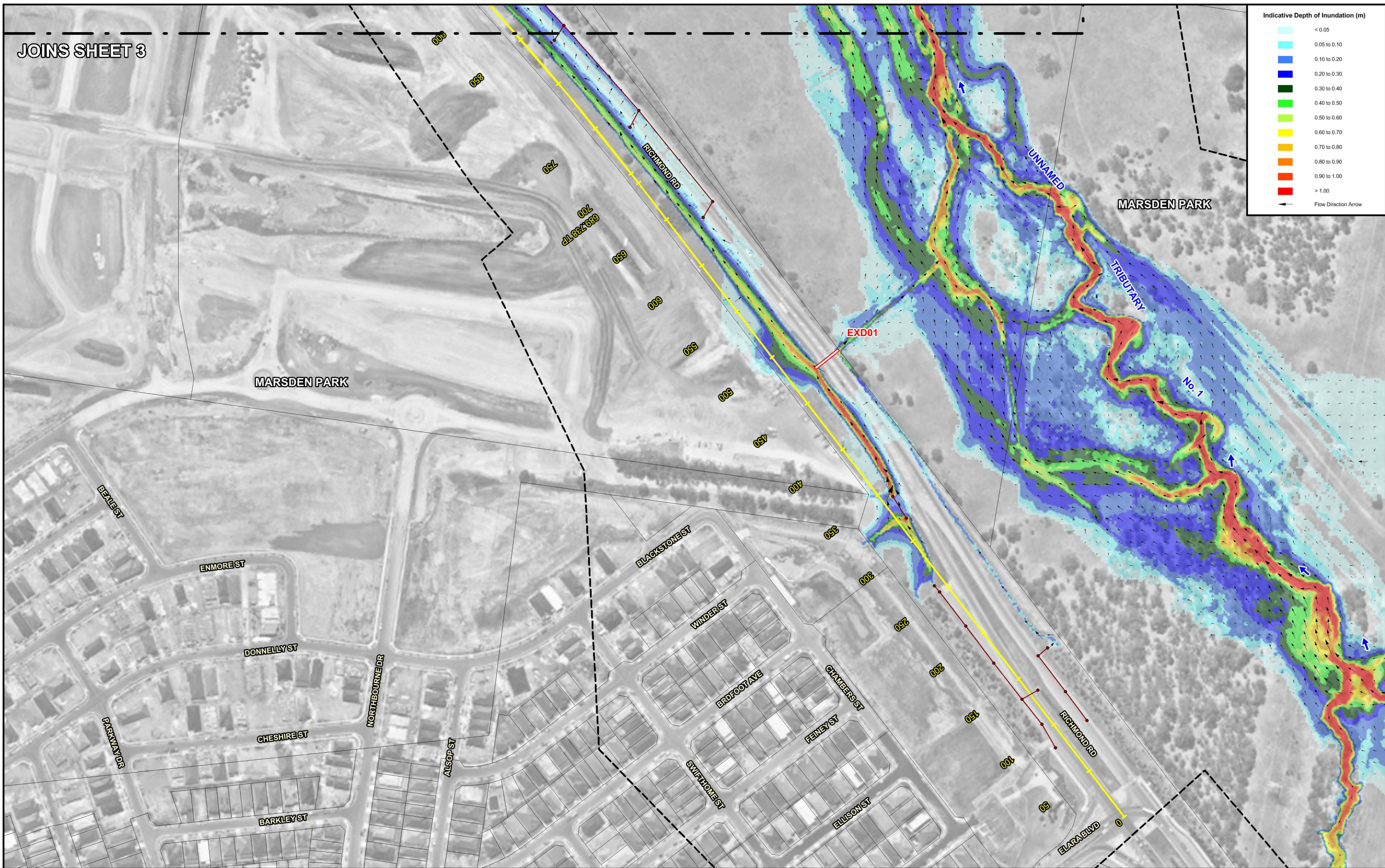
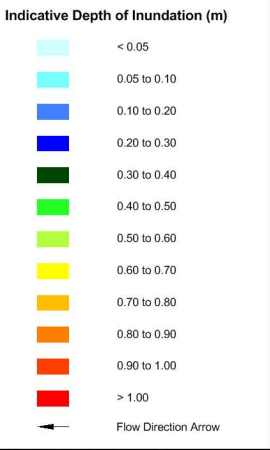
LEGEND

- Modelled Stormwater Network
- TUFLOW Model Extent
- Richmond Road Upgrade Control String
- Development Precinct Boundary
- Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 4.6
(Sheet 1 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
10% AEP - MINOR AND MAJOR TRIBUTARY FLOODING

JOINS SHEET 3

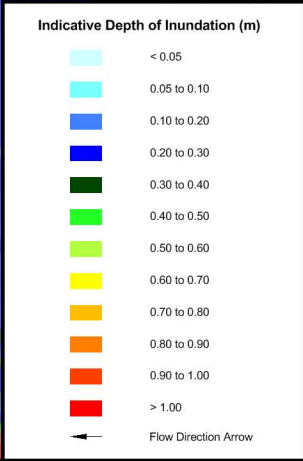
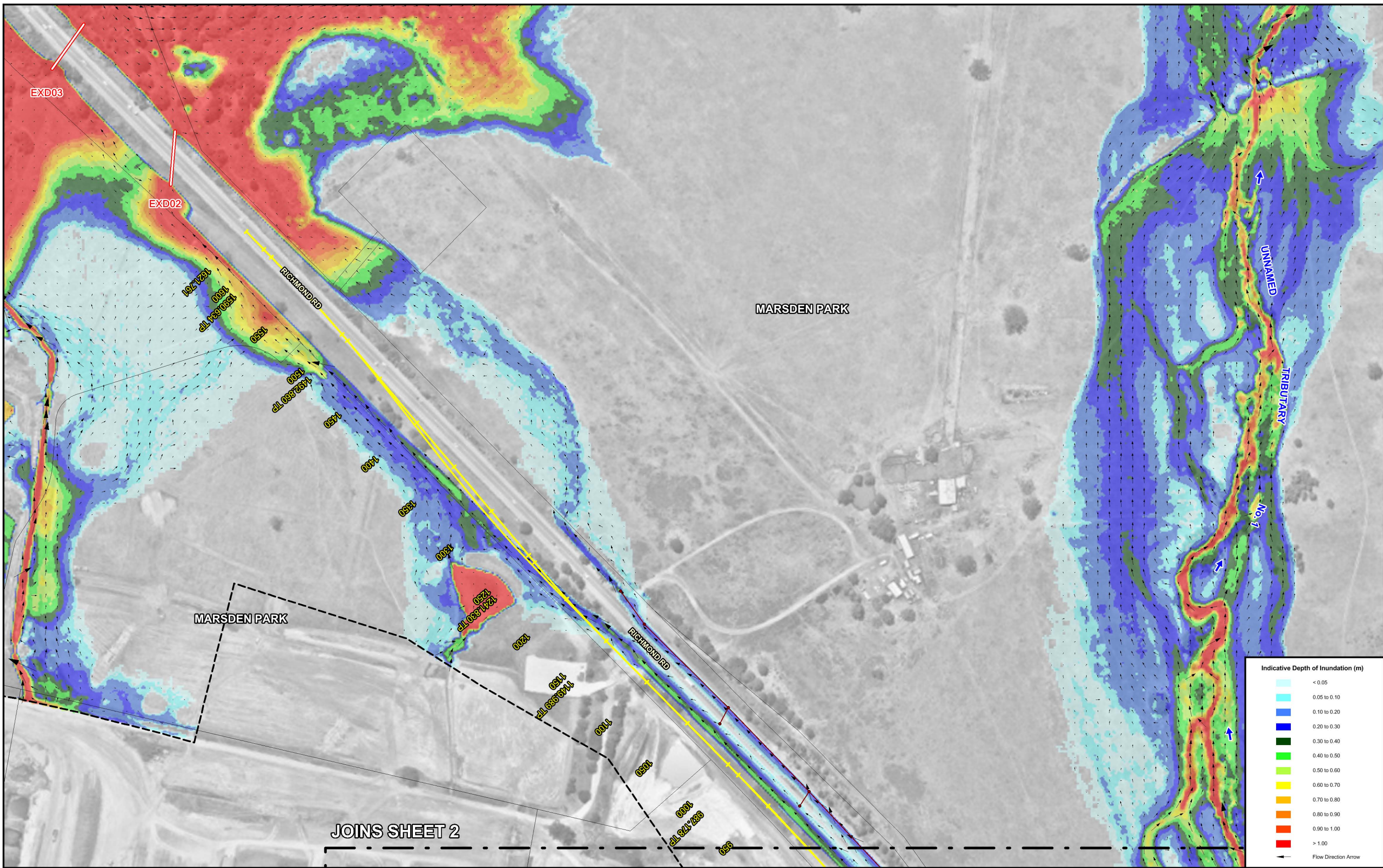


- LEGEND
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Figure 4.6
(Sheet 2 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
10% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



N

30 0 30 60 90 m

Scale: 1:3,000

LEGEND

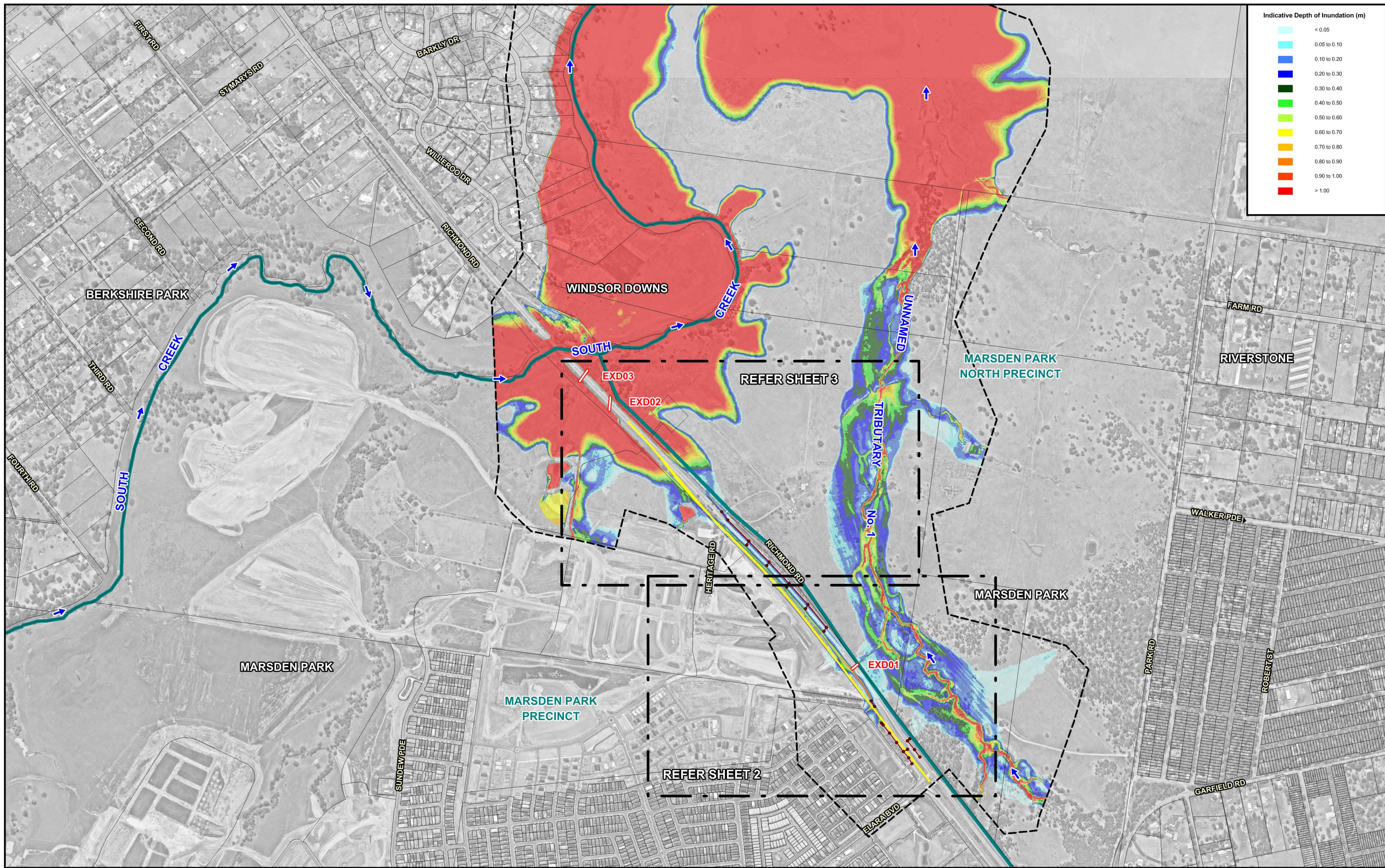
- Modelled Stormwater Network
- TUFLOW Model Extent
- Richmond Road Upgrade String and Chainage
- EXD02 Existing Transverse Drainage Structure and Identifier

RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD

FLOODING AND DRAINAGE INVESTIGATION

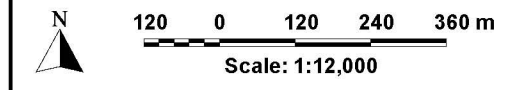
Figure 4.6
(Sheet 3 of 3)

TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
10% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



Indicative Depth of Inundation (m)

<0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00



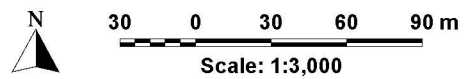
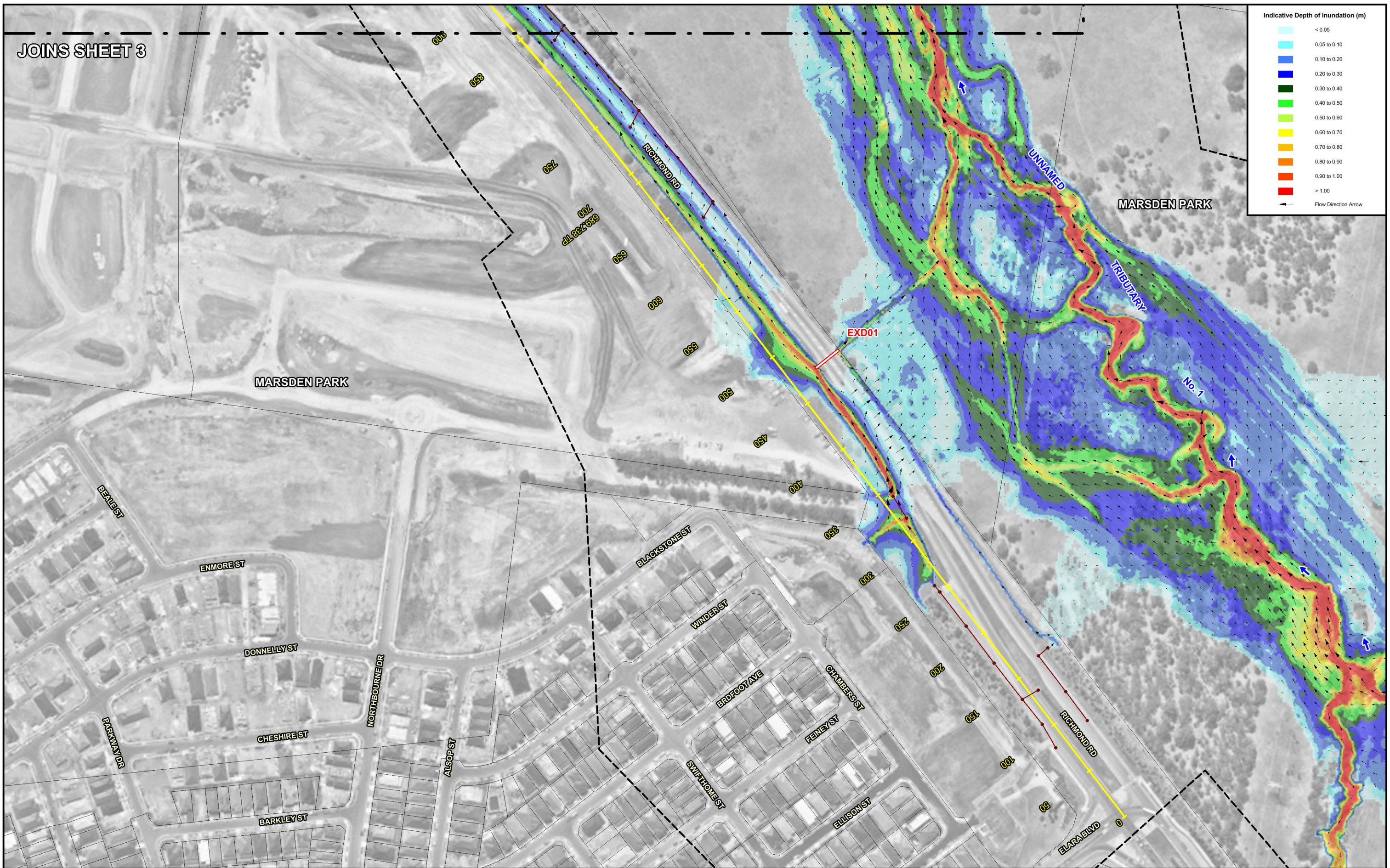
LEGEND

	Modelled Stormwater Network		Richmond Road Upgrade Control String
	TUFLOW Model Extent		Development Precinct Boundary
	Existing Transverse Drainage Structure and Identifier		

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 4.7
(Sheet 1 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
1% AEP - MINOR AND MAJOR TRIBUTARY FLOODING

JOINS SHEET 3

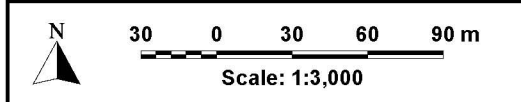
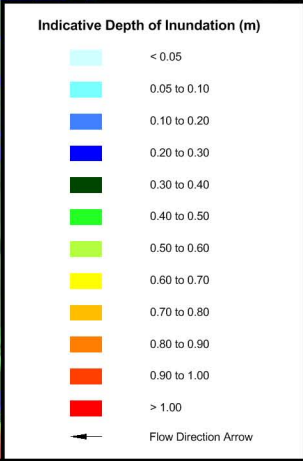
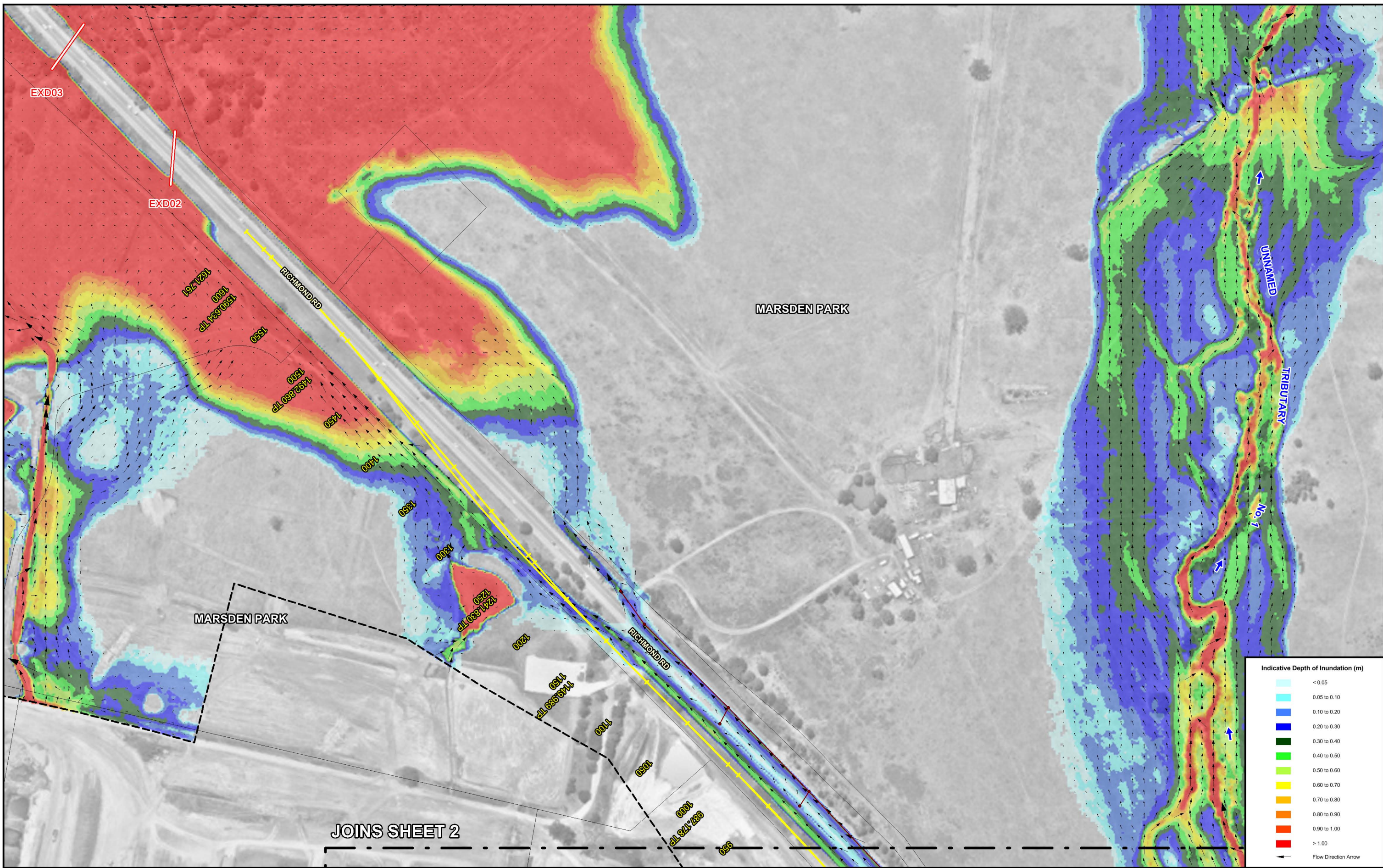


- LEGEND
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - Existing Transverse Drainage Structure and Identifier

RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION



Figure 4.7
(Sheet 2 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
1% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



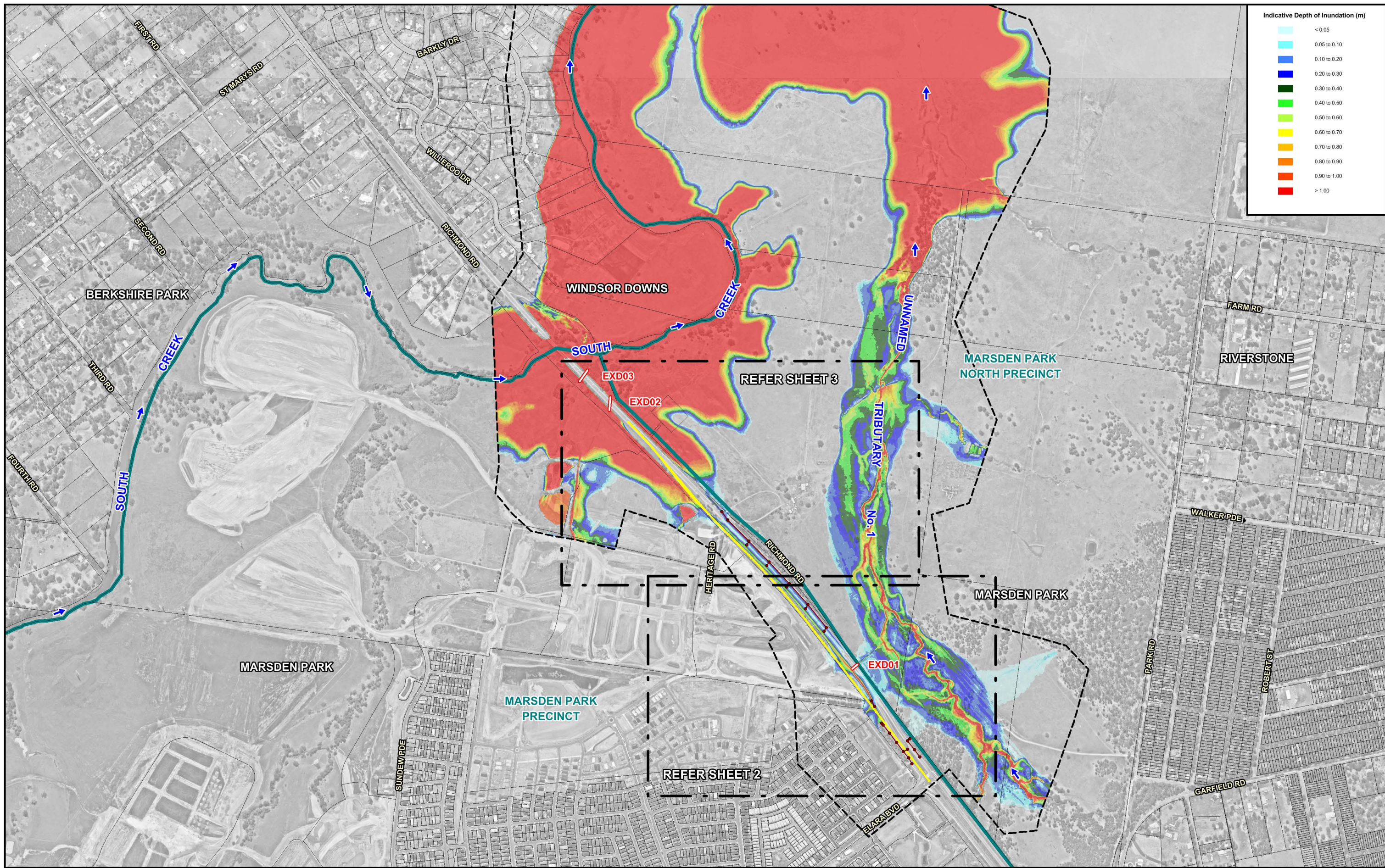
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JOINS SHEET 2

- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 4.7
(Sheet 3 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
1% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



Indicative Depth of Inundation (m)

<0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00

Scale: 1:12,000

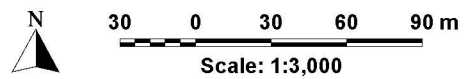
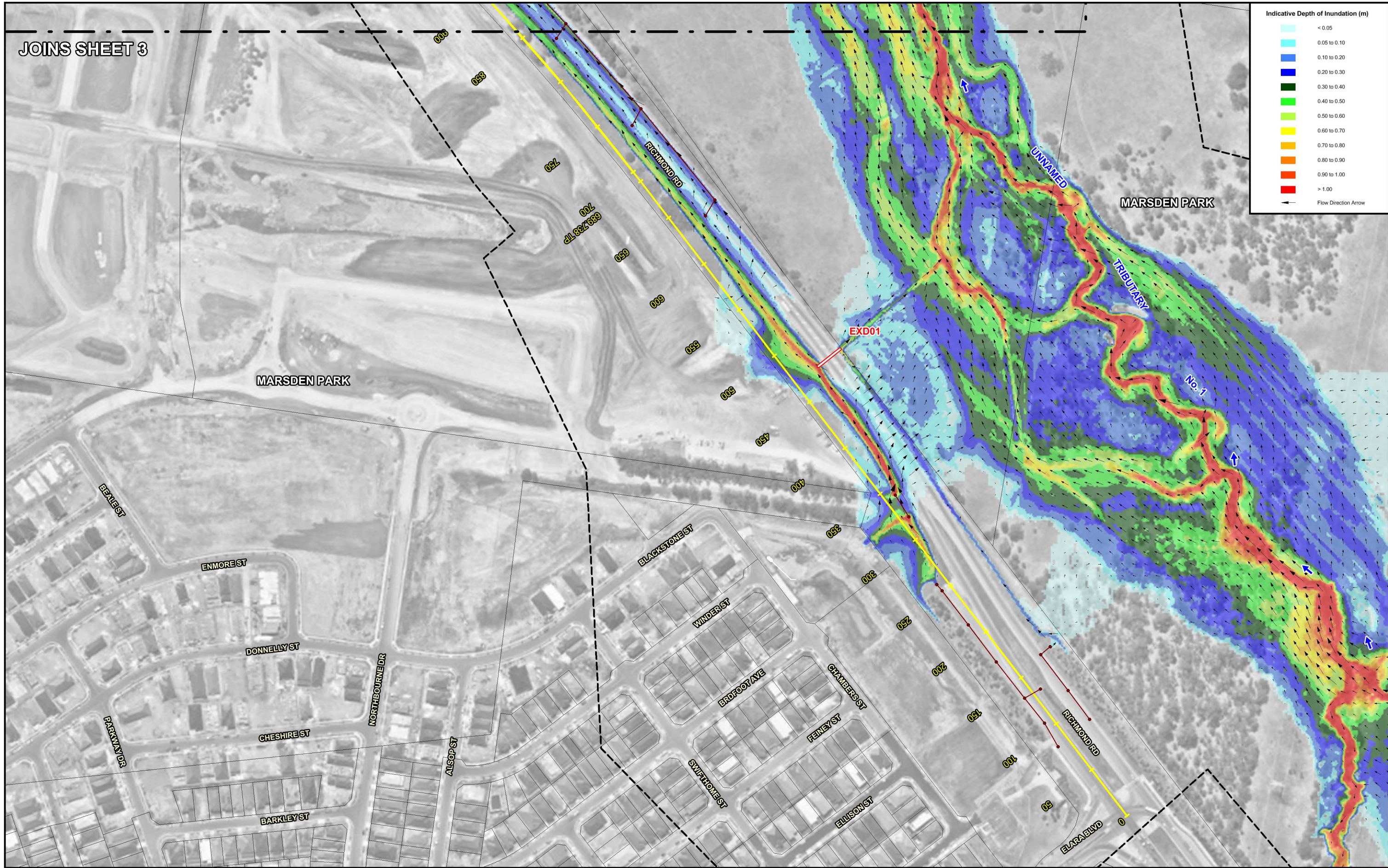
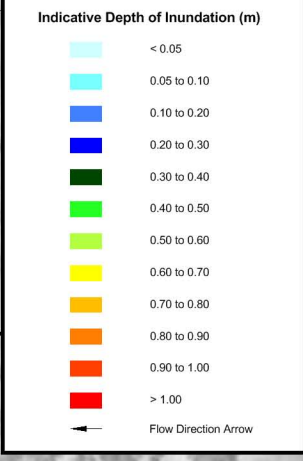
- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Existing Transverse Drainage Structure and Identifier
 - Richmond Road Upgrade Control String
 - Development Precinct Boundary

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Figure 4.8
(Sheet 1 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
0.2% AEP - MINOR AND MAJOR TRIBUTARY FLOODING

JOINS SHEET 3

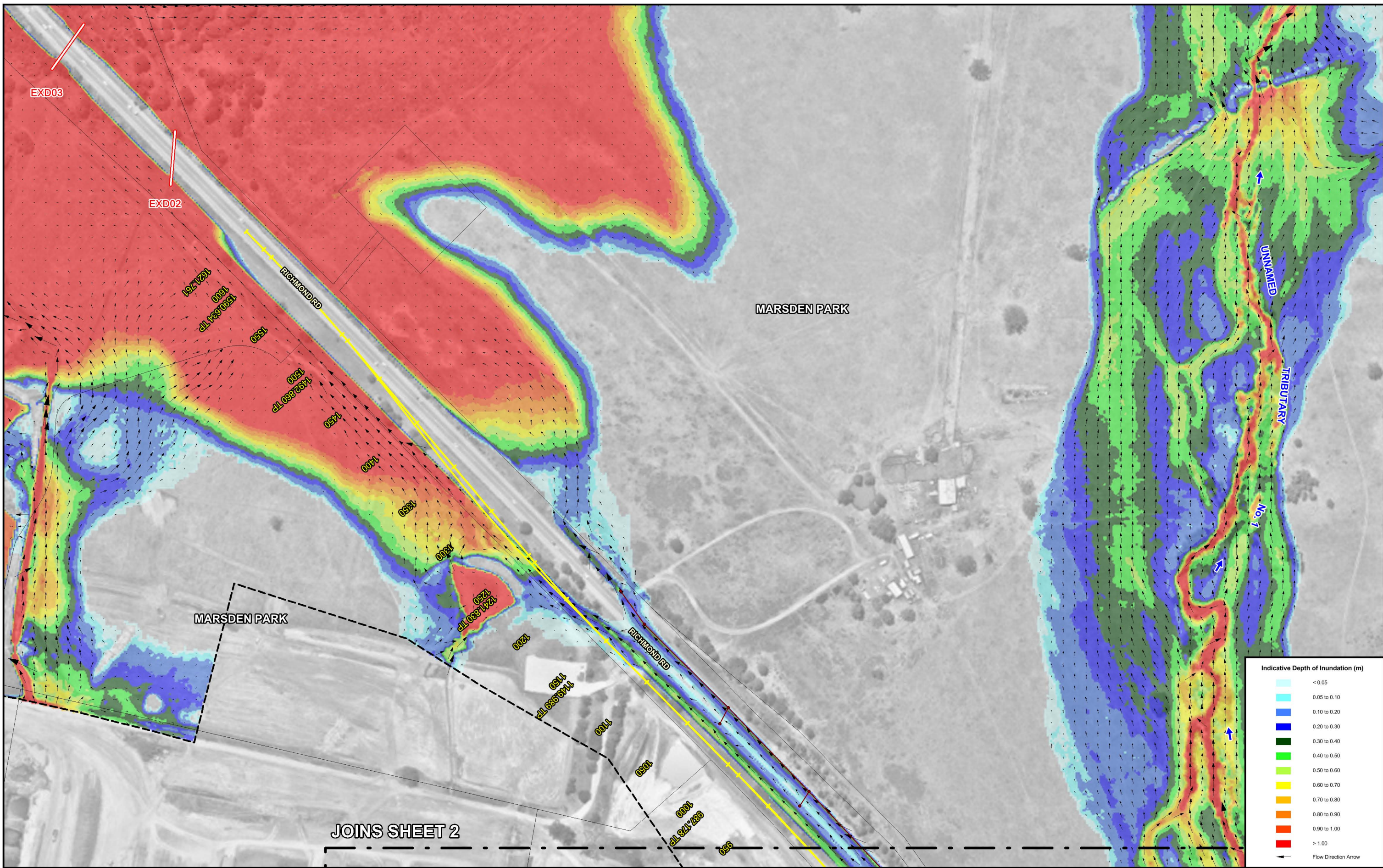


- LEGEND
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



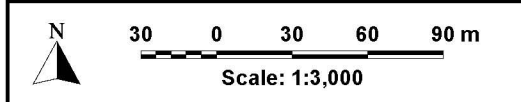
Figure 4.8
(Sheet 2 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
0.2% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



Indicative Depth of Inundation (m)

< 0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00

Flow Direction Arrow



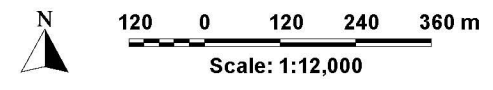
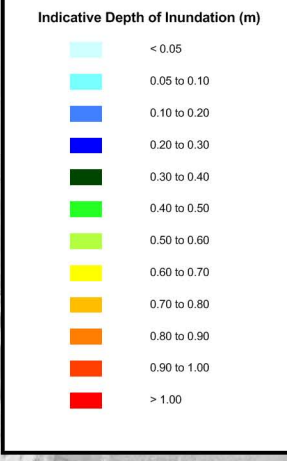
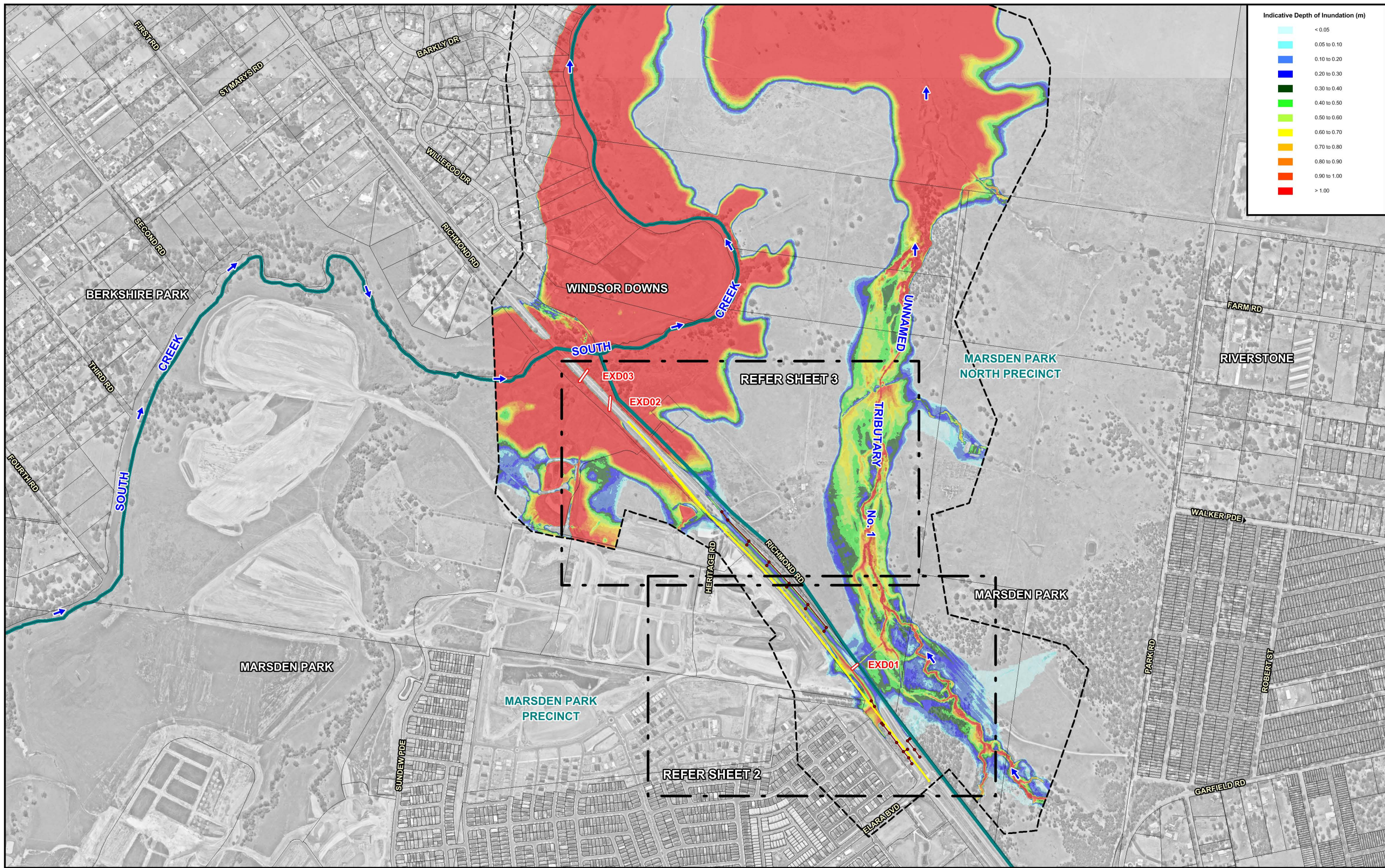
Lyall & Associates

JOINS SHEET 2

- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - EXD02 Existing Transverse Drainage Structure and Identifier

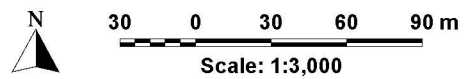
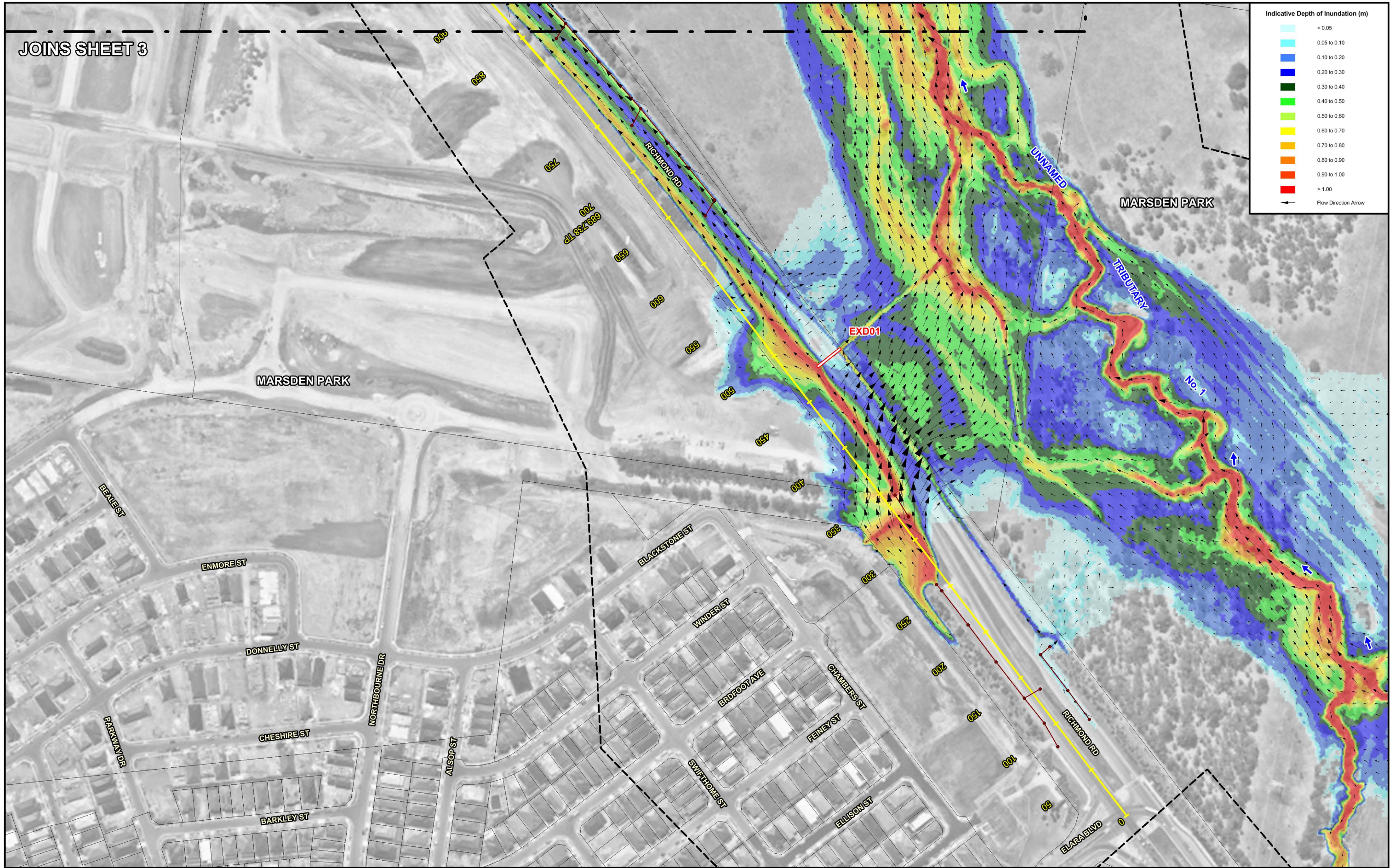
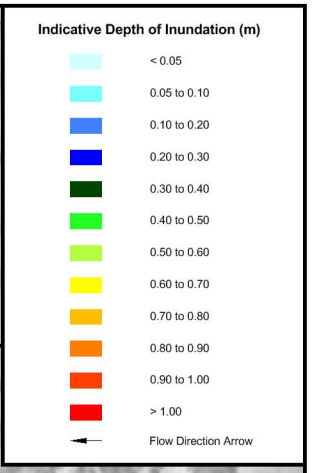
**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 4.8
(Sheet 3 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
0.2% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Control String
 - Development Precinct Boundary
 - EXD01 Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

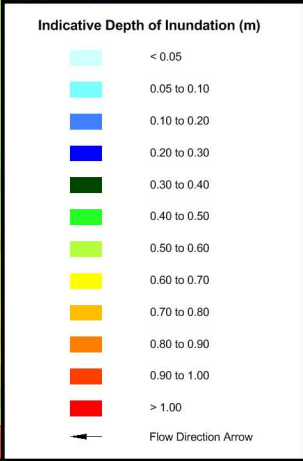
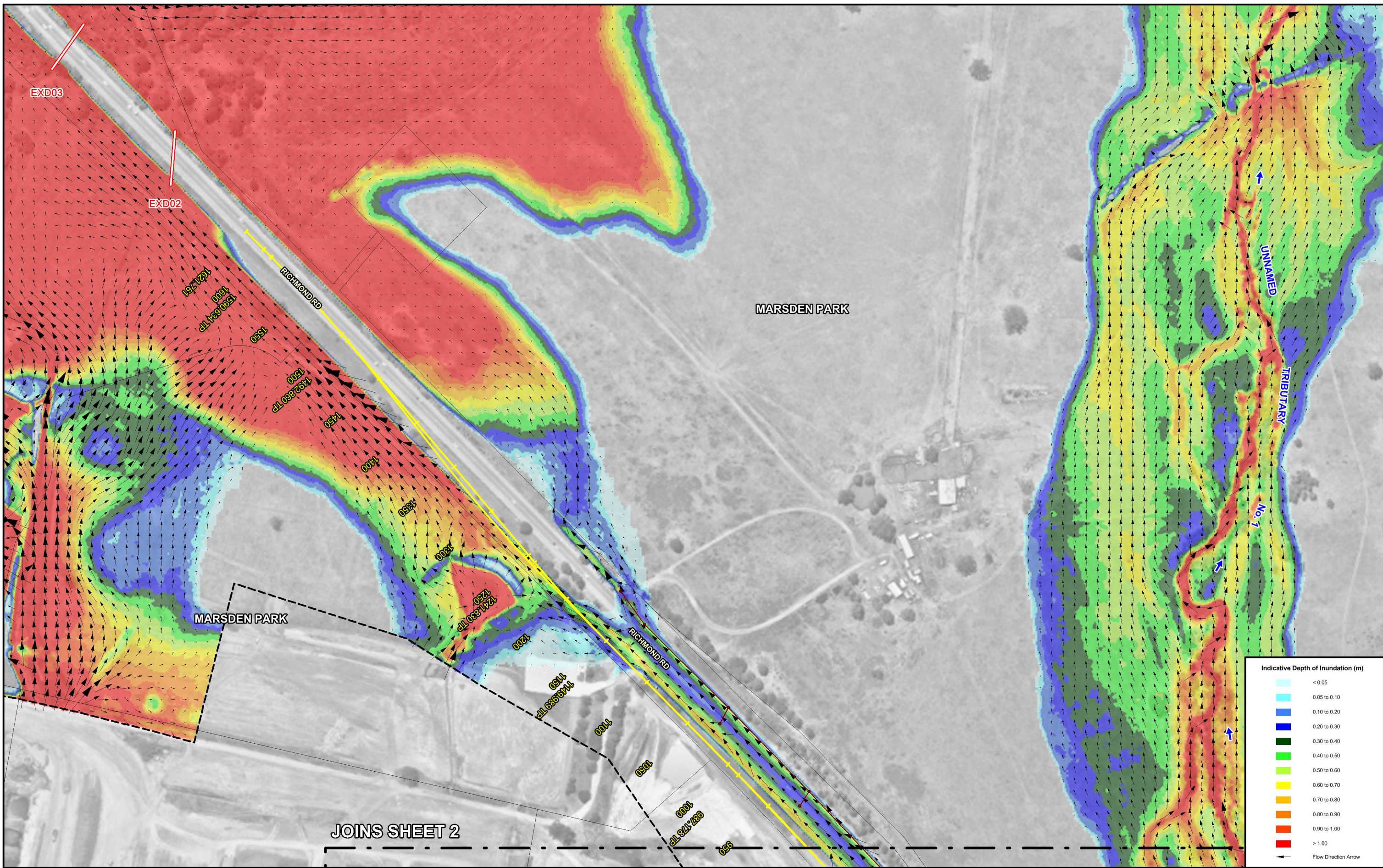


- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade String and Chainage
 - Existing Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Figure 4.9
(Sheet 2 of 3)
TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
PMF - MINOR TRIBUTARY FLOODING



N

Scale: 1:3,000

LEGEND

- Modelled Stormwater Network
- TUFLOW Model Extent
- Richmond Road Upgrade String and Chainage
- EXD02 Existing Transverse Drainage Structure and Identifier

RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD

FLOODING AND DRAINAGE INVESTIGATION

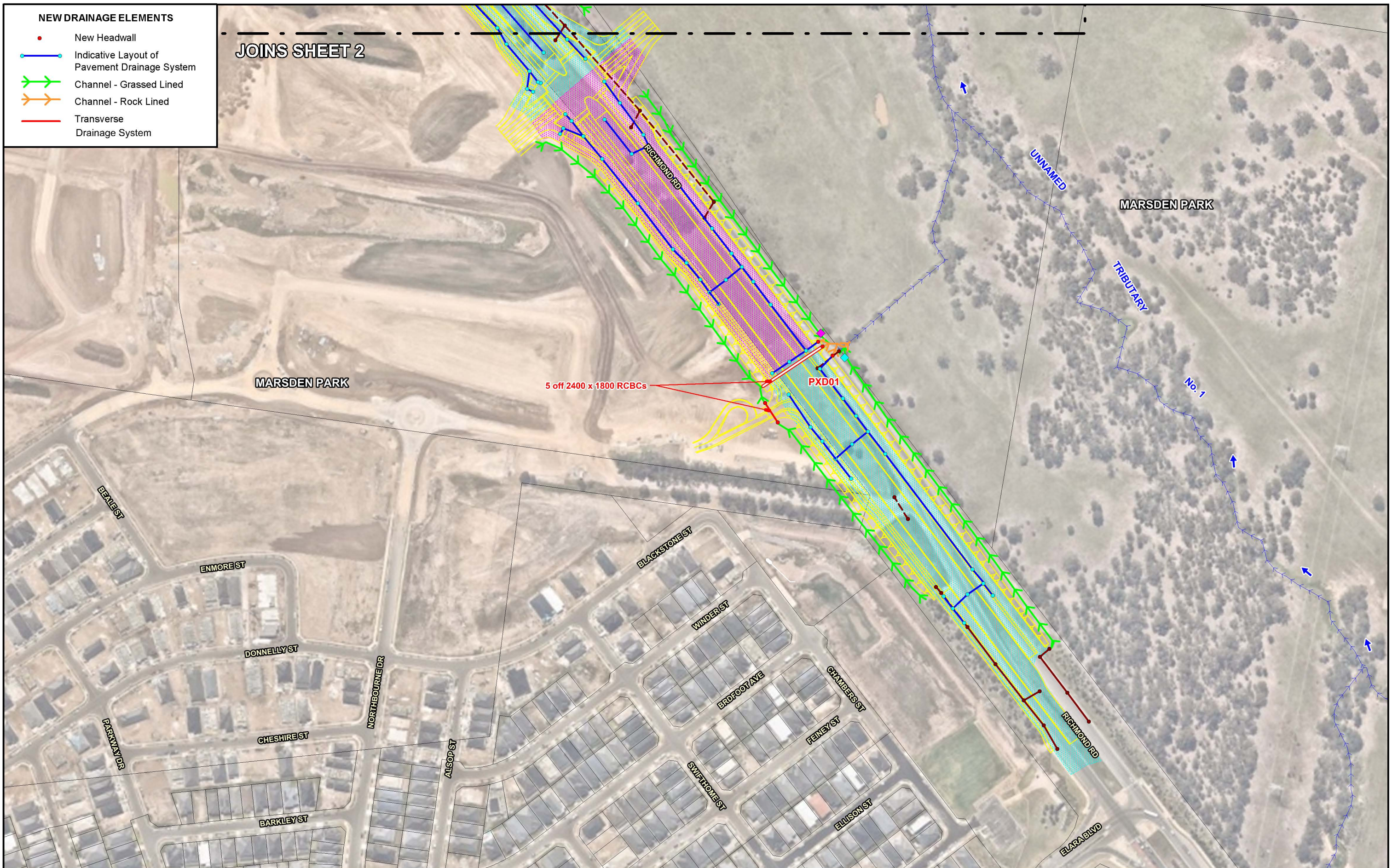
Figure 4.9
(Sheet 3 of 3)

TUFLOW MODEL RESULTS - PRE-UPGRADE CONDITIONS
PMF - MINOR TRIBUTARY FLOODING

NEW DRAINAGE ELEMENTS

- New Headwall
- Indicative Layout of Pavement Drainage System
- Channel - Grassed Lined
- Channel - Rock Lined
- Transverse Drainage System

JOINS SHEET 2



5 off 2400 x 1800 RCBCs

PXD01

UNNAMED TRIBUTARY No. 1

MARSDEN PARK

MARSDEN PARK

BEALEST

ENMOREST

DONNELLYST

CHESHIREST

BARKLEYST

NORTHBOURNE DR

ALSOPST

BLACKSTONEST

WINDERST

BRDFOOT AVE

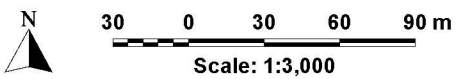
CHAMBERSST

FEINEYST

ELLISONST

RICHMOND RD

ELARA BLVD

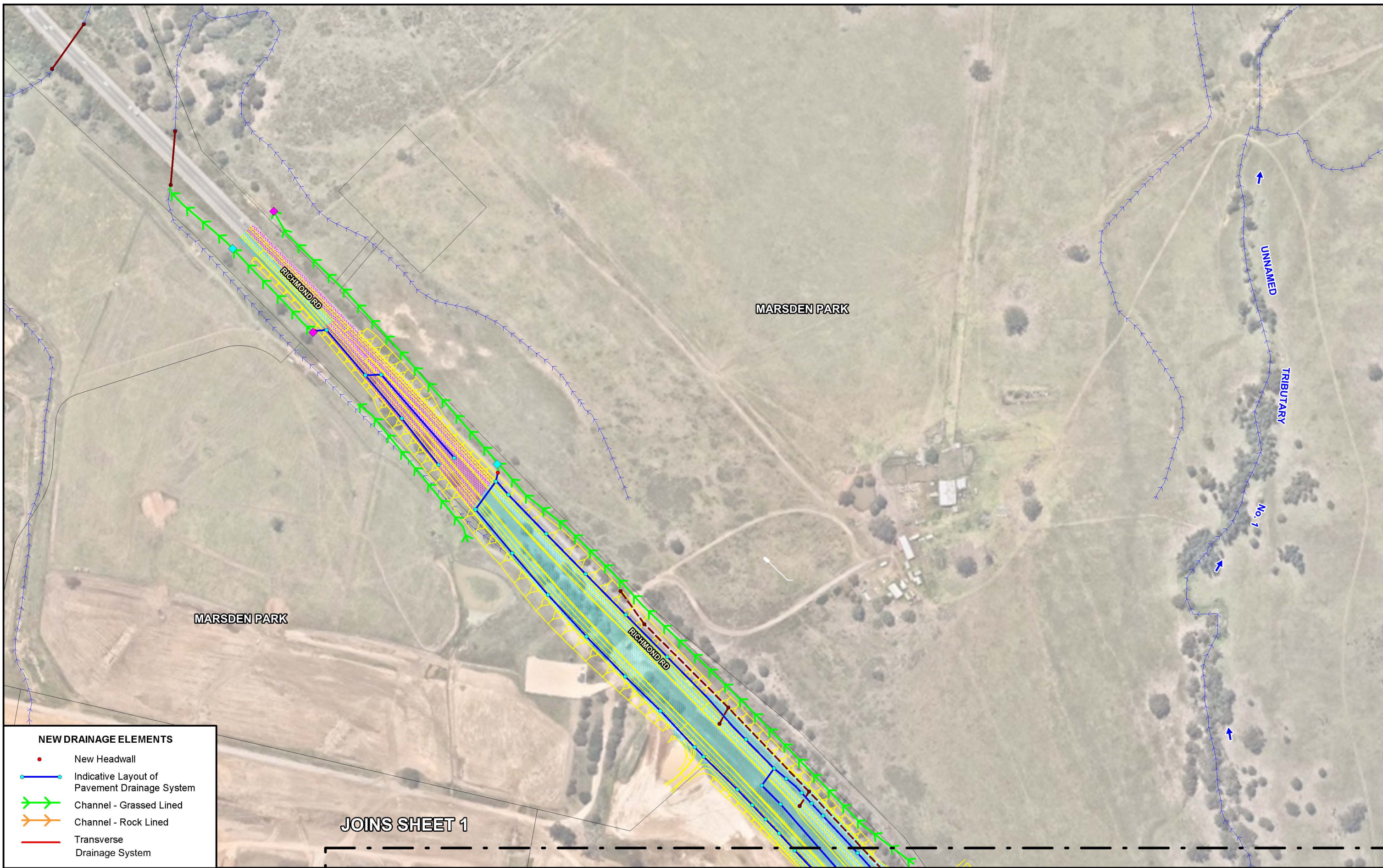


LEGEND

- Existing Stormwater Drainage Network to be Retained
- - - Existing Stormwater Drainage Network to be Demolished
- ◆ ◆ Pavement Drainage Outlet Location
- Extent of Catchment Controlled by Future Pavement Drainage System

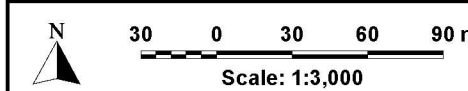
- Richmond Road Upgrade Design String
- PXD01** Proposed Transverse Drainage Structure and Identifier

RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD FLOODING AND DRAINAGE INVESTIGATION



NEW DRAINAGE ELEMENTS

- New Headwall
- Indicative Layout of Pavement Drainage System
- Channel - Grassed Lined
- Channel - Rock Lined
- Transverse Drainage System

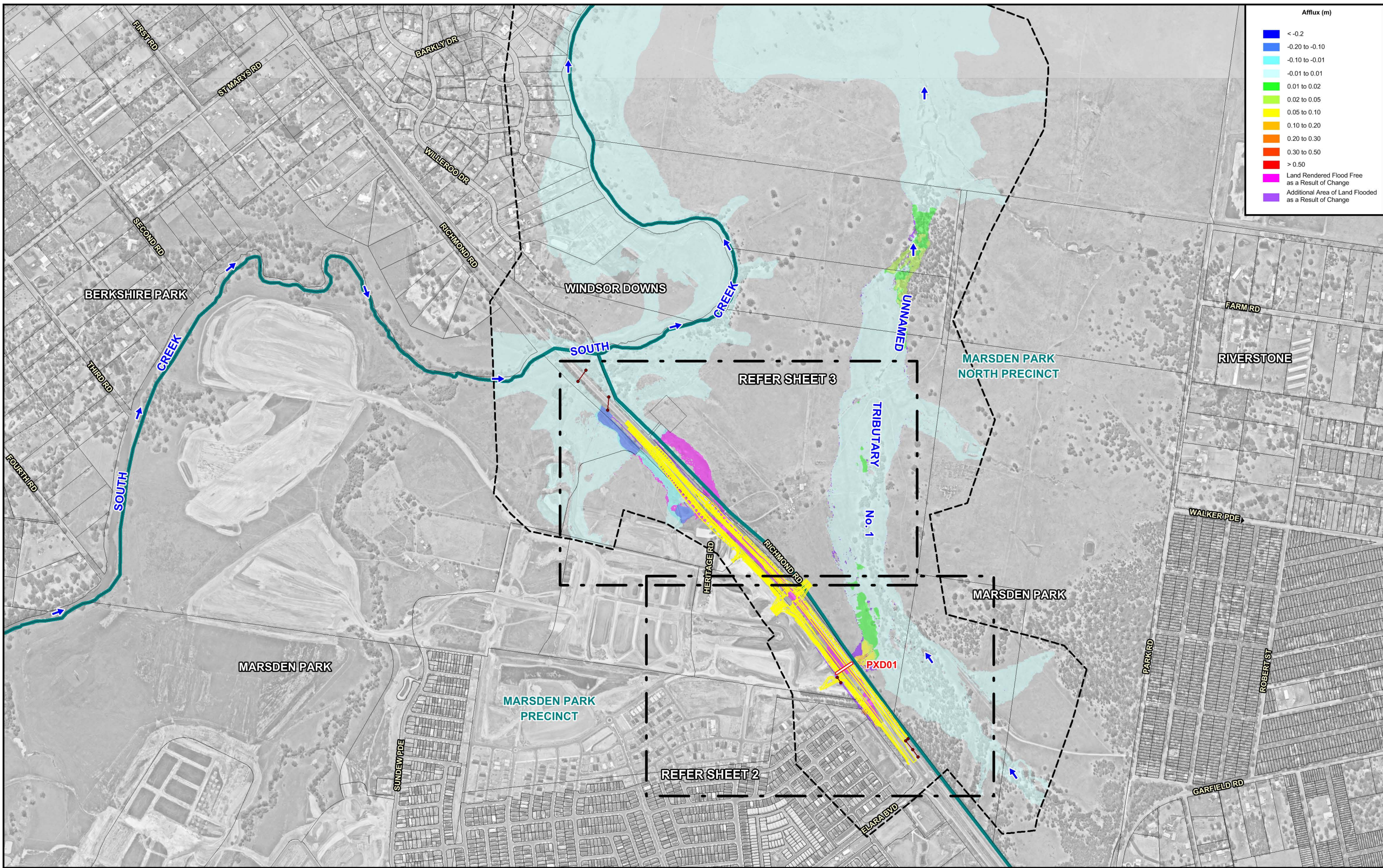


LEGEND

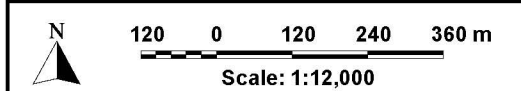
- Existing Stormwater Drainage Network to be Retained
- - - Existing Stormwater Drainage Network to be Demolished
- ◆ ◆ Pavement Drainage Outlet Location
- Extent of Catchment Controlled by Future Pavement Drainage System

Richmond Road Upgrade Design String

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Afflux (m)	
Blue	< -0.2
Light Blue	-0.20 to -0.10
Light Cyan	-0.10 to -0.01
Light Green	-0.01 to 0.01
Green	0.01 to 0.02
Yellow-Green	0.02 to 0.05
Yellow	0.05 to 0.10
Orange	0.10 to 0.20
Red-Orange	0.20 to 0.30
Red	0.30 to 0.50
Dark Red	> 0.50
Pink	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change



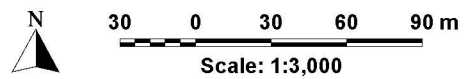
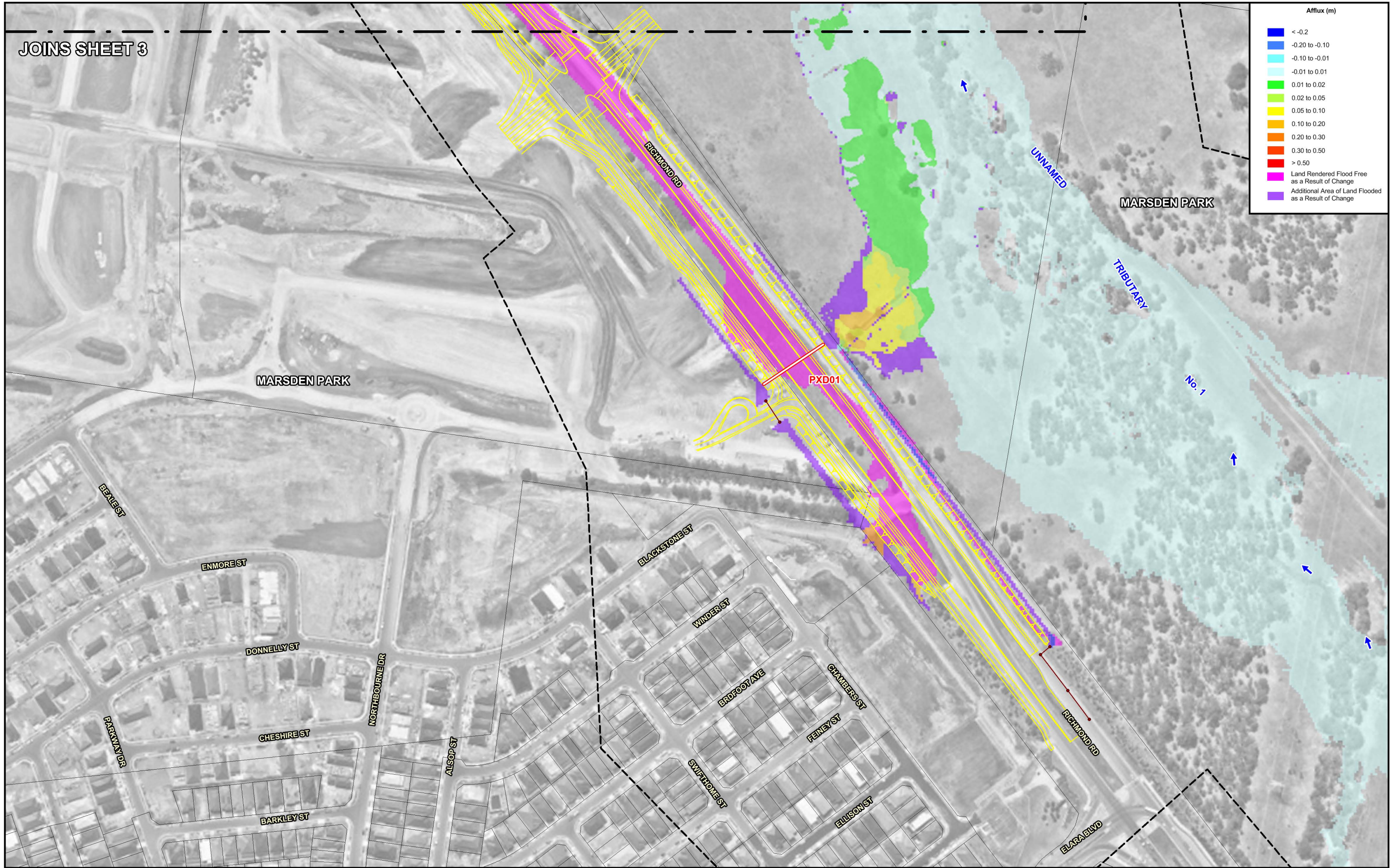
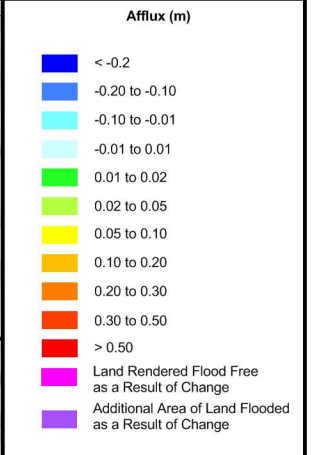
Lyll & Associates

LEGEND	
	Modelled Stormwater Network
	TUFLOW Model Extent
	Richmond Road Upgrade Design String
	Development Precinct Boundary
	Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

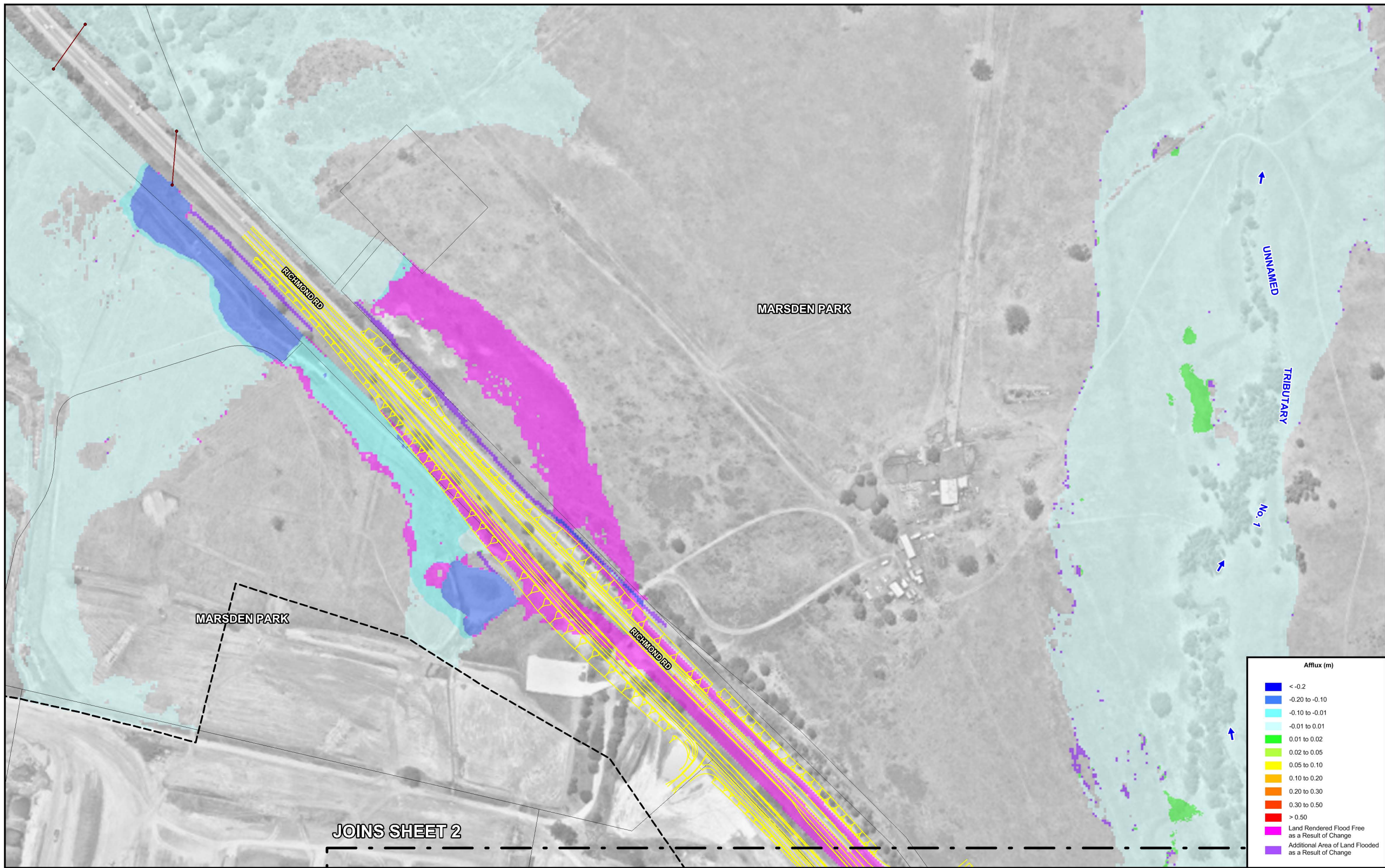
Figure 5.2
(Sheet 1 of 3)

IMPACT OF ROAD UPGRADE ON FLOOD BEHAVIOUR
20% AEP - MINOR AND MAJOR TRIBUTARY FLOODING

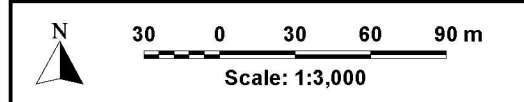


- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String
 - Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Afflux (m)	
Dark Blue	< -0.2
Blue	-0.20 to -0.10
Cyan	-0.10 to -0.01
Light Cyan	-0.01 to 0.01
Light Green	0.01 to 0.02
Green	0.02 to 0.05
Yellow-Green	0.05 to 0.10
Yellow	0.10 to 0.20
Orange	0.20 to 0.30
Red-Orange	0.30 to 0.50
Red	> 0.50
Magenta	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change

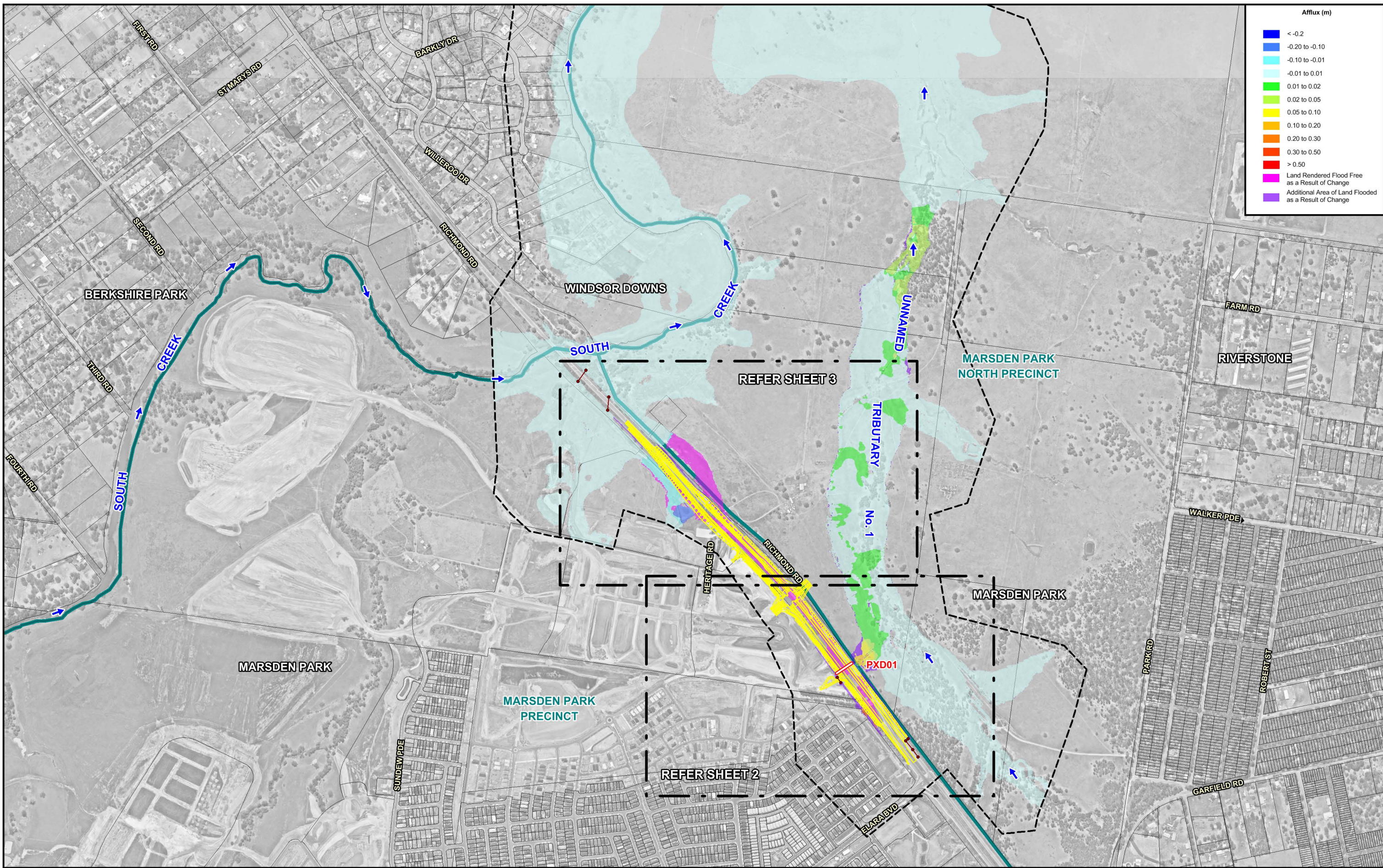


JOINS SHEET 2

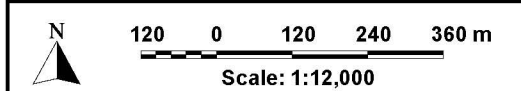
- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 5.2
(Sheet 3 of 3)
IMPACT OF ROAD UPGRADE ON FLOOD BEHAVIOUR
20% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



Afflux (m)	
Blue	< -0.2
Light Blue	-0.20 to -0.10
Light Cyan	-0.10 to -0.01
Light Green	-0.01 to 0.01
Green	0.01 to 0.02
Yellow-Green	0.02 to 0.05
Yellow	0.05 to 0.10
Orange	0.10 to 0.20
Red-Orange	0.20 to 0.30
Red	0.30 to 0.50
Dark Red	> 0.50
Pink	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change

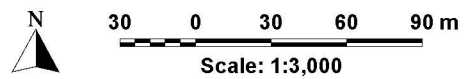
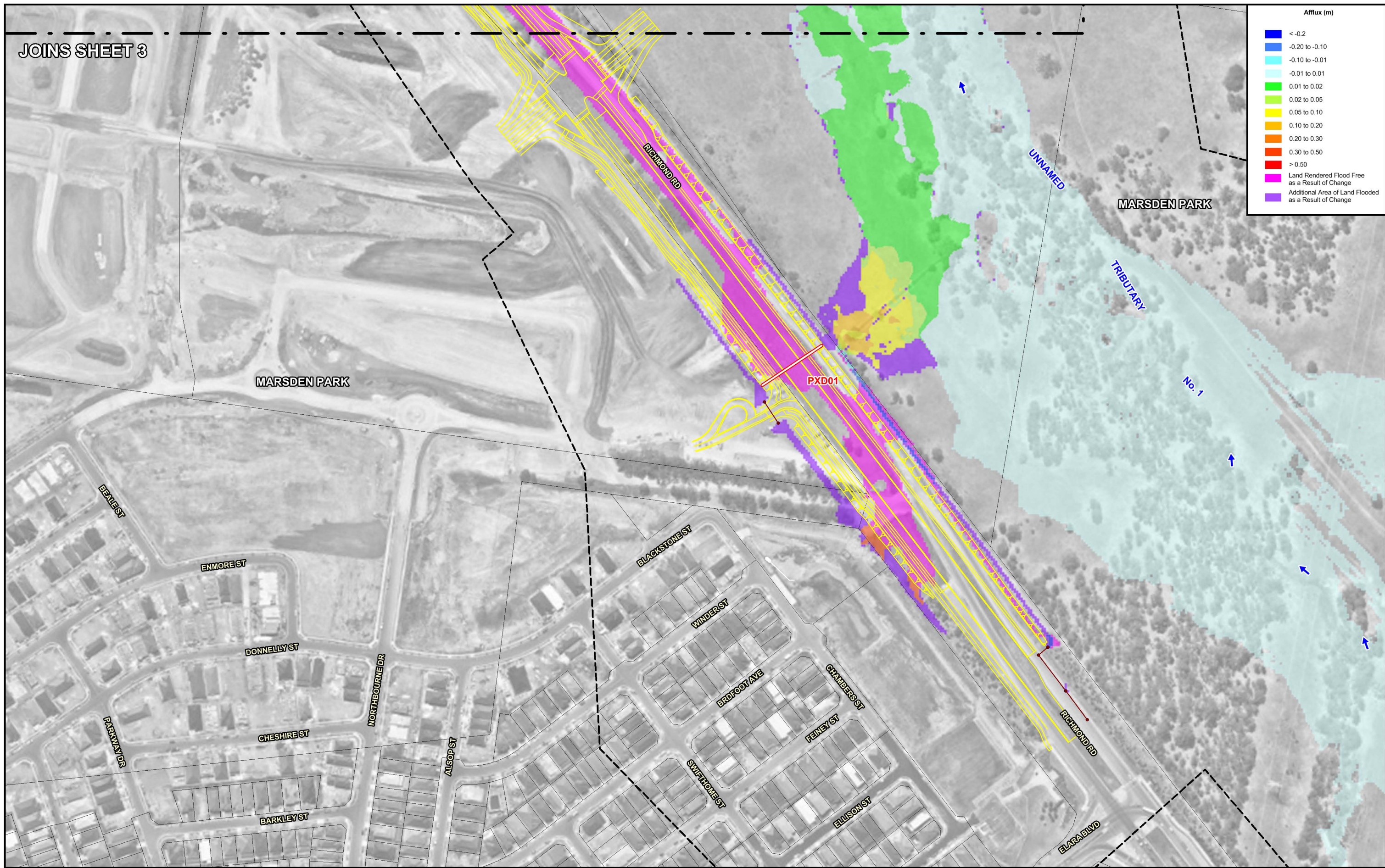
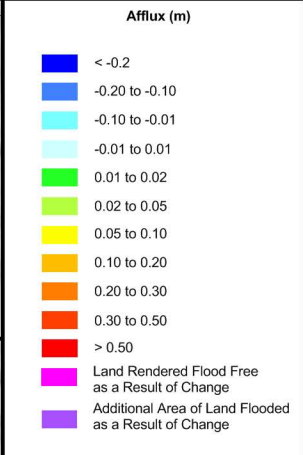


LEGEND	
	Modelled Stormwater Network
	TUFLOW Model Extent
	Richmond Road Upgrade Design String
	Development Precinct Boundary
	Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

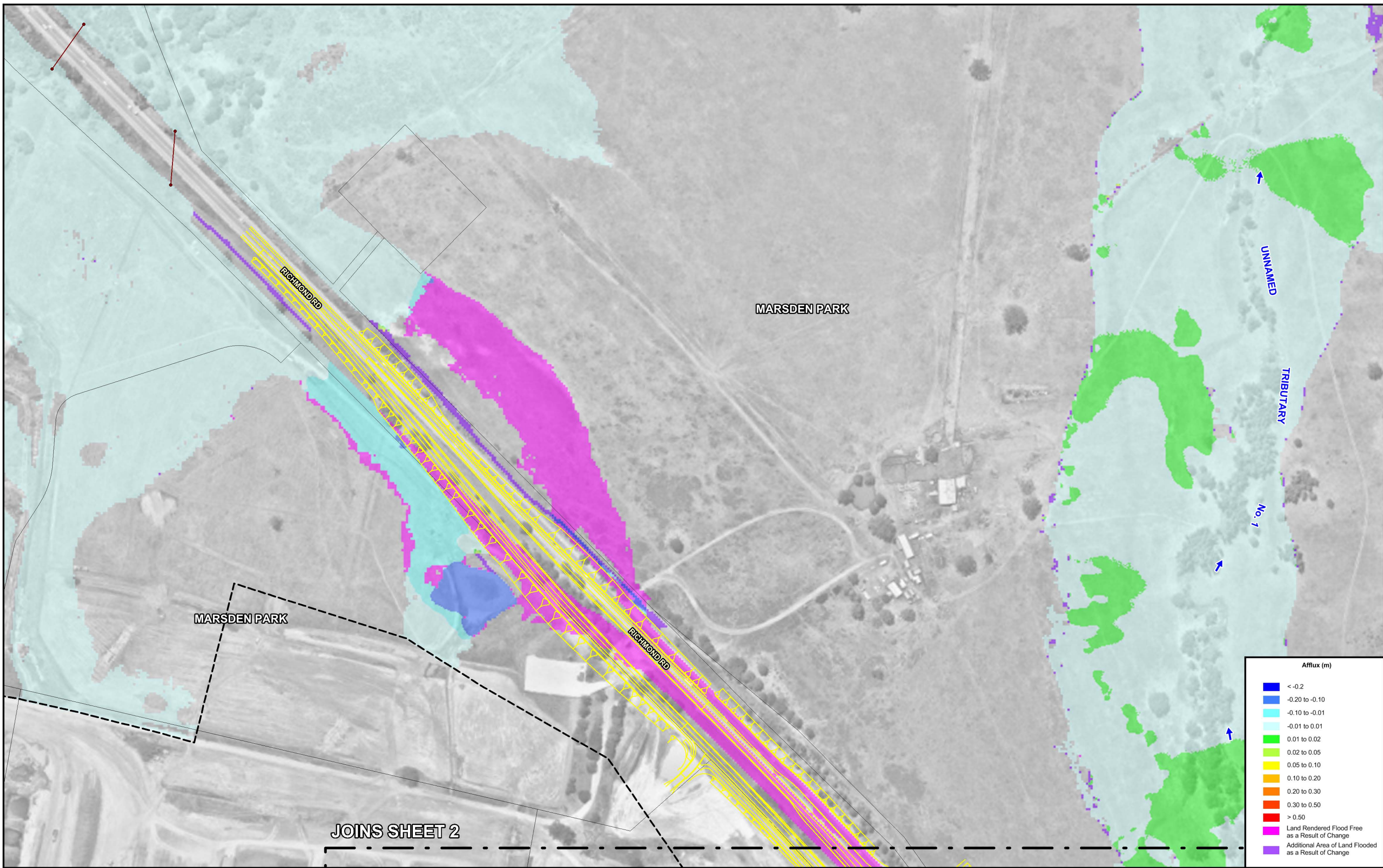
Figure 5.3
(Sheet 1 of 3)

IMPACT OF ROAD UPGRADE ON FLOOD BEHAVIOUR
10% AEP - MINOR AND MAJOR TRIBUTARY FLOODING

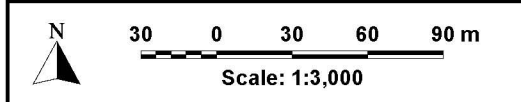


- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String
 - Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Afflux (m)	
Dark Blue	<math>< -0.2</math>
Blue	-0.20 to -0.10
Light Blue	-0.10 to -0.01
Cyan	-0.01 to 0.01
Light Green	0.01 to 0.02
Green	0.02 to 0.05
Yellow-Green	0.05 to 0.10
Yellow	0.10 to 0.20
Orange	0.20 to 0.30
Red-Orange	0.30 to 0.50
Red	> 0.50
Pink	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change

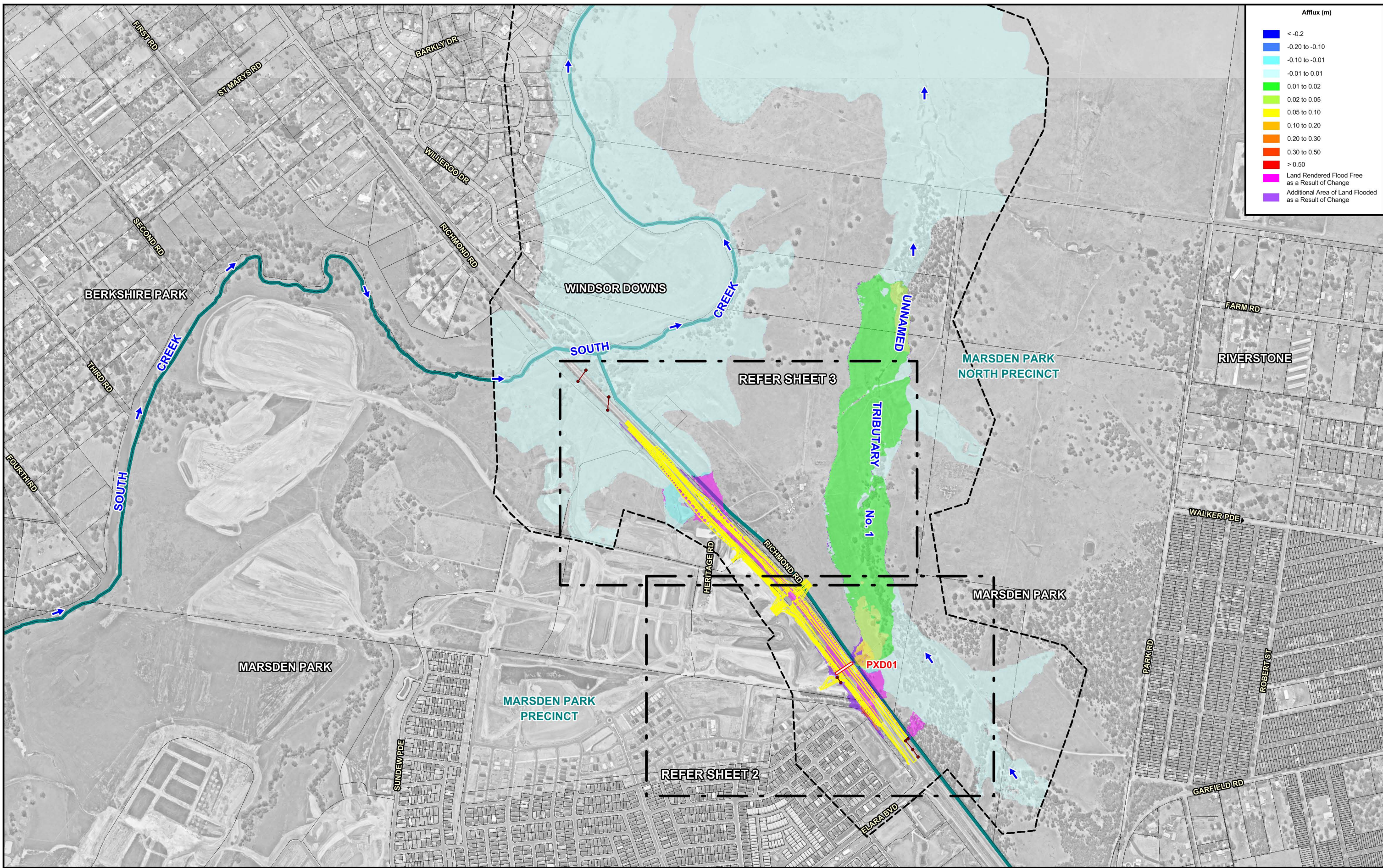


JOINS SHEET 2

- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String

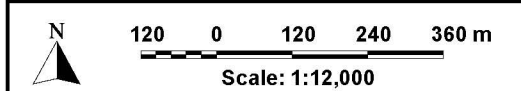
**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 5.3
(Sheet 3 of 3)
IMPACT OF ROAD UPGRADE ON FLOOD BEHAVIOUR
10% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



Afflux (m)

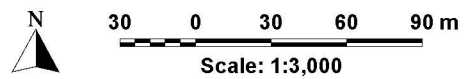
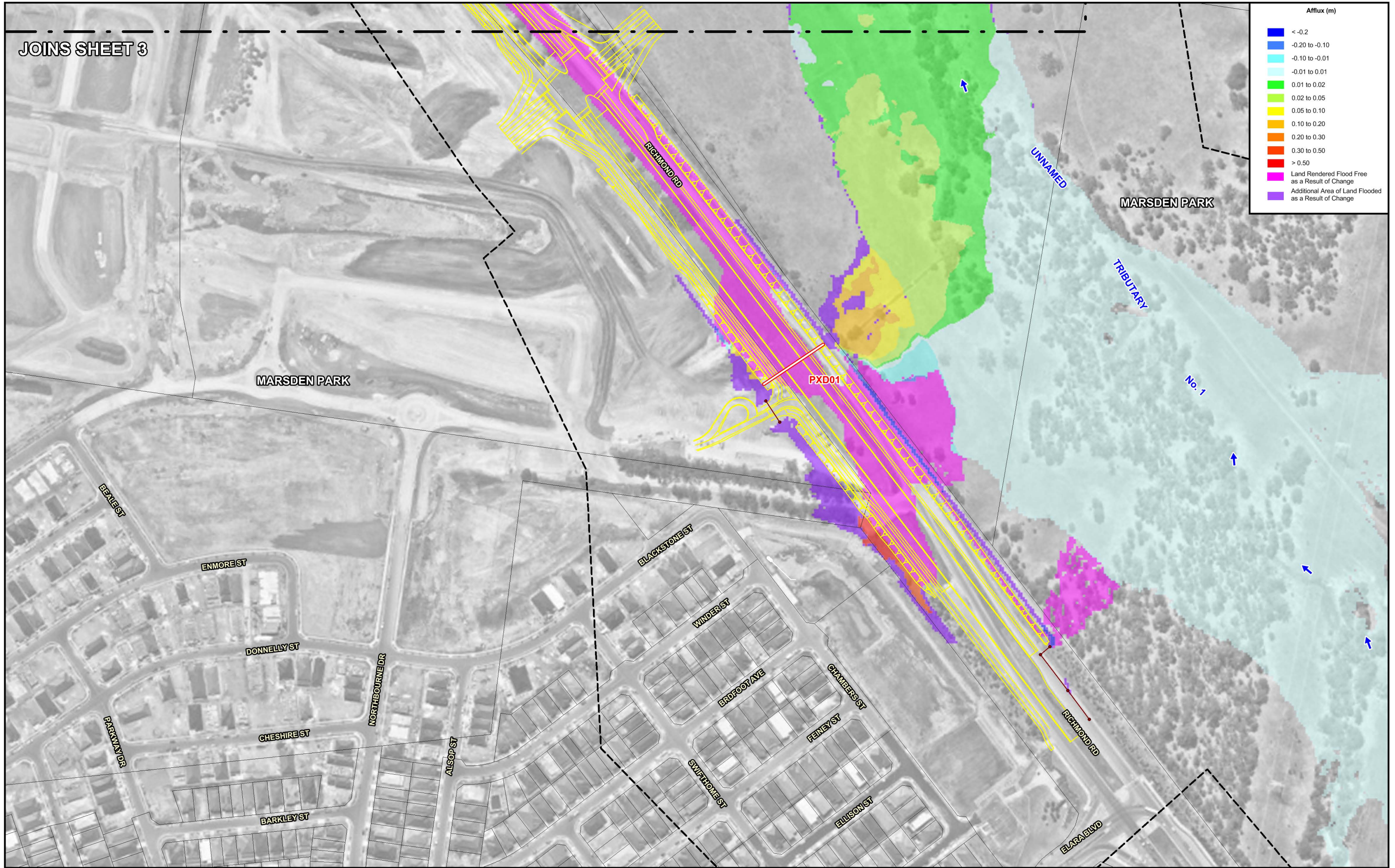
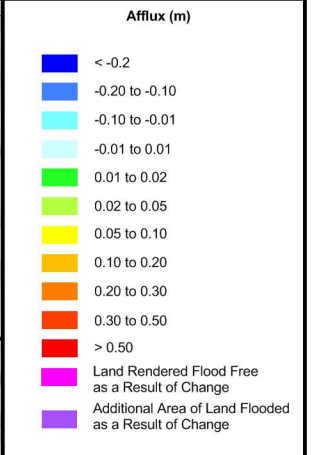
<math>< -0.2</math>
-0.20 to -0.10
-0.10 to -0.01
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.50
> 0.50
Land Rendered Flood Free as a Result of Change
Additional Area of Land Flooded as a Result of Change



LEGEND

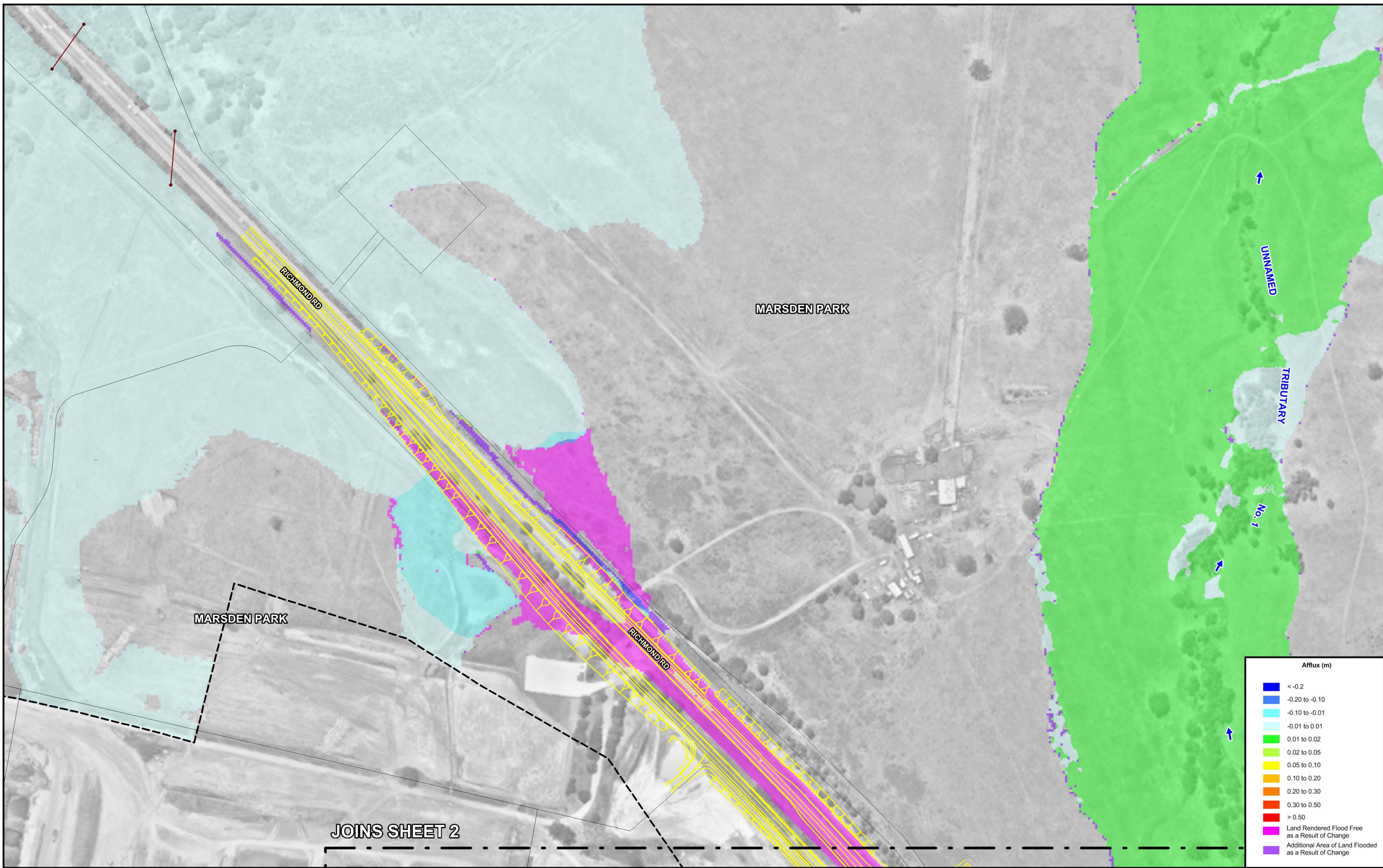
	Modelled Stormwater Network		Richmond Road Upgrade Design String
	TUFLOW Model Extent		Development Precinct Boundary
			Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



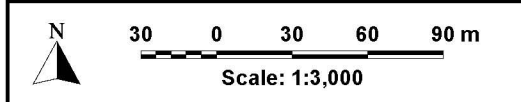
- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String
 - Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Afflux (m)

Dark Blue	< -0.2
Blue	-0.20 to -0.10
Cyan	-0.10 to -0.01
Light Cyan	-0.01 to 0.01
Light Green	0.01 to 0.02
Green	0.02 to 0.05
Yellow-Green	0.05 to 0.10
Yellow	0.10 to 0.20
Orange	0.20 to 0.30
Red-Orange	0.30 to 0.50
Red	> 0.50
Magenta	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change

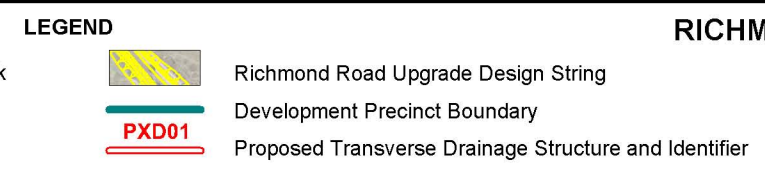
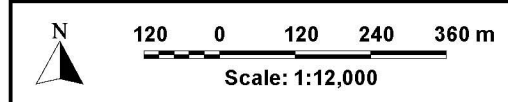
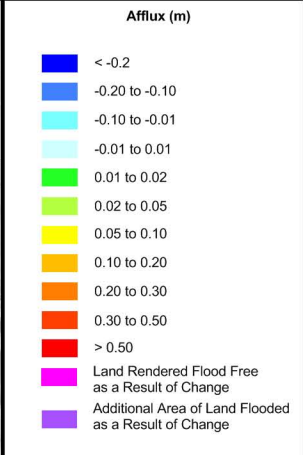
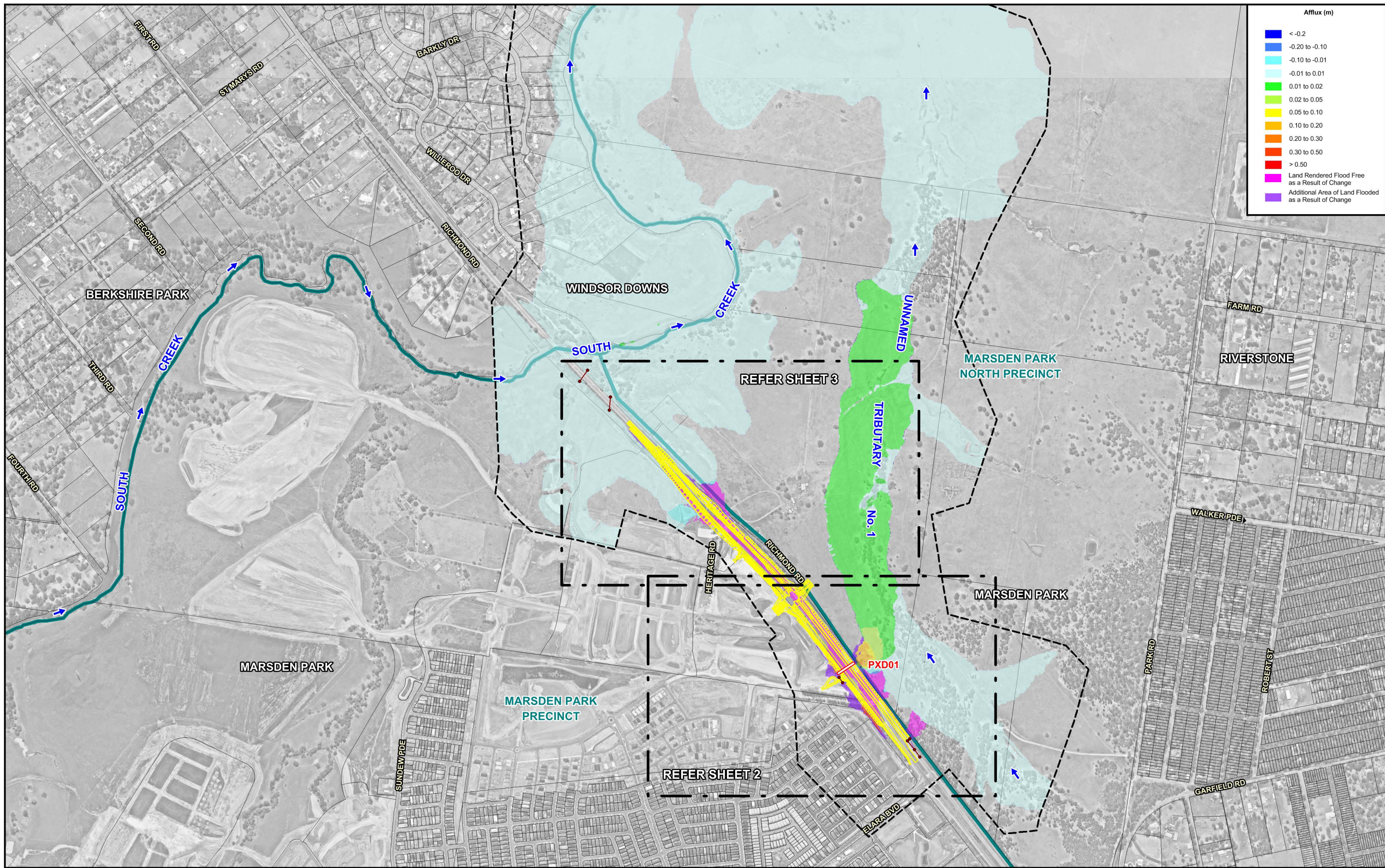


JOINS SHEET 2

- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String

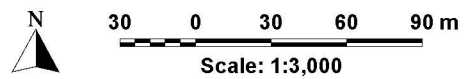
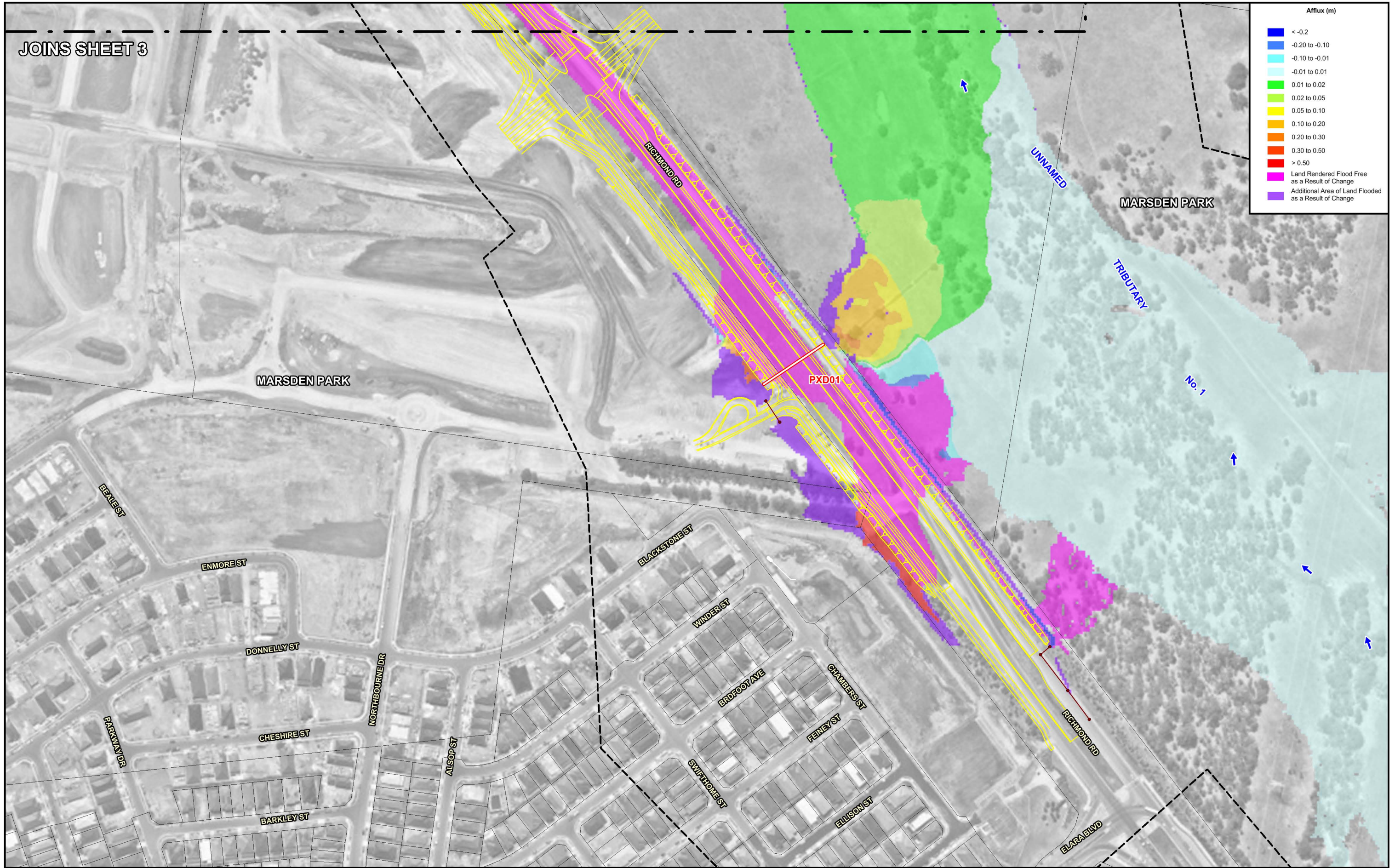
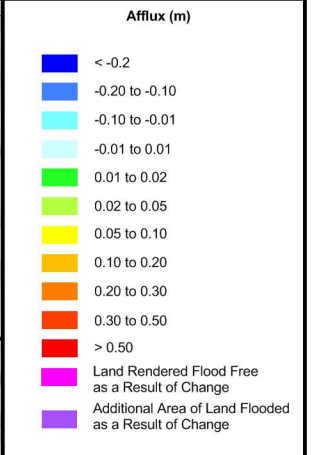
**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 5.4
(Sheet 3 of 3)
IMPACT OF ROAD UPGRADE ON FLOOD BEHAVIOUR
1% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



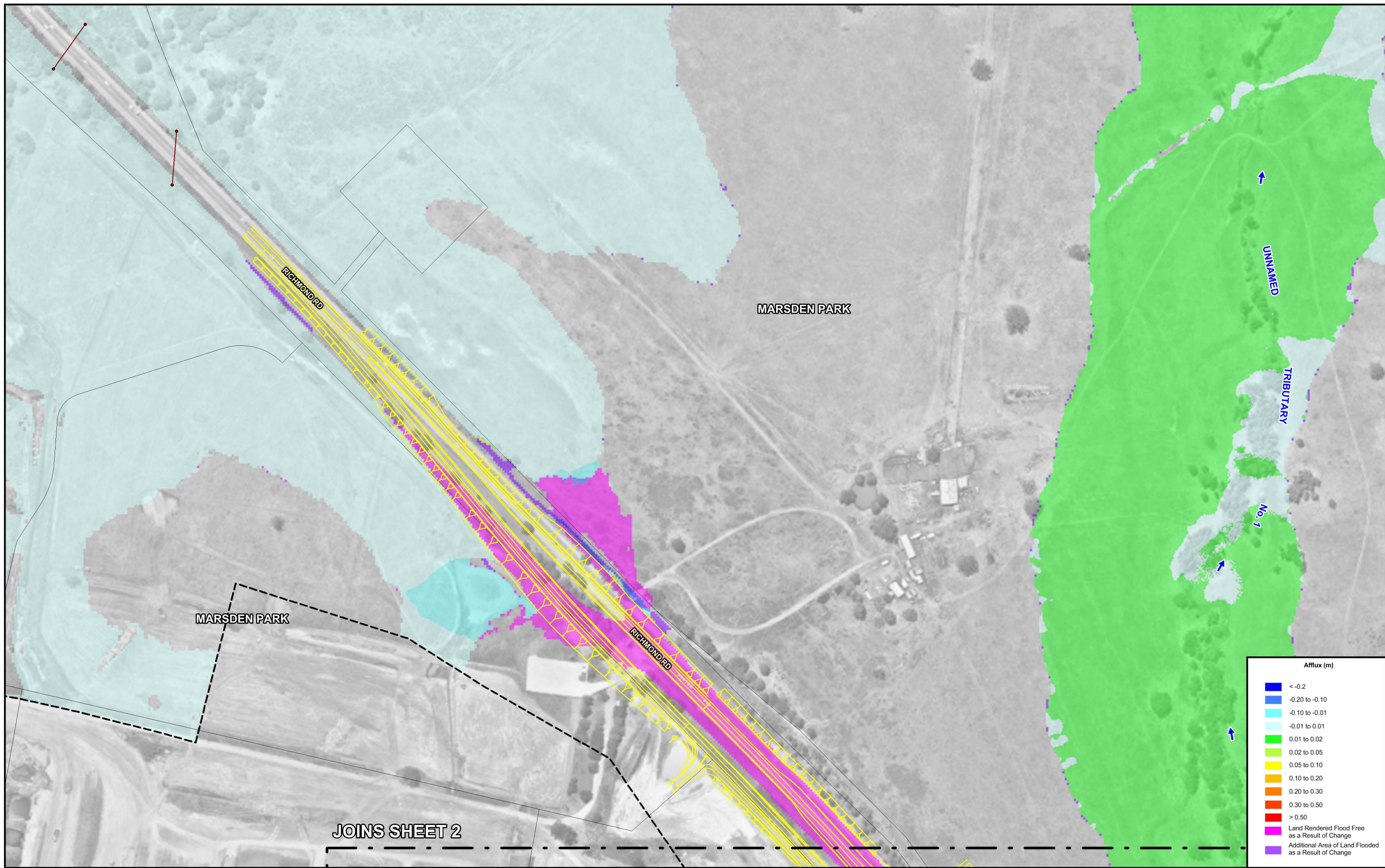
**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 5.5
(Sheet 1 of 3)
IMPACT OF ROAD UPGRADE ON FLOOD BEHAVIOUR
0.2% AEP - MINOR AND MAJOR TRIBUTARY FLOODING



- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String
 - Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Afflux (m)

Blue	< -0.2
Light Blue	-0.20 to -0.10
Cyan	-0.10 to -0.01
Light Green	-0.01 to 0.01
Green	0.01 to 0.02
Yellow-Green	0.02 to 0.05
Yellow	0.05 to 0.10
Orange	0.10 to 0.20
Red-Orange	0.20 to 0.30
Red	0.30 to 0.50
Dark Red	> 0.50
Magenta	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change

Scale: 1:3,000

LEGEND

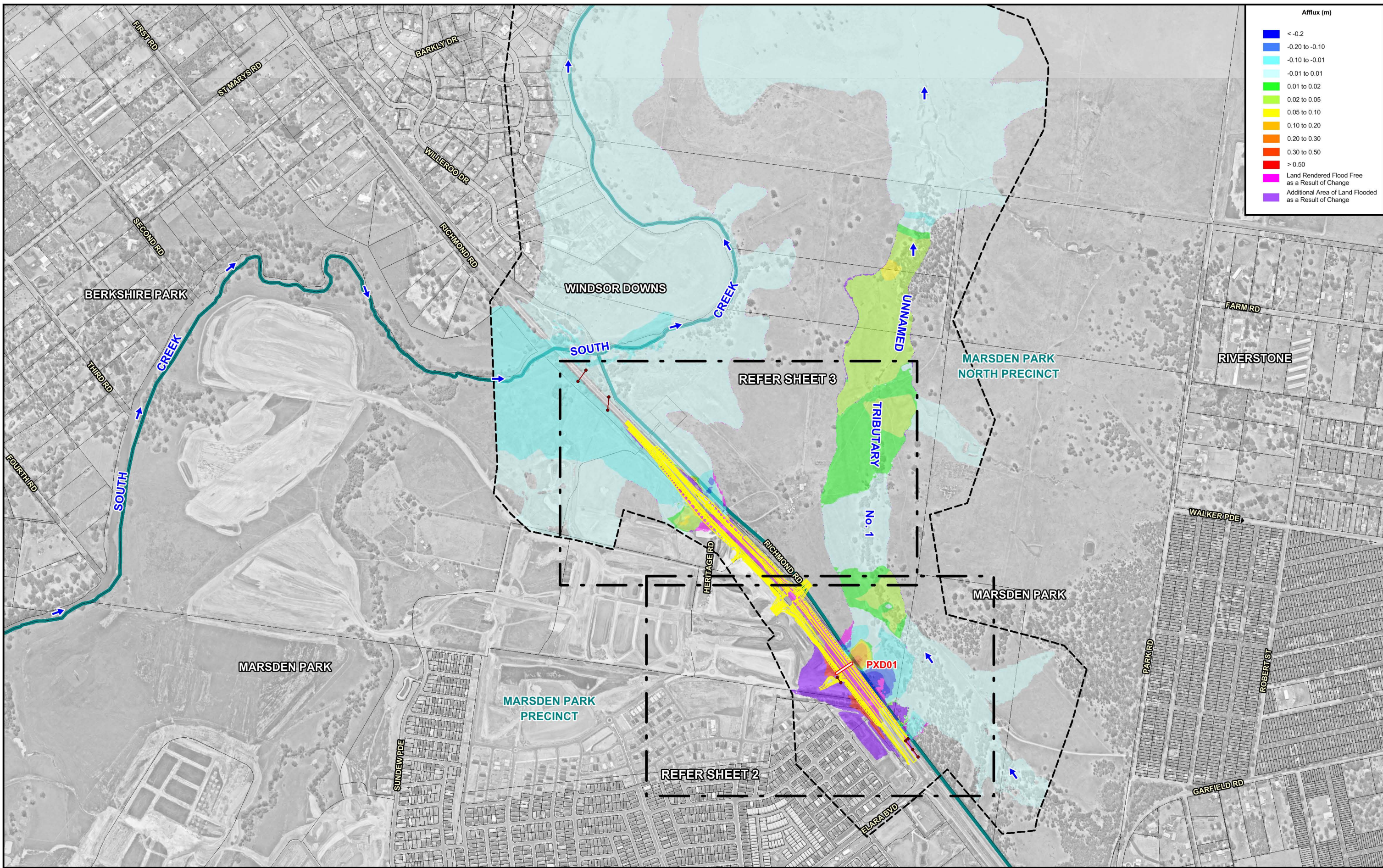
 Modelled Stormwater Network

 TUFLOW Model Extent

 Richmond Road Upgrade Design String

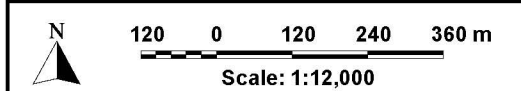
RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD

FLOODING AND DRAINAGE INVESTIGATION



Afflux (m)

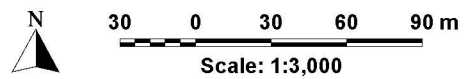
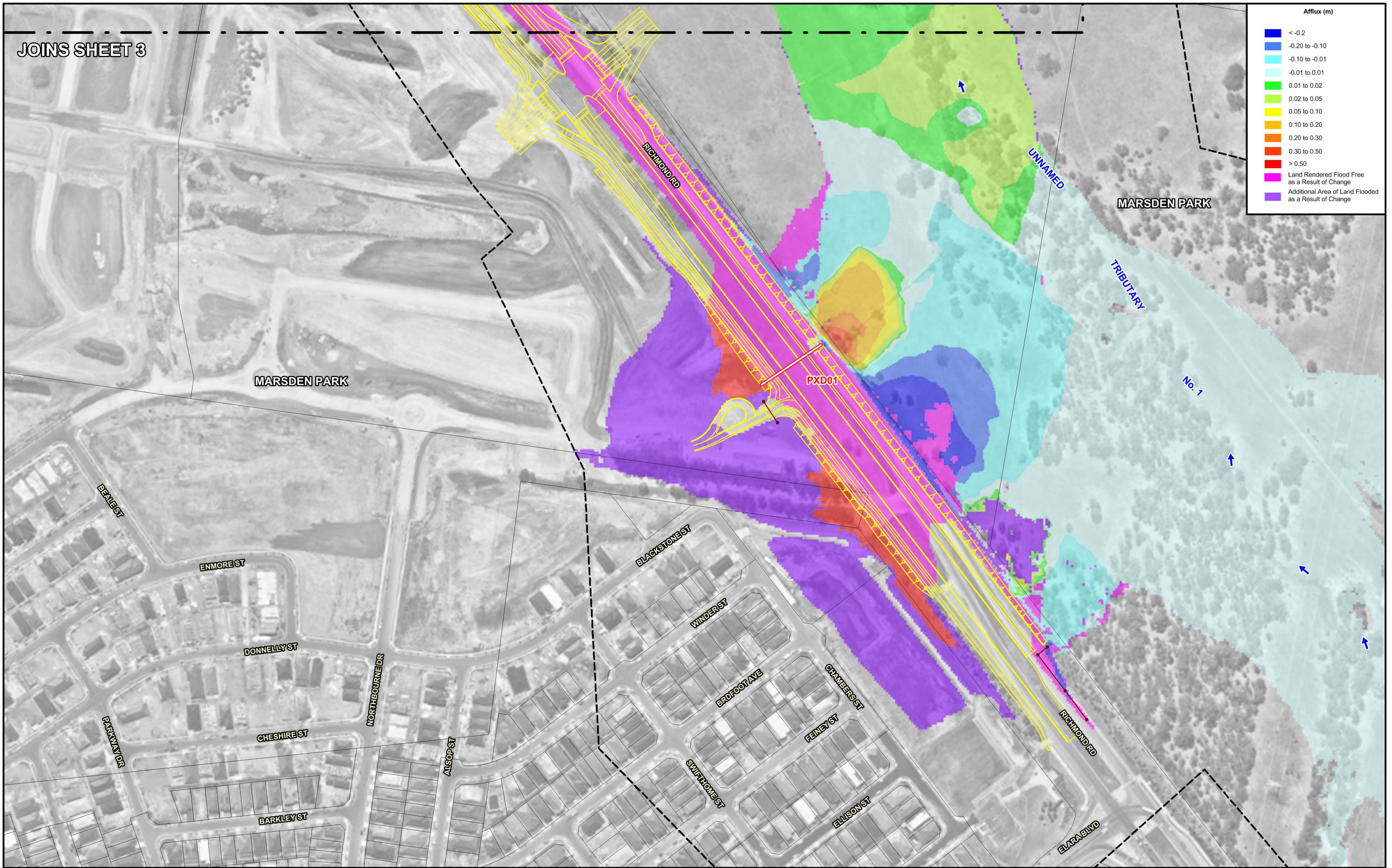
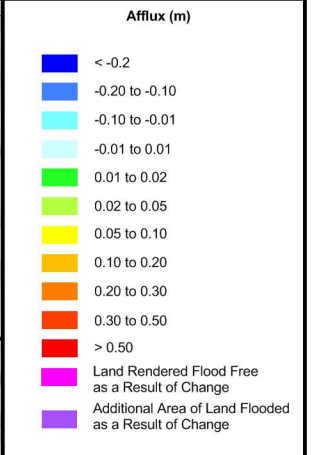
<math>< -0.2</math>
-0.20 to -0.10
-0.10 to -0.01
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.50
> 0.50
Land Rendered Flood Free as a Result of Change
Additional Area of Land Flooded as a Result of Change



LEGEND

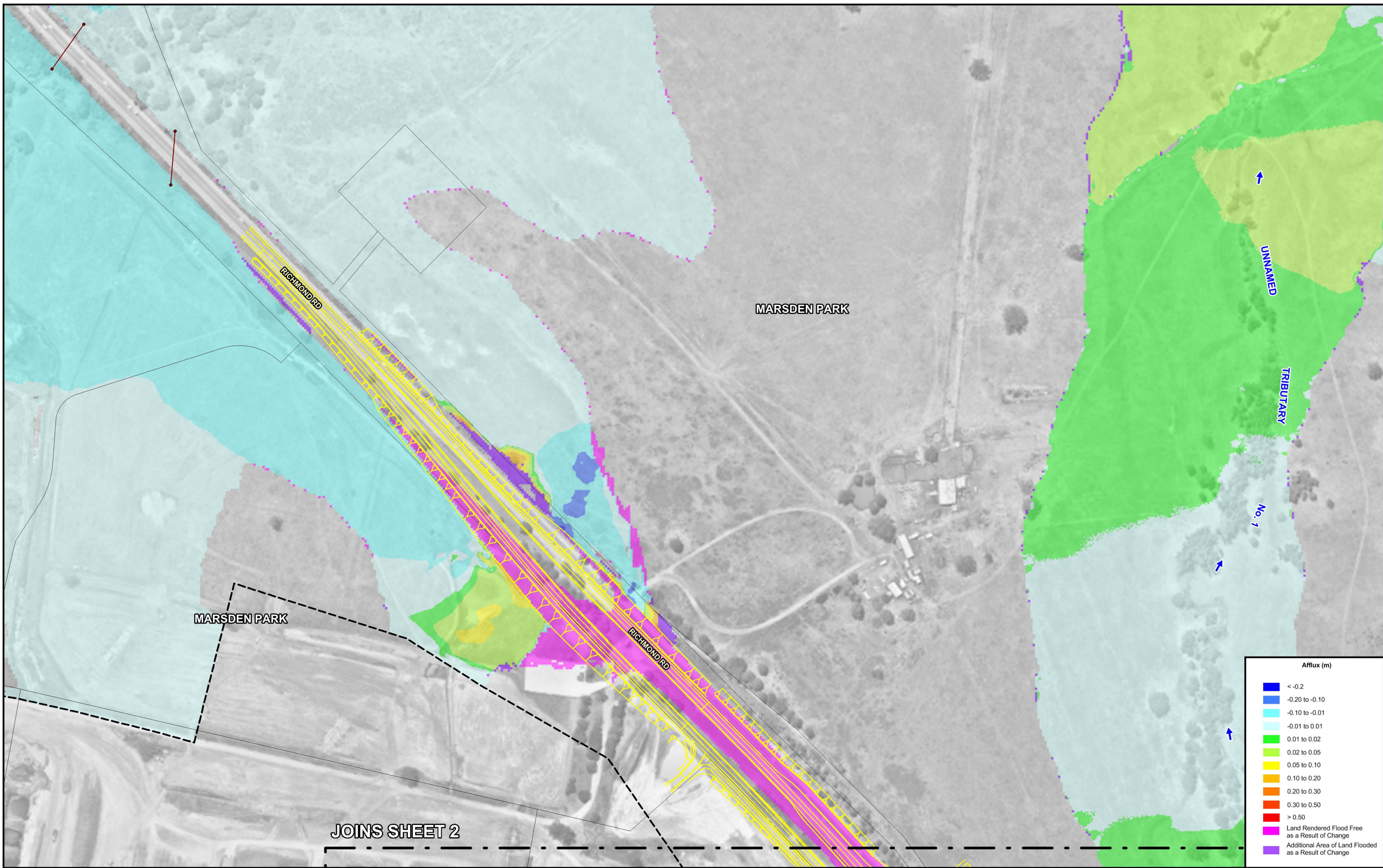
	Modelled Stormwater Network		Richmond Road Upgrade Design String
	TUFLOW Model Extent		Development Precinct Boundary
			Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

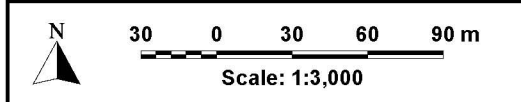


- LEGEND**
- Modelled Stormwater Network
 - TUFLOW Model Extent
 - Richmond Road Upgrade Design String
 - Proposed Transverse Drainage Structure and Identifier

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**



Afflux (m)	
Dark Blue	< -0.2
Blue	-0.20 to -0.10
Cyan	-0.10 to -0.01
Light Cyan	-0.01 to 0.01
Light Green	0.01 to 0.02
Green	0.02 to 0.05
Yellow-Green	0.05 to 0.10
Yellow	0.10 to 0.20
Orange	0.20 to 0.30
Red-Orange	0.30 to 0.50
Red	> 0.50
Magenta	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change



JOINS SHEET 2





LEGEND	
Red line with dots	Modelled Stormwater Network
Dashed line	TUFLOW Model Extent
Yellow and purple hatched area	Richmond Road Upgrade Design String

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

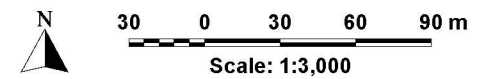
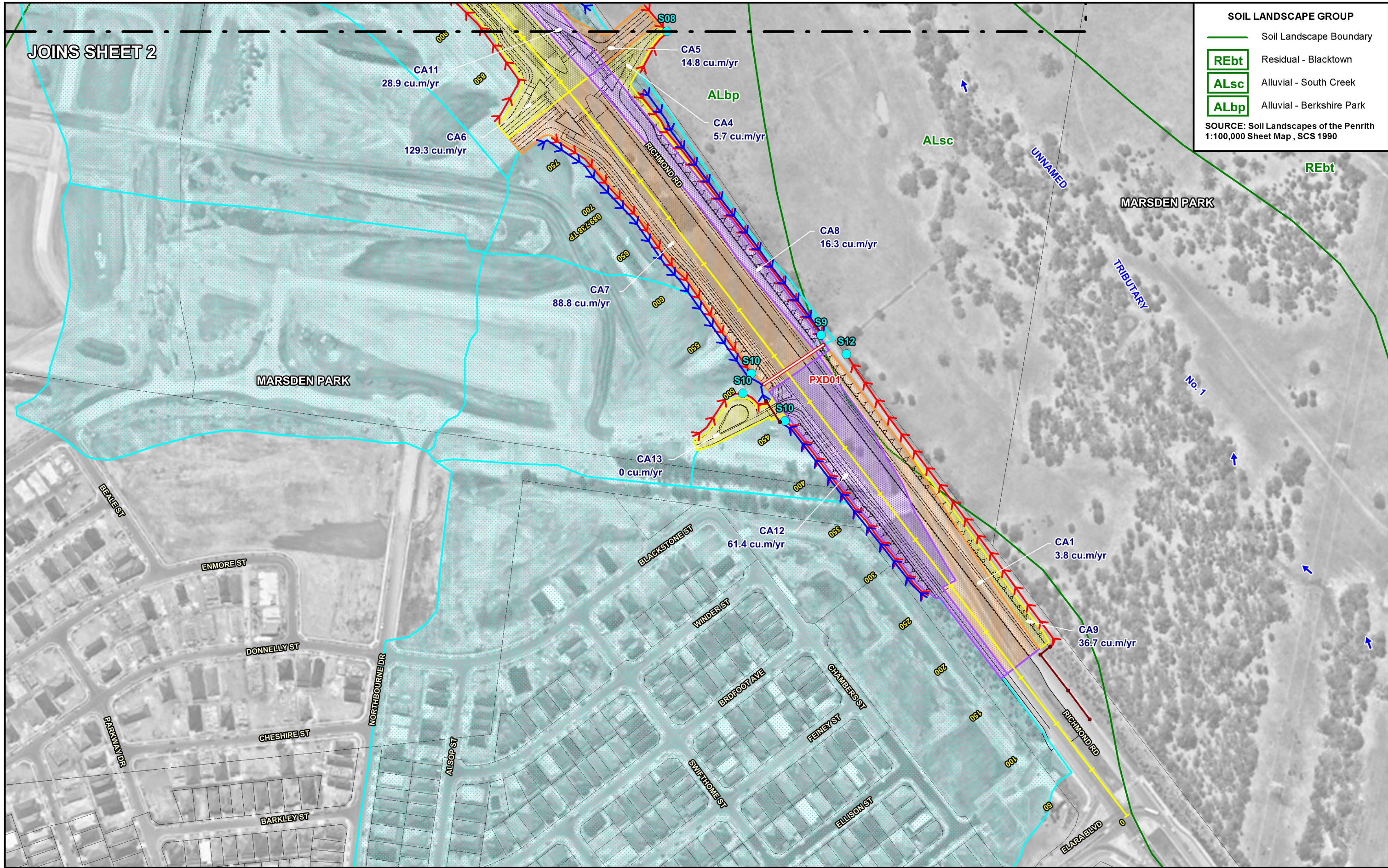
Figure 5.6
(Sheet 3 of 3)
IMPACT OF ROAD UPGRADE ON FLOOD BEHAVIOUR
PMF - MINOR TRIBUTARY FLOODING

JOINS SHEET 2







SOIL LANDSCAPE GROUP

-  Soil Landscape Boundary
-  Residual - Blacktown
-  Alluvial - South Creek
-  Alluvial - Berkshire Park

SOURCE: Soil Landscapes of the Penrith 1:100,000 Sheet Map, SCS 1990



LEGEND

-  Temporary Table Drain Controlling On-site Water
-  New Permanent Catch Drain Controlling Off-site Water
-  Temporary Sediment Sump Location and Identifier
-  Extent of Catchment Generating On-Site Water and Identifier
-  Extent of Catchment Draining into Permanent Catch Drains
-  Control Area Identifier and Average Annual Soil Loss





-  Richmond Road Upgrade String and Chainage
-  Richmond Road Upgrade Design Strings
-  Proposed Transverse Drainage Structure and Identifier
-  Piped Drainage System

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

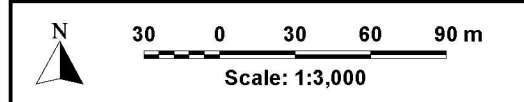
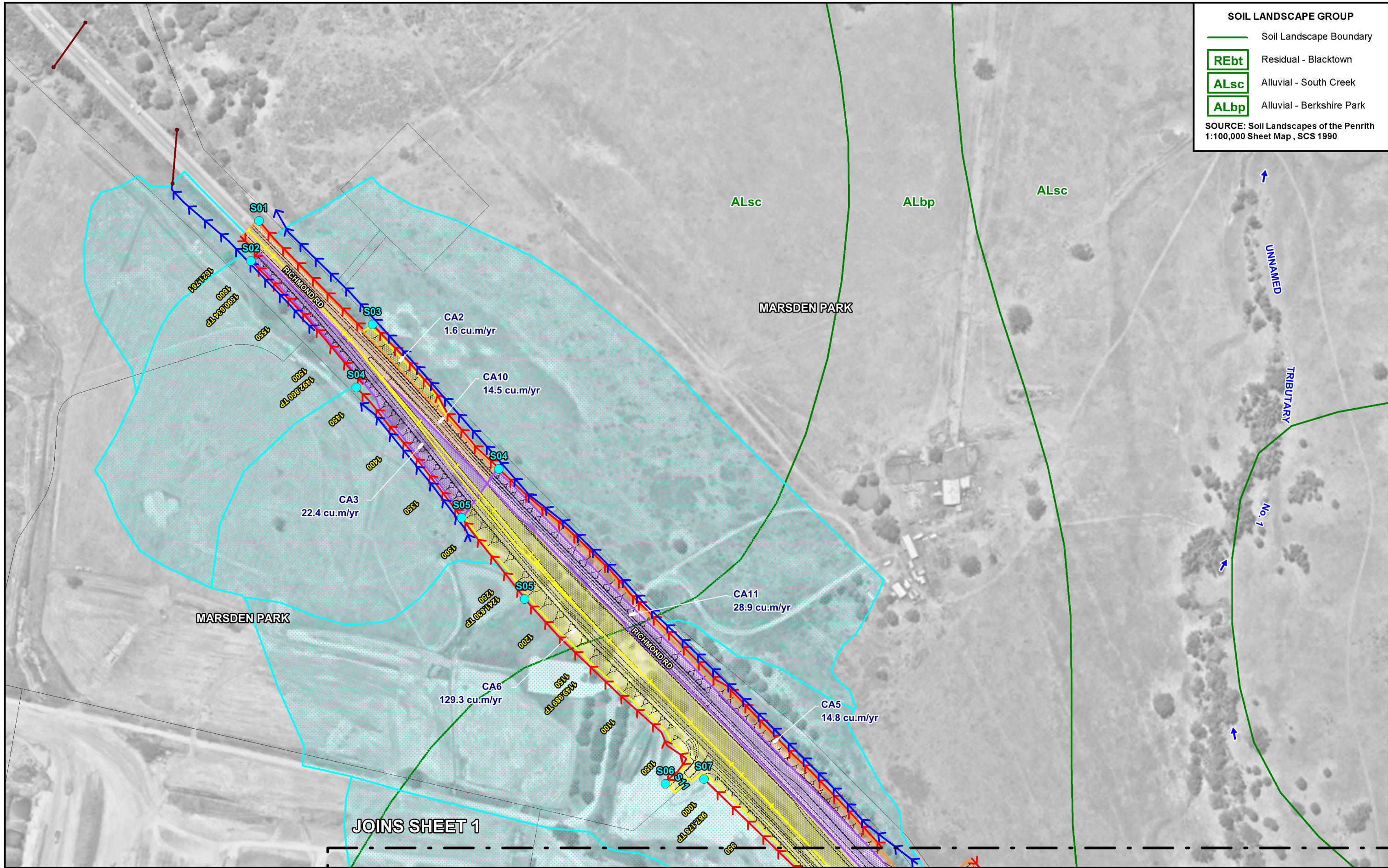
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Figure 6.1
(Sheet 1 of 2)

SOIL LANDSCAPE GROUP










-  Soil Landscape Boundary
-  Residual - Blacktown
-  Alluvial - South Creek
-  Alluvial - Berkshire Park

SOURCE: Soil Landscapes of the Penrith
1:100,000 Sheet Map, SCS 1990



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LEGEND

 Temporary Table Drain Controlling On-site Water	 Extent of Catchment Generating On-Site Water and Identifier	 Richmond Road Upgrade String and Chainage
 New Permanent Catch Drain Controlling Off-site Water	 Extent of Catchment Draining into Permanent Catch Drains	 Richmond Road Upgrade Design Strings
 S01 Temporary Sediment Sump Location and Identifier	 CA2 Control Area Identifier and Average Annual Soil Loss 1.6 cu.m/yr	 Piped Drainage System

**RICHMOND ROAD UPGRADE ELARA BOULEVARD TO HERITAGE ROAD
FLOODING AND DRAINAGE INVESTIGATION**

Figure 6.1
(Sheet 2 of 2)