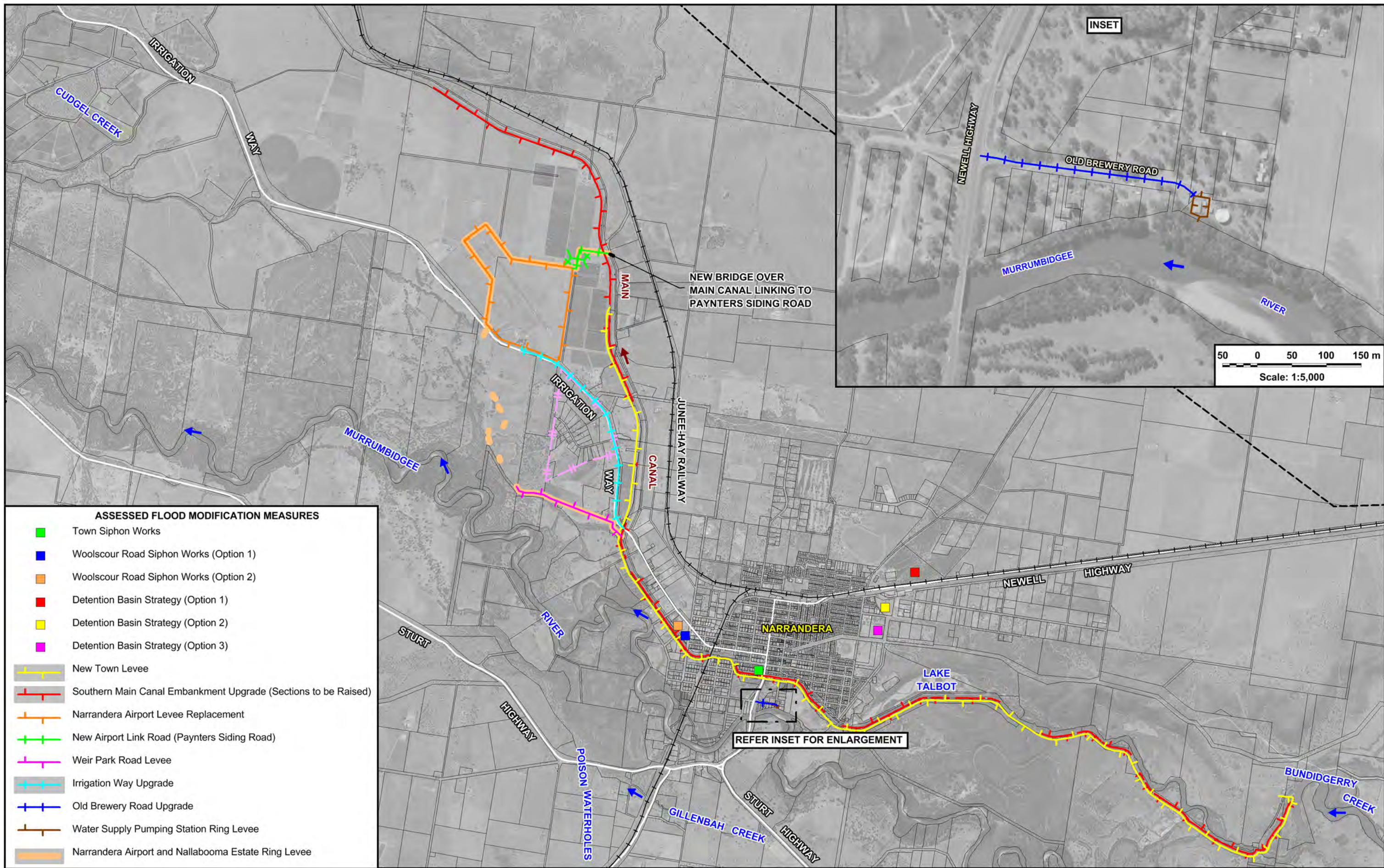


LEGEND

 E1 National Parks and Nature Reserves	 R5 Large Lot Residential	 SP2 Infrastructure
 E2 Environmental Conservation	 RE1 Public Recreation	 W1 Natural Waterways
 E4 Environmental Living	 RU1 Primary Production	 W2 Recreational Water Ways
 IN1 General Industrial	 RU4 Primary Production Small Lots	 DM Deferred Matter
 IN2 Light Industrial	 RU5 Village	

**REVIEW OF THE NARRANDERA FLOODPLAIN
RISK MANAGEMENT STUDY AND PLAN**



- ASSESSED FLOOD MODIFICATION MEASURES**
- Town Siphon Works
 - Woolscour Road Siphon Works (Option 1)
 - Woolscour Road Siphon Works (Option 2)
 - Detention Basin Strategy (Option 1)
 - Detention Basin Strategy (Option 2)
 - Detention Basin Strategy (Option 3)
 - |— New Town Levee
 - |— Southern Main Canal Embankment Upgrade (Sections to be Raised)
 - |— Narrandera Airport Levee Replacement
 - |— New Airport Link Road (Paynters Siding Road)
 - |— Weir Park Road Levee
 - |— Irrigation Way Upgrade
 - |— Old Brewery Road Upgrade
 - |— Water Supply Pumping Station Ring Levee
 - |— Narrandera Airport and Nallabooma Estate Ring Levee

500 0 500 1000 1500 m
 Scale: 1:50,000

Lyall & Associates

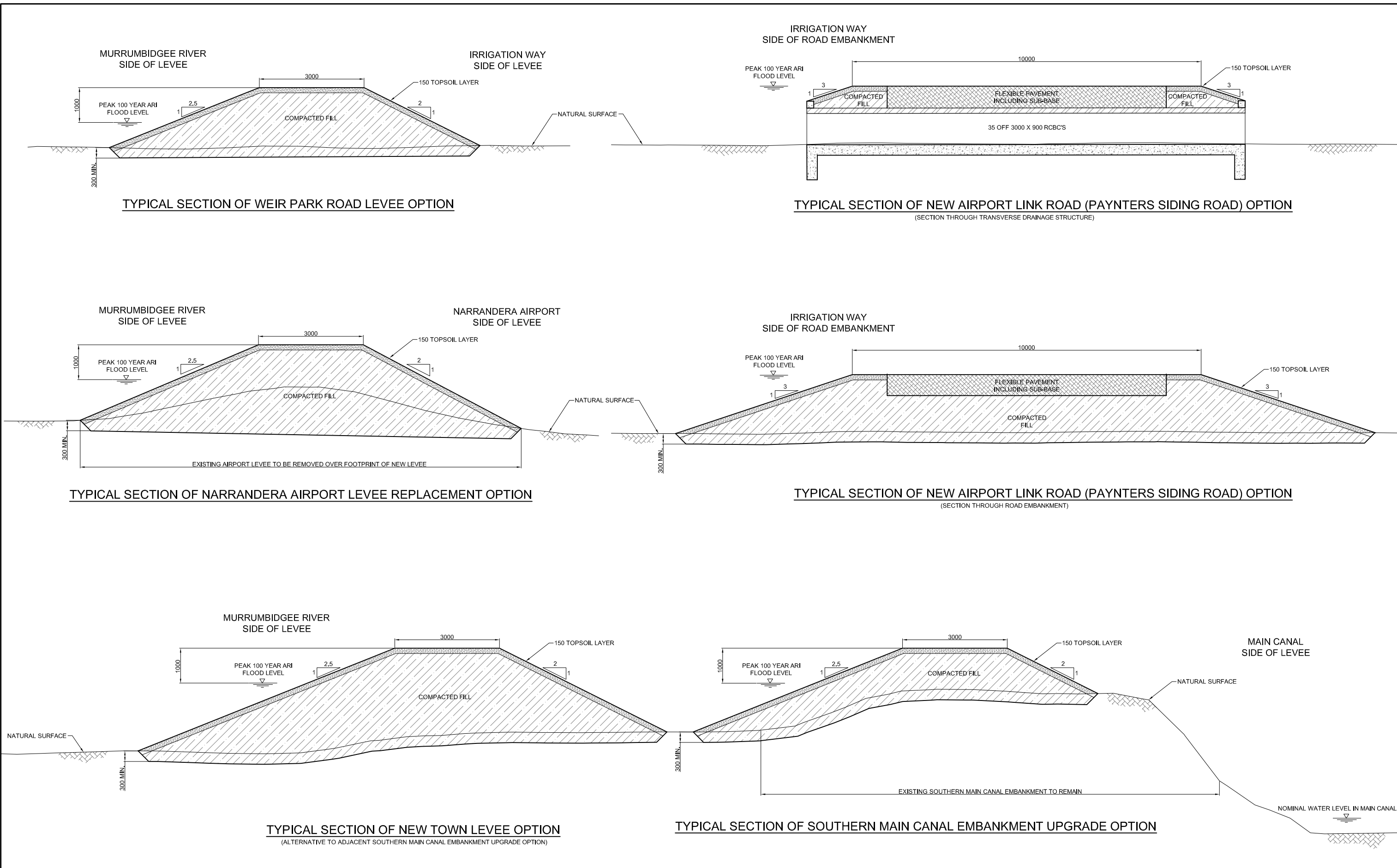
NOTE:
 Location of homesteads and unnamed residences only shown for potentially flood affected areas.

- LEGEND**
- TUFLOW Model Extent
 - Major Road
 - Railway
 - |— Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 3.1

ASSESSED FLOOD MODIFICATION MEASURES



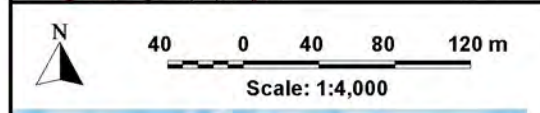
**NARRANDERA FLOOD STUDY REVIEW
AND LEVEE OPTIONS ASSESSMENT**

Figure 3.2



Scale
Vertical 1:100
Horizontal 1:100

TYPICAL SECTIONS OF ASSESSED LEVEE AND EMBANKMENT UPGRADE OPTIONS
MURRUMBIDGEE RIVER FLOODPLAIN



LEGEND

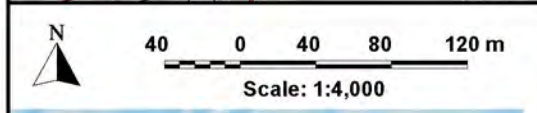
	Railway		Detention Basin Strategy Design Strings
	Existing Stormwater Network		Earth Embankment
	Proposed Stormwater Network		Road Upgrade
			Channel/ Relief Drain

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 3.3



KEY FEATURES OF DETENTION BASIN STRATEGY (OPTION 1)



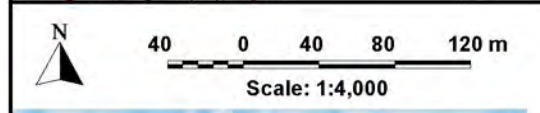
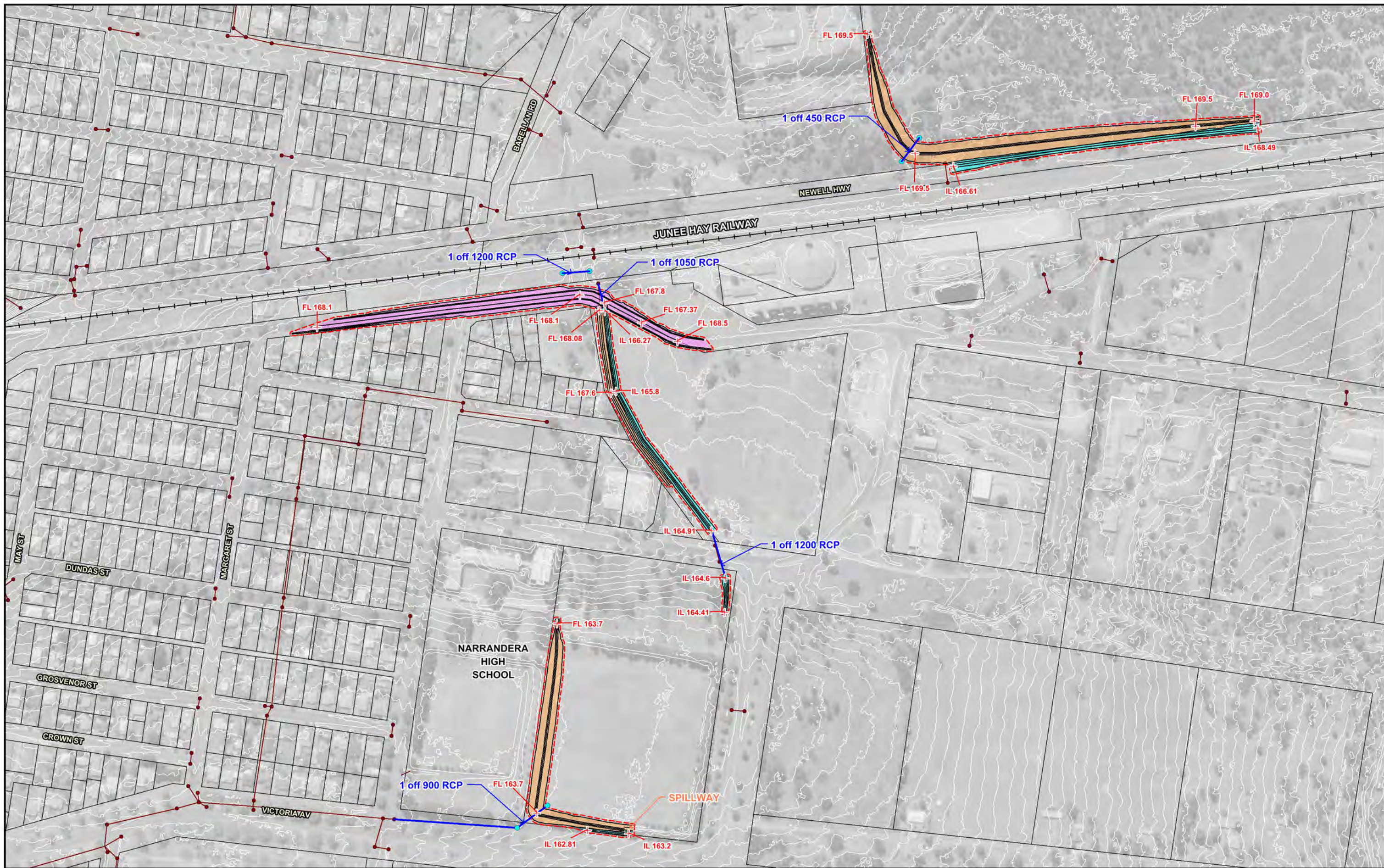
LEGEND

	Railway		Detention Basin Strategy Design Strings
	Existing Stormwater Network		Earth Embankment
	Proposed Stormwater Network		Road Upgrade
			Channel/ Relief Drain

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 3.4

KEY FEATURES OF DETENTION BASIN STRATEGY (OPTION 2)



LEGEND

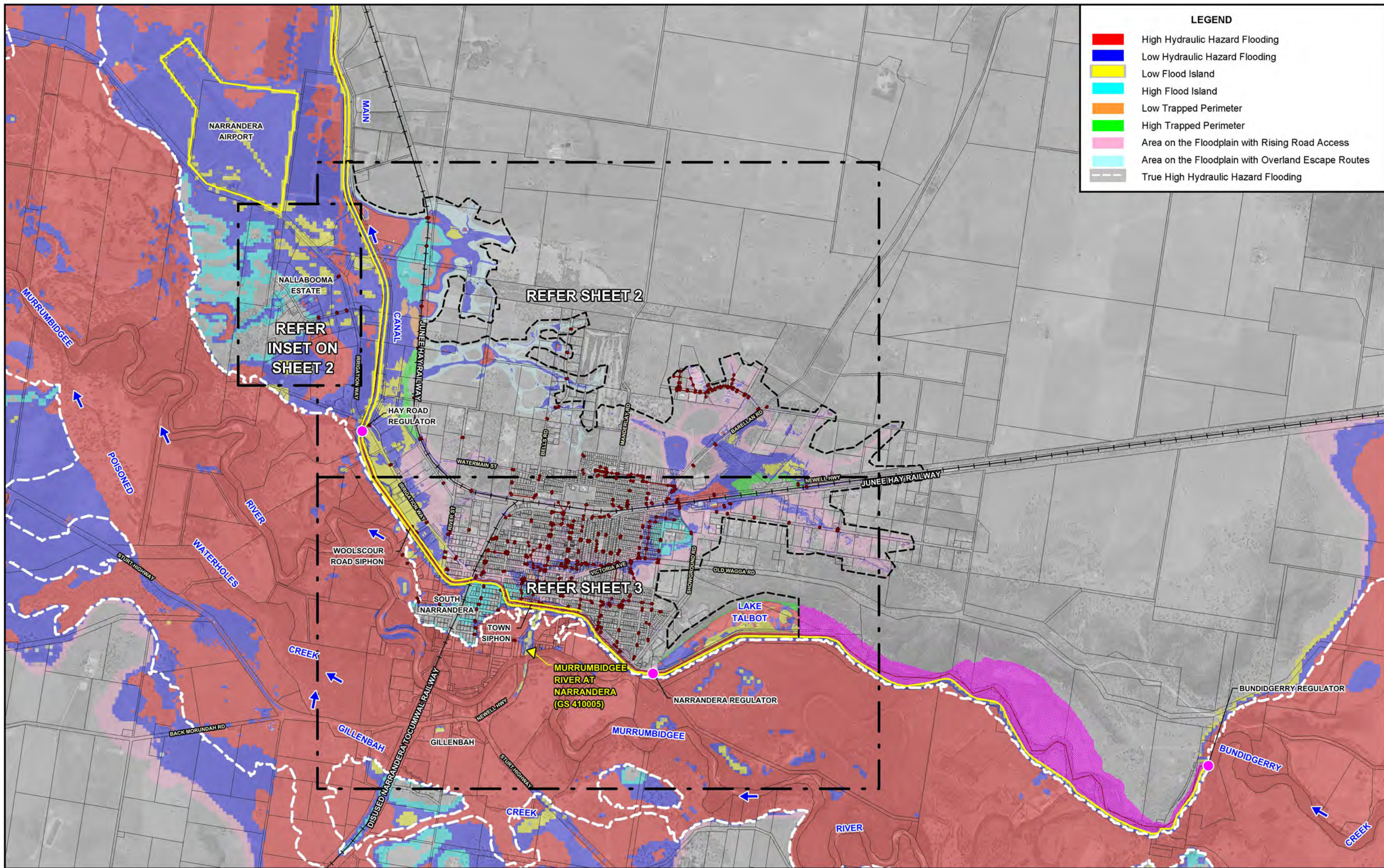
	Railway		Detention Basin Strategy Design Strings
	Existing Stormwater Network		Earth Embankment
	Proposed Stormwater Network		Road Upgrade
			Channel/ Relief Drain

**REVIEW OF THE NARRANDERA FLOODPLAIN
RISK MANAGEMENT STUDY AND PLAN**

Figure 3.5

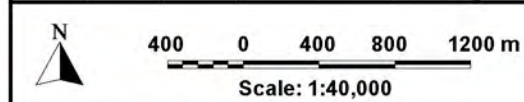


KEY FEATURES OF DETENTION BASIN STRATEGY (OPTION 3)



LEGEND

[Red Box]	High Hydraulic Hazard Flooding
[Blue Box]	Low Hydraulic Hazard Flooding
[Yellow Box]	Low Flood Island
[Cyan Box]	High Flood Island
[Orange Box]	Low Trapped Perimeter
[Green Box]	High Trapped Perimeter
[Pink Box]	Area on the Floodplain with Rising Road Access
[Light Blue Box]	Area on the Floodplain with Overland Escape Routes
[Grey Box]	True High Hydraulic Hazard Flooding



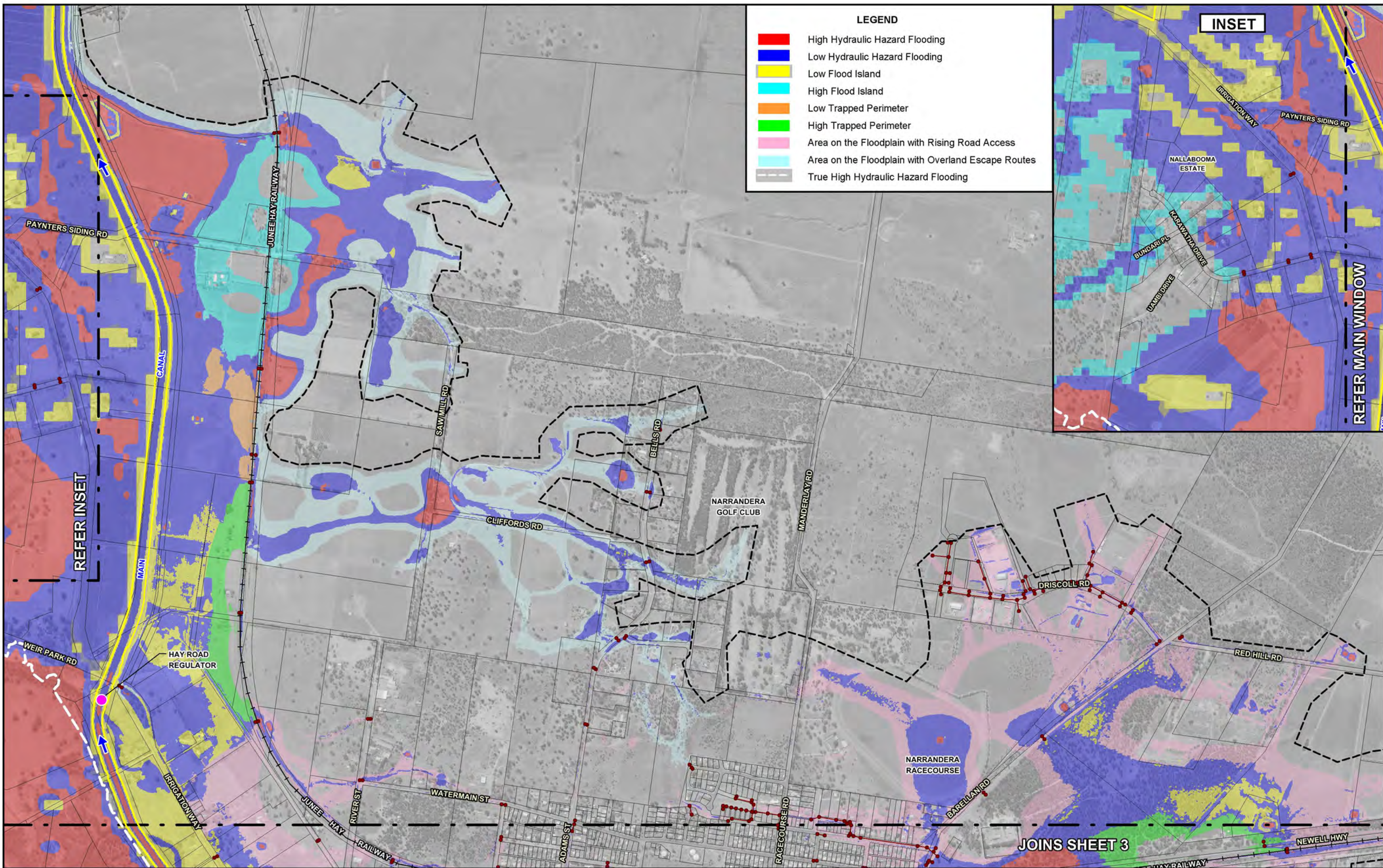
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

[Red line with dots]	Modelled Stormwater Network
[Yellow line]	Existing Canal Embankment / Levee
[Black line with cross-ticks]	Railway
[Dashed black line]	Limit of Overland Flow Mapping

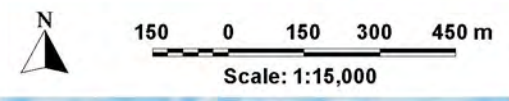
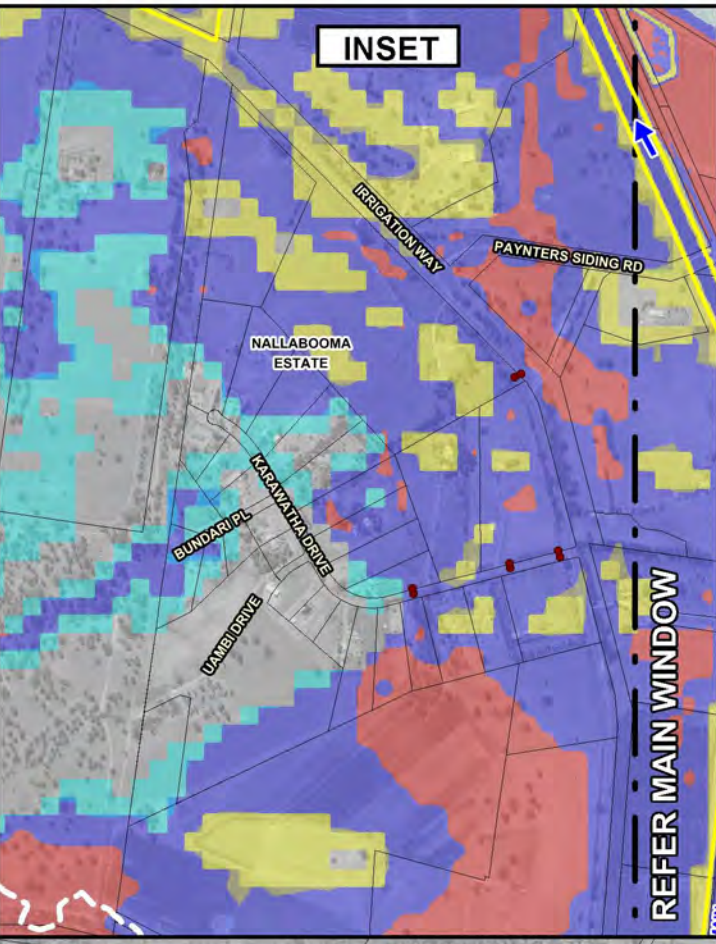
[Yellow triangle]	WaterNSW Stream Gauge
[Pink dot]	Murrumbidgee Irrigation Operated Regulator
[Pink shaded area]	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN



LEGEND

- High Hydraulic Hazard Flooding
- Low Hydraulic Hazard Flooding
- Low Flood Island
- High Flood Island
- Low Trapped Perimeter
- High Trapped Perimeter
- Area on the Floodplain with Rising Road Access
- Area on the Floodplain with Overland Escape Routes
- True High Hydraulic Hazard Flooding



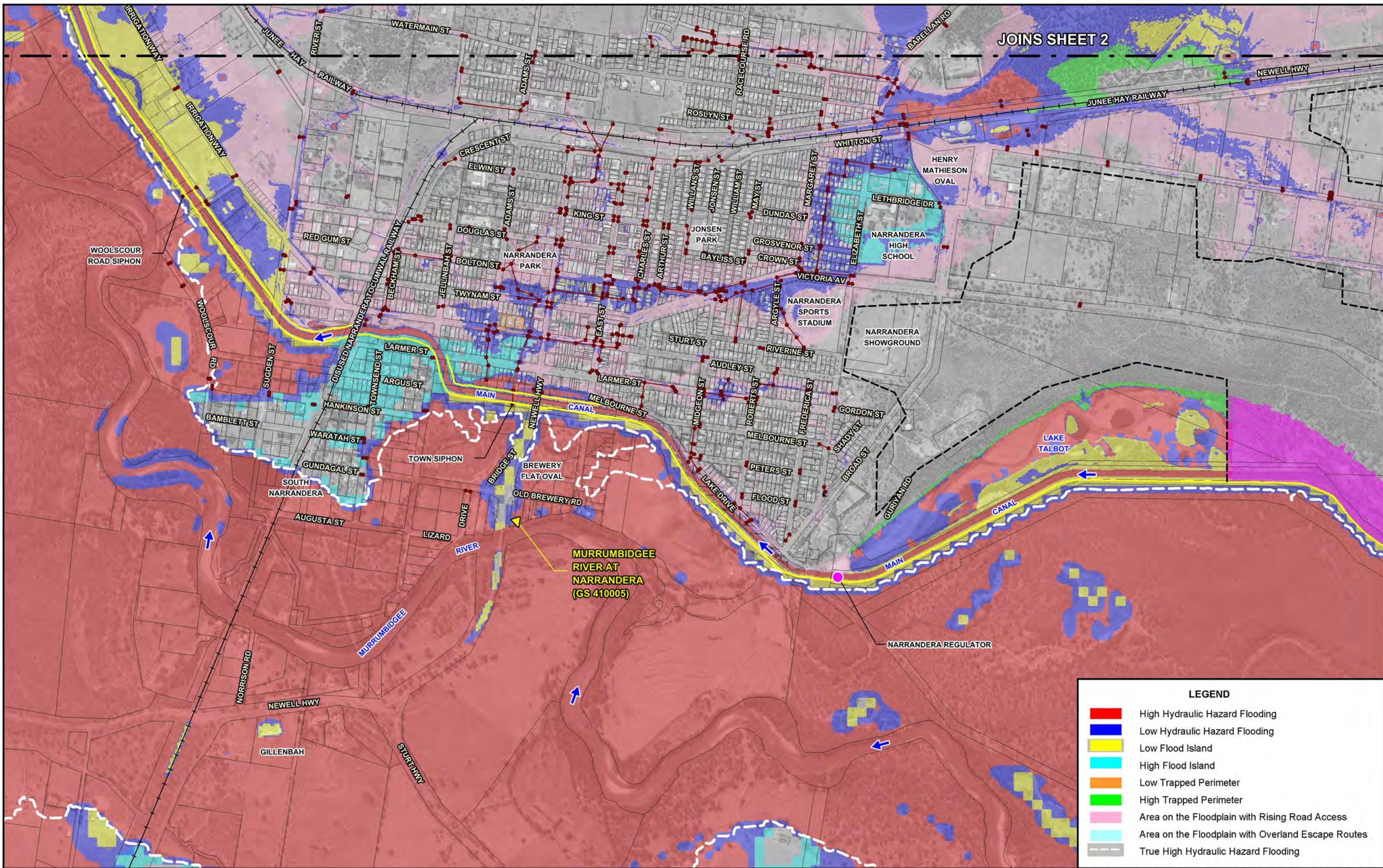
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

- Modelled Stormwater Network
- Existing Canal Embankment / Levee
- Railway
- Limit of Overland Flow Mapping
- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 3.6
 (Sheet 2 of 3)
 FLOOD EMERGENCY RESPONSE PLANNING CLASSIFICATIONS
 1% AEP



JOINS SHEET 2

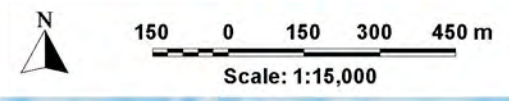
MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

LEGEND

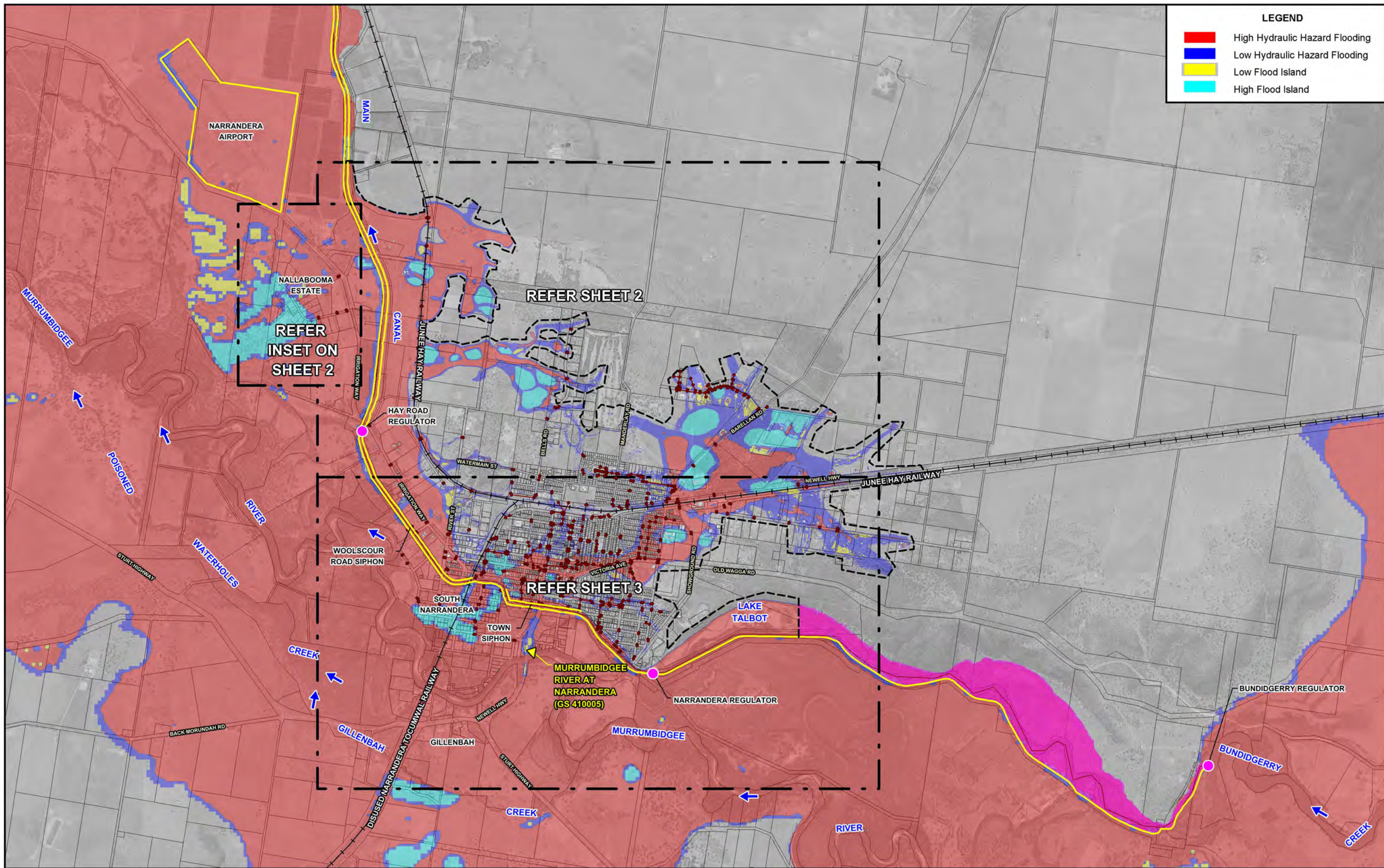
- Modelled Stormwater Network
- Existing Canal Embankment / Levee
- Railway
- Limit of Overland Flow Mapping
- WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 3.6 (Sheet 3 of 3)
FLOOD EMERGENCY RESPONSE PLANNING CLASSIFICATIONS
1% AEP



NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.



LEGEND

- High Hydraulic Hazard Flooding
- Low Hydraulic Hazard Flooding
- Low Flood Island
- High Flood Island

Lyall & Associates

NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

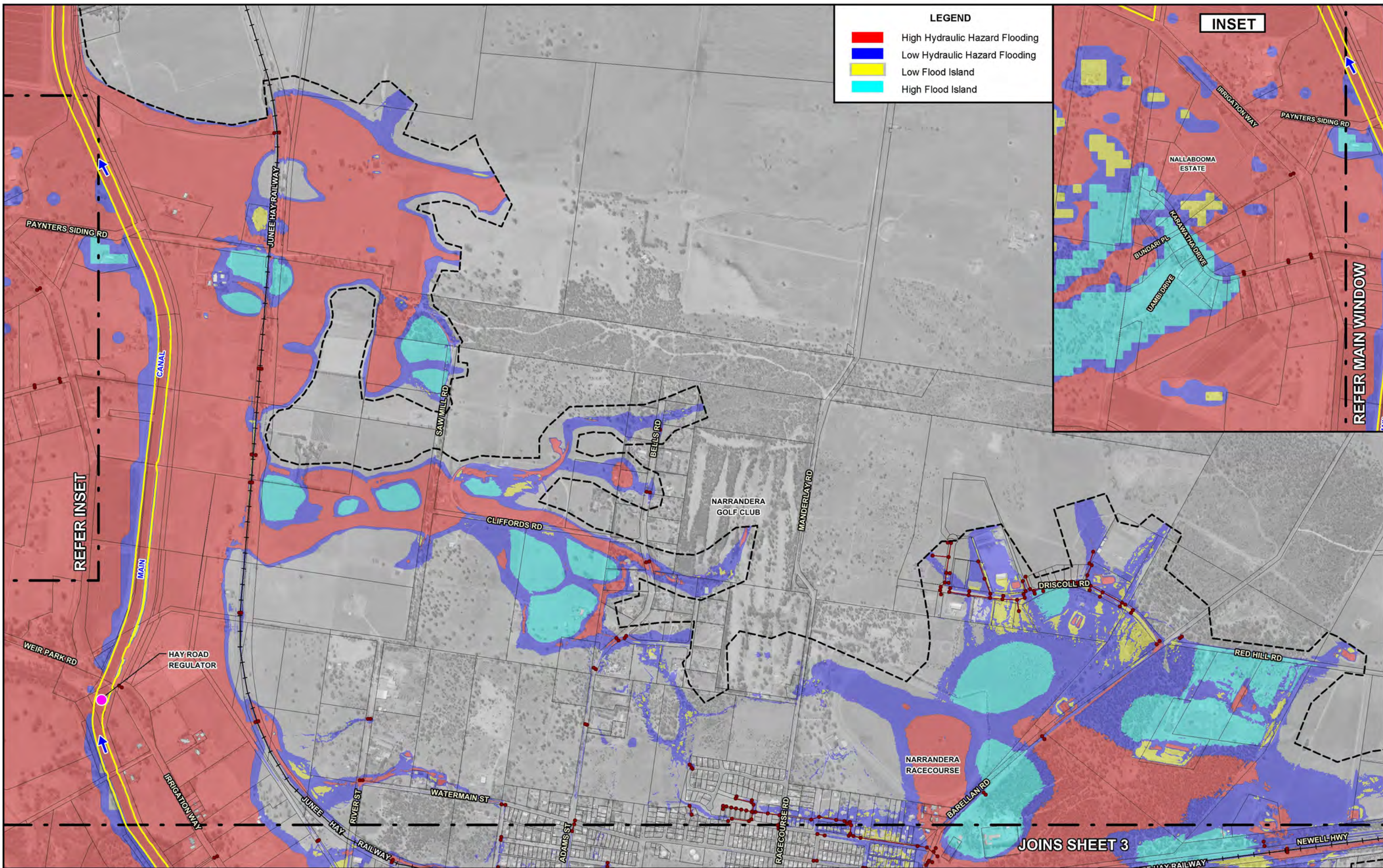
LEGEND

- Modelled Stormwater Network
- Existing Canal Embankment / Levee
- +— Railway
- - - Limit of Overland Flow Mapping

- ▼ WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

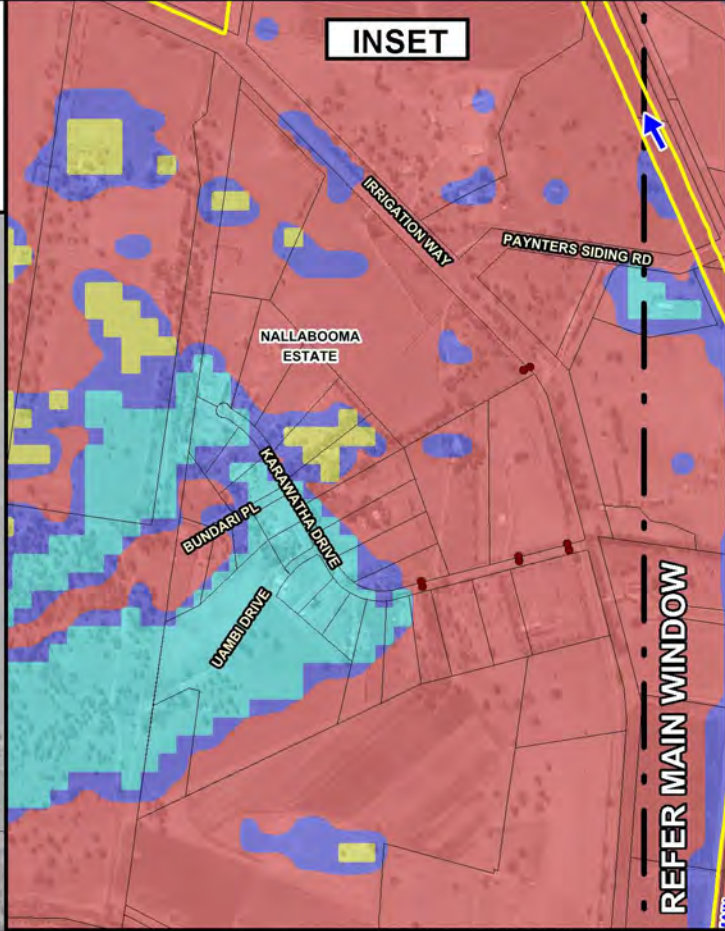
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 3.7
 (Sheet 1 of 3)
FLOOD EMERGENCY RESPONSE PLANNING CLASSIFICATIONS PMF



LEGEND

- High Hydraulic Hazard Flooding
- Low Hydraulic Hazard Flooding
- Low Flood Island
- High Flood Island



N

150 0 150 300 450 m

Scale: 1:15,000

NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

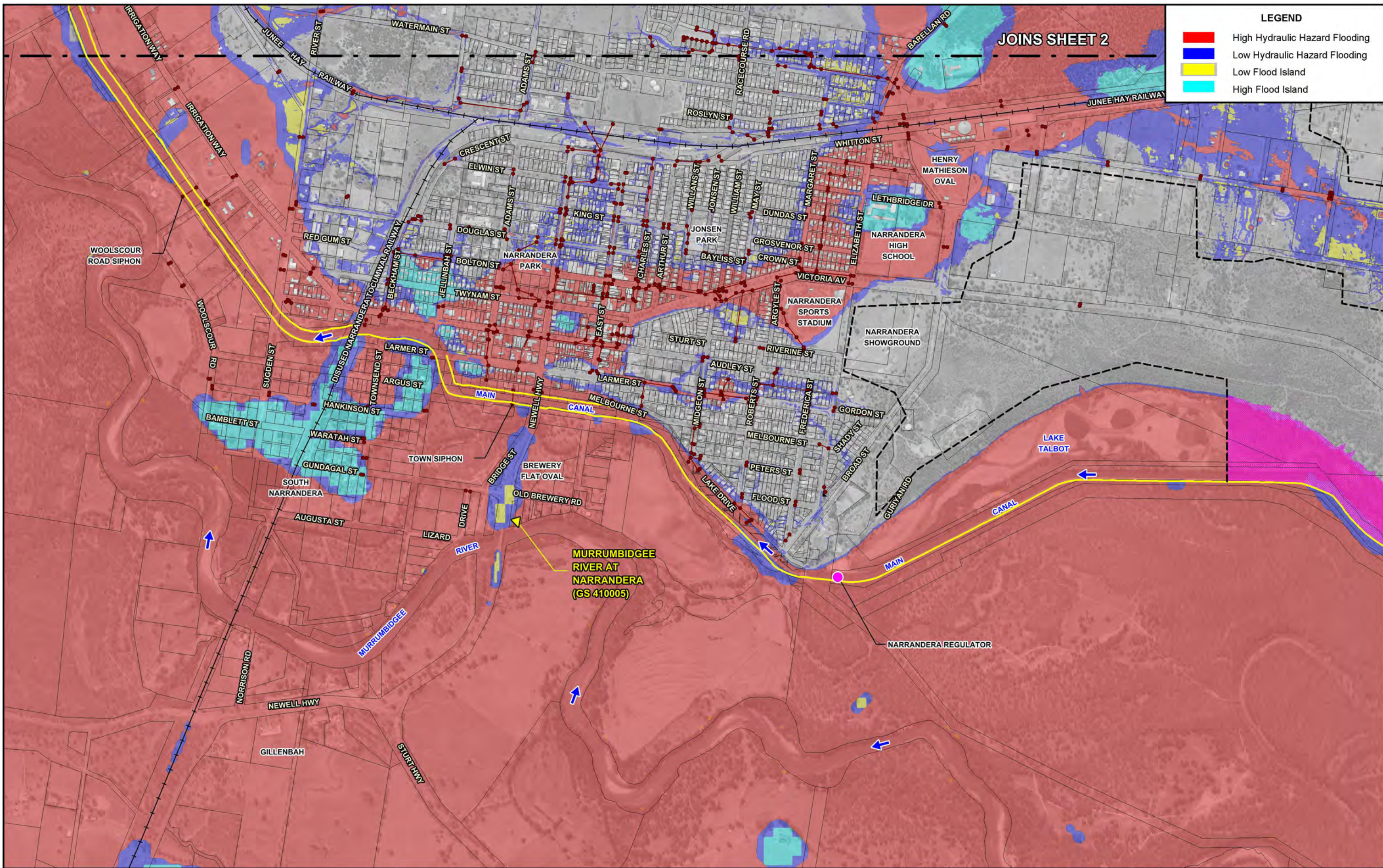
LEGEND

- Modelled Stormwater Network
- Existing Canal Embankment / Levee
- +— Railway
- - - Limit of Overland Flow Mapping

- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 3.7
 (Sheet 2 of 3)
 FLOOD EMERGENCY RESPONSE PLANNING CLASSIFICATIONS
 PMF



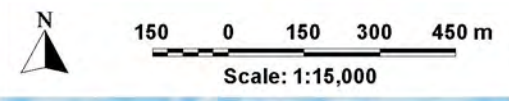
LEGEND

- High Hydraulic Hazard Flooding
- Low Hydraulic Hazard Flooding
- Low Flood Island
- High Flood Island

JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN



NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

- Modelled Stormwater Network
- Existing Canal Embankment / Levee
- +— Railway
- - - Limit of Overland Flow Mapping
- ▼ WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

Lyal & Associates

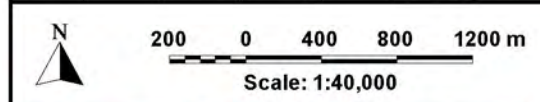
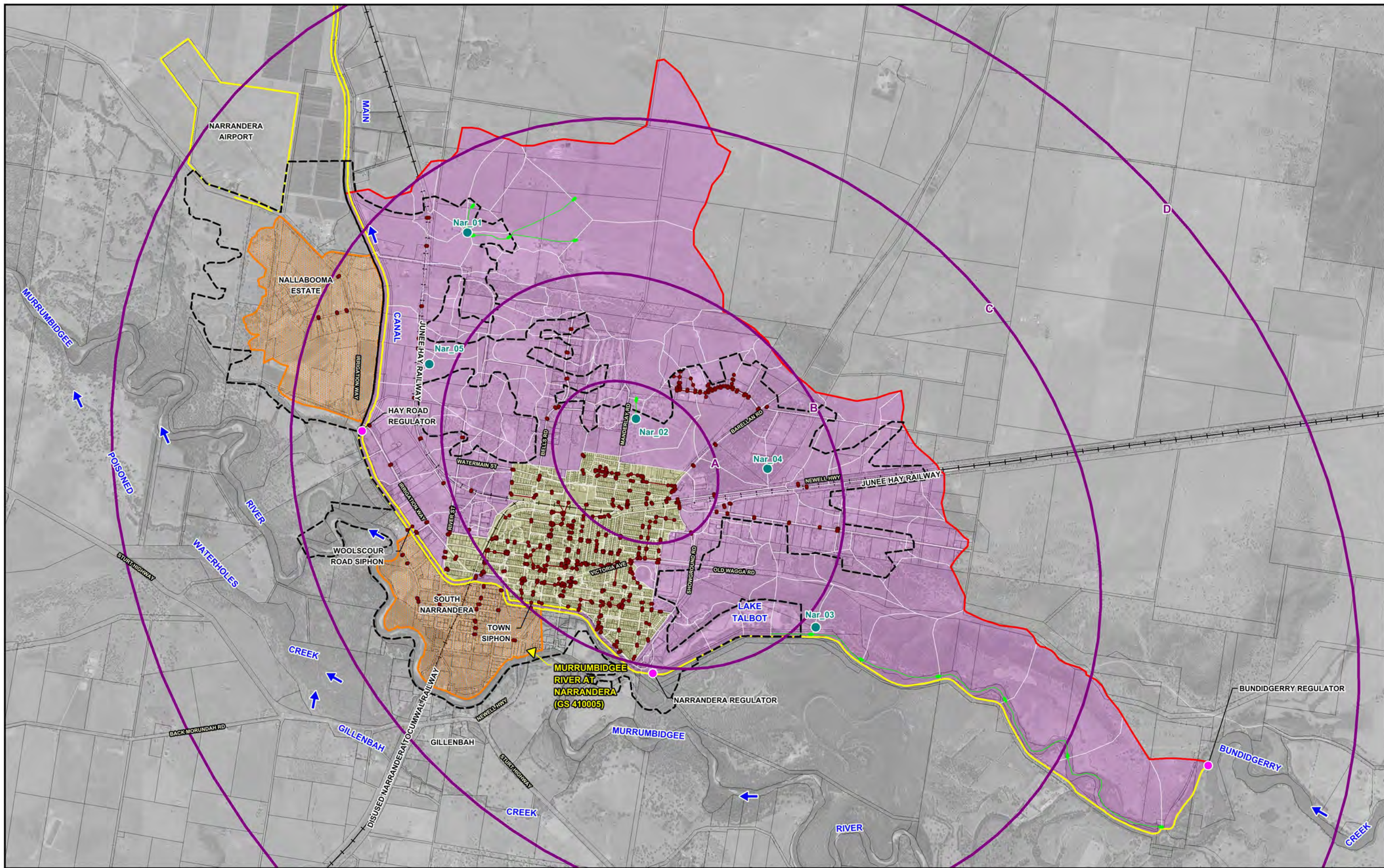
APPENDIX B

HYDROLOGIC AND HYDRAULIC MODELLING

LIST OF FIGURES (APPENDIX B)

- B2.1 Local Catchment Hydrologic Model Layout

- B3.1 Local Catchment TUFLOW Model Layout (3 Sheets)
- B3.2 TUFLOW Schematisation of Floodplain
- B3.3 TUFLOW Model Results – 20% AEP (3 Sheets)
- B3.4 TUFLOW Model Results – 10% AEP (3 Sheets)
- B3.5 TUFLOW Model Results – 5% AEP (3 Sheets)
- B3.6 TUFLOW Model Results – 1% AEP (3 Sheets)
- B3.7 TUFLOW Model Results – 0.5% AEP (3 Sheets)
- B3.8 TUFLOW Model Results – 0.2% AEP (3 Sheets)
- B3.9 TUFLOW Model Results – Extreme Flood (3 Sheets)
- B3.10 Sensitivity of Local Catchment Flood Behaviour to 20% Increase in Hydraulic Roughness Values – 1% AEP (3 Sheets)
- B3.11 Sensitivity of Local Catchment Flood Behaviour to Partial Blockage of All Hydraulic Structures – 1% AEP (3 Sheets)
- B3.12 Sensitivity of Local Catchment Flood Behaviour to Full Blockage of Siphons Only – 1% AEP (3 Sheets)

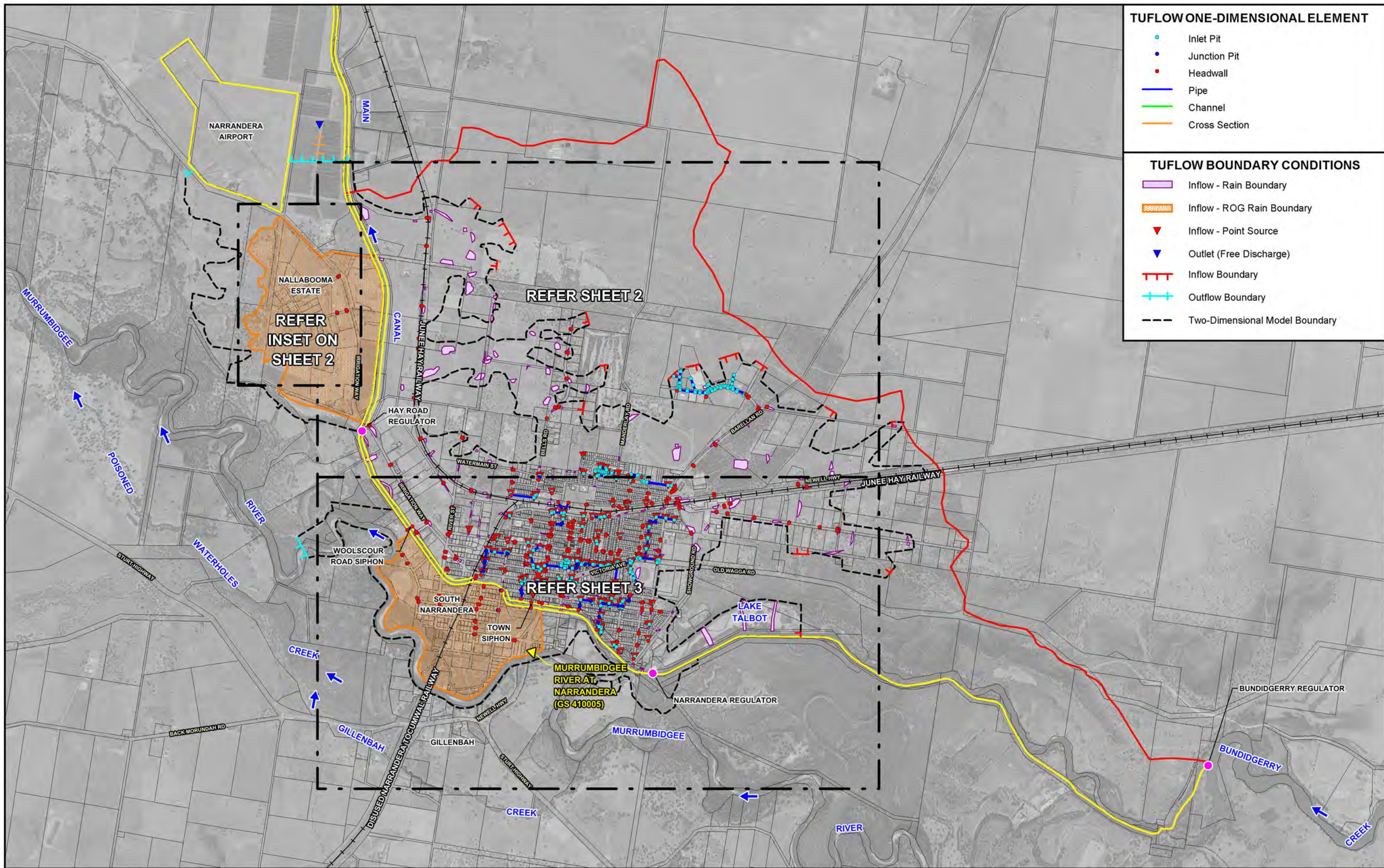


LEGEND	
	Local Catchment Boundary
	Sub-Catchment Boundary
	ILSAX Sub-Catchments
	RAFTS Sub-Catchments
	Rain Boundary
	Existing Canal Embankment / Levee
	Modelled Stormwater Network
	Local Catchment TUFLOW Model Extent
	Local Catchment PMP Ellipses
	WaterNSW Stream Gauge
	Murrumbidgee Irrigation Operated Regulator
	RAFTS Sub-Catchment Link
	Location of Peak Flow Comparison

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

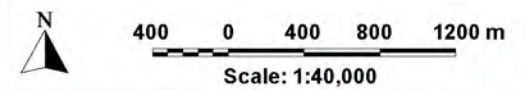


Figure B2.1
LOCAL CATCHMENT HYDROLOGIC MODEL LAYOUT

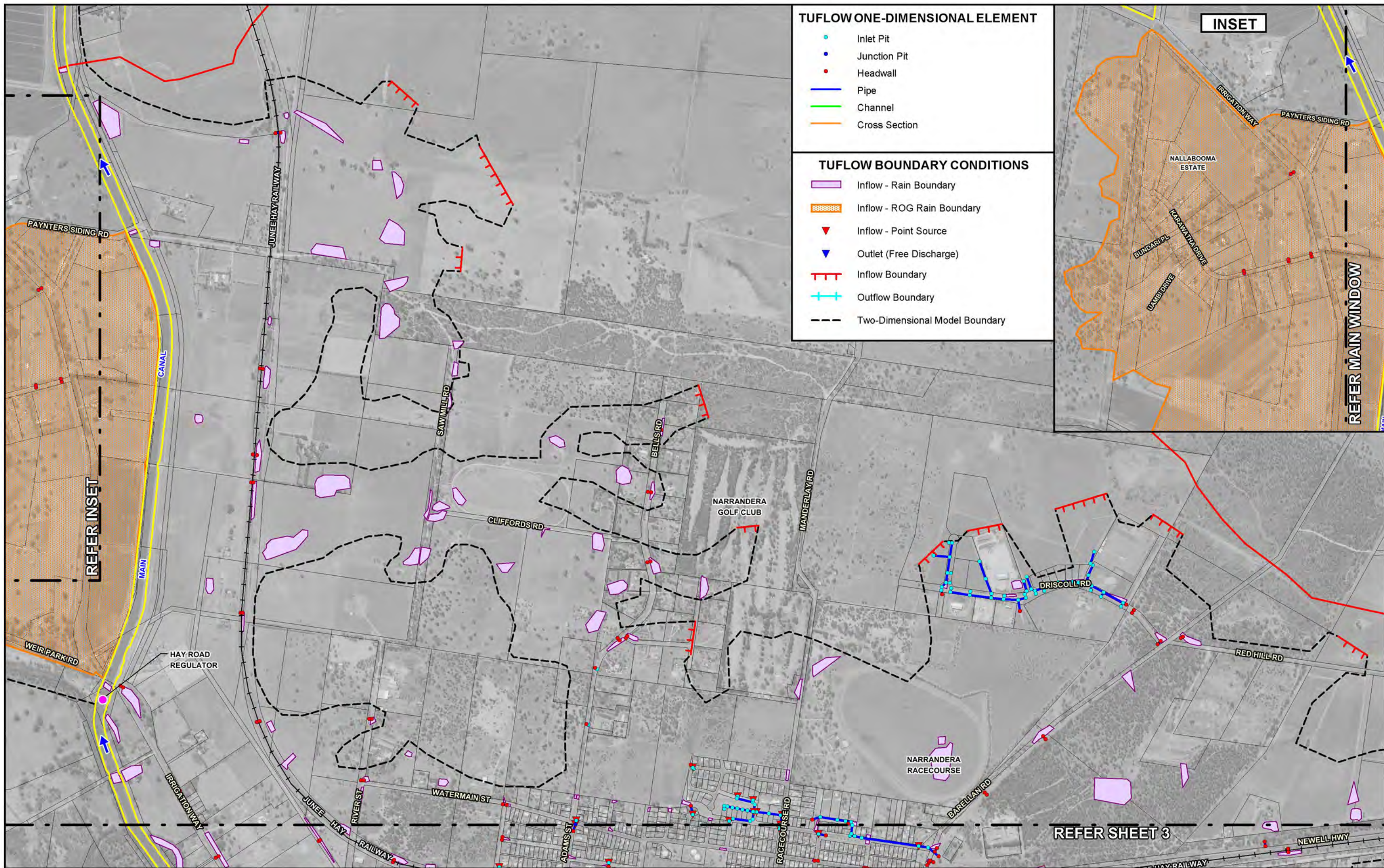


- TUFLOW ONE-DIMENSIONAL ELEMENT**
- Inlet Pit
 - Junction Pit
 - Headwall
 - Pipe
 - Channel
 - Cross Section

- TUFLOW BOUNDARY CONDITIONS**
- Inflow - Rain Boundary
 - Inflow - ROG Rain Boundary
 - ▼ Inflow - Point Source
 - ▼ Outlet (Free Discharge)
 - Inflow Boundary
 - Outflow Boundary
 - Two-Dimensional Model Boundary

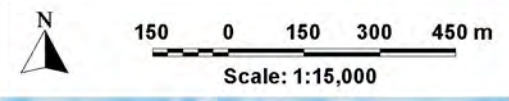
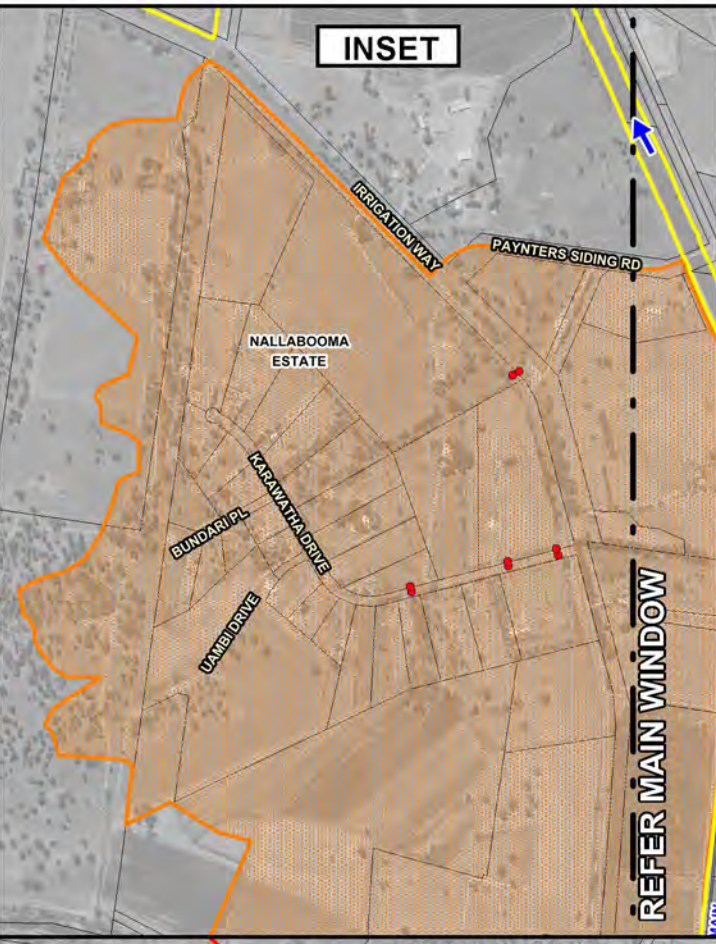


- LEGEND**
- Local Catchment Boundary
 - Existing Canal Embankment / Levee
 - ▼ WaterNSW Stream Gauge
 - Murrumbidgee Irrigation Operated Regulator



- TUFLOW ONE-DIMENSIONAL ELEMENT**
- Inlet Pit
 - Junction Pit
 - Headwall
 - Pipe
 - Channel
 - Cross Section

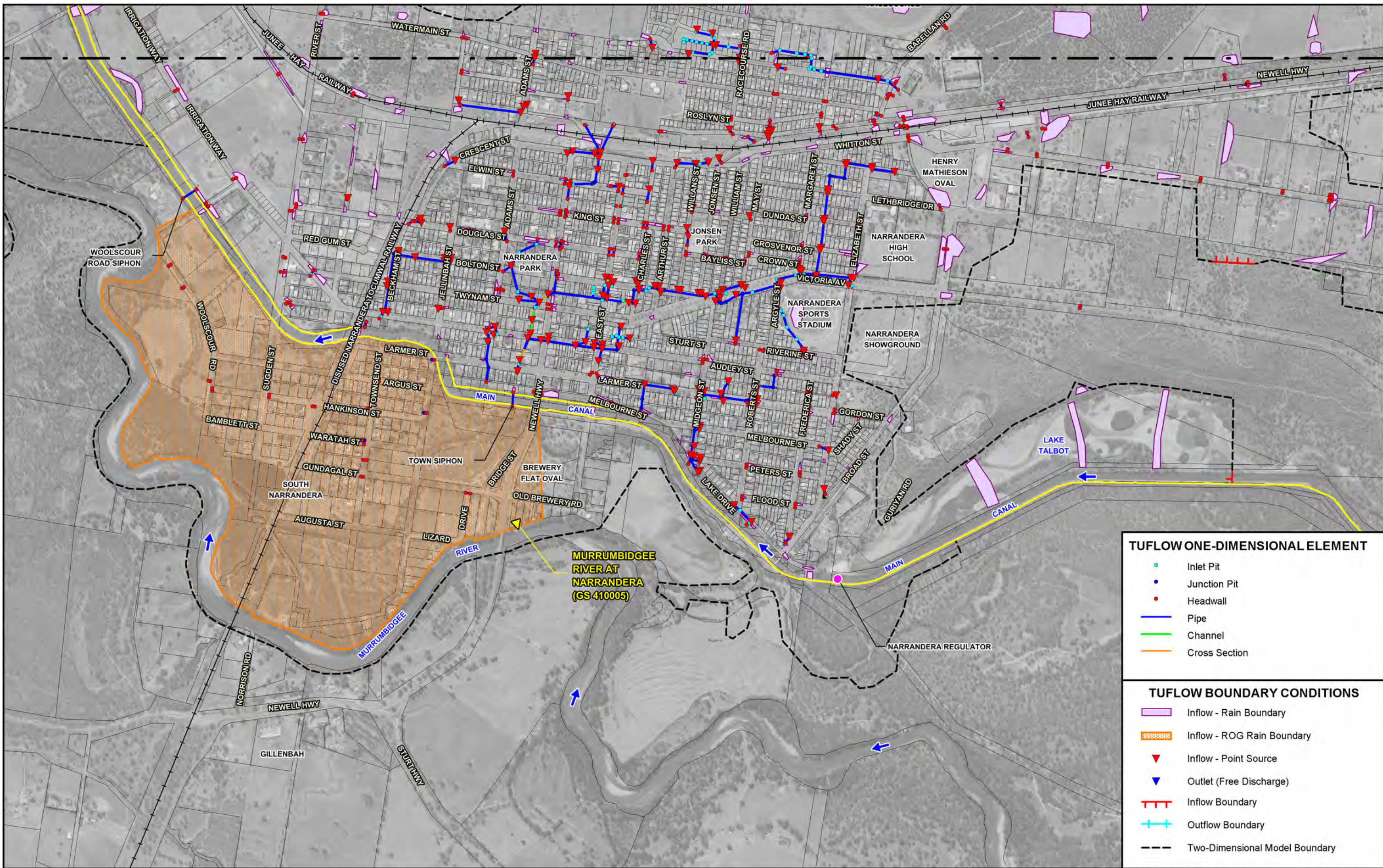
- TUFLOW BOUNDARY CONDITIONS**
- Inflow - Rain Boundary
 - Inflow - ROG Rain Boundary
 - ▼ Inflow - Point Source
 - ▼ Outlet (Free Discharge)
 - ┌┐┌ Inflow Boundary
 - └└└ Outflow Boundary
 - Two-Dimensional Model Boundary



- LEGEND**
- Local Catchment Boundary
 - Existing Canal Embankment / Levee
 - Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.1
(Sheet 2 of 3)

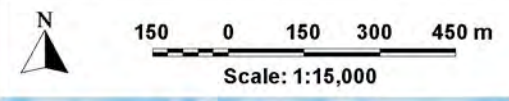


TUFLOW ONE-DIMENSIONAL ELEMENT

- Inlet Pit
- Junction Pit
- Headwall
- Pipe
- Channel
- Cross Section

TUFLOW BOUNDARY CONDITIONS

- Inflow - Rain Boundary
- Inflow - ROG Rain Boundary
- ▼ Inflow - Point Source
- ▼ Outlet (Free Discharge)
- Inflow Boundary
- Outflow Boundary
- Two-Dimensional Model Boundary

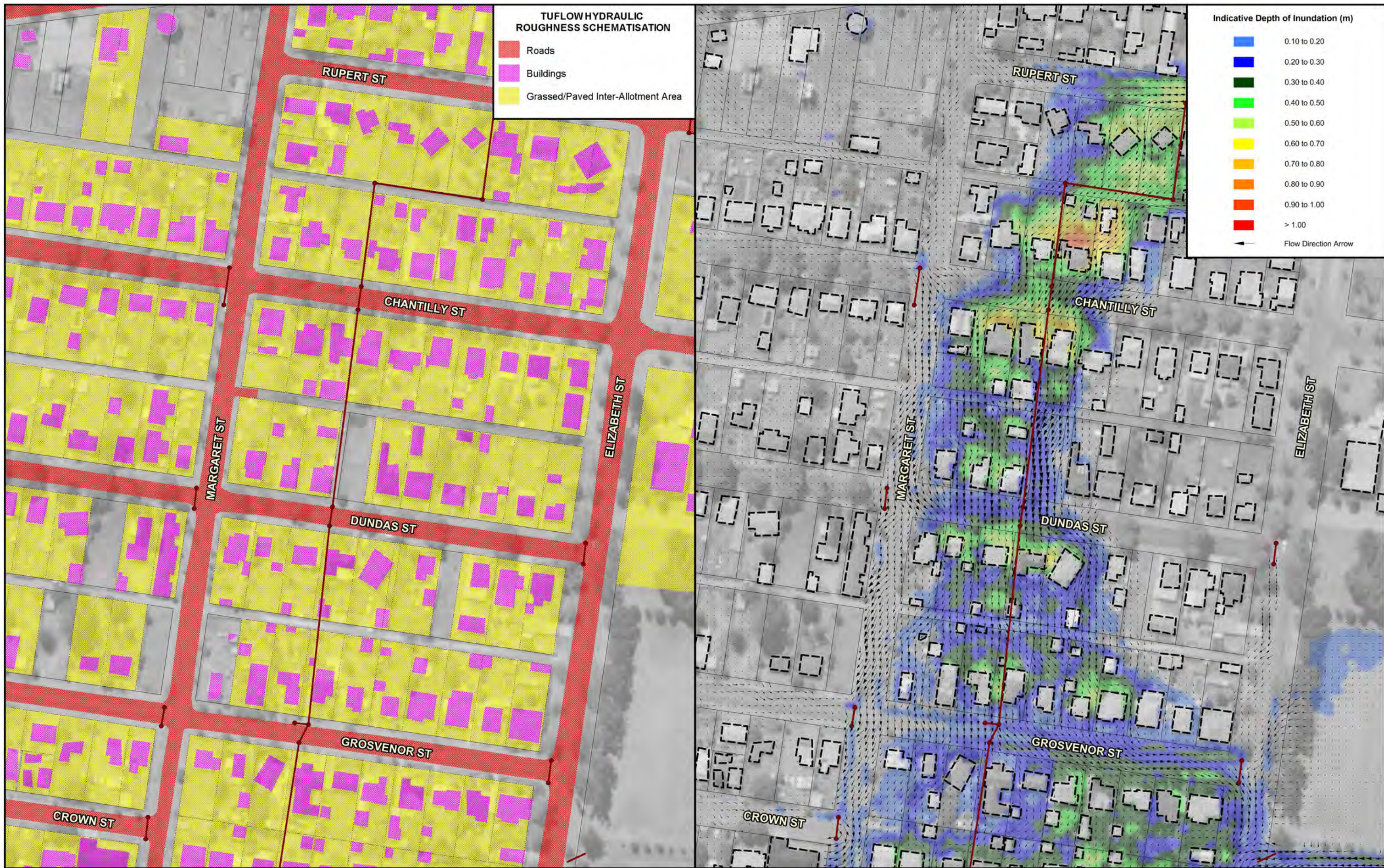


LEGEND

- Local Catchment Boundary
- Existing Canal Embankment / Levee
- ▼ WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.1
(Sheet 3 of 3)



TUFLOW HYDRAULIC ROUGHNESS SCHEMATISATION

- Roads
- Buildings
- Grassed/Paved Inter-Allotment Area

Indicative Depth of Inundation (m)

- 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

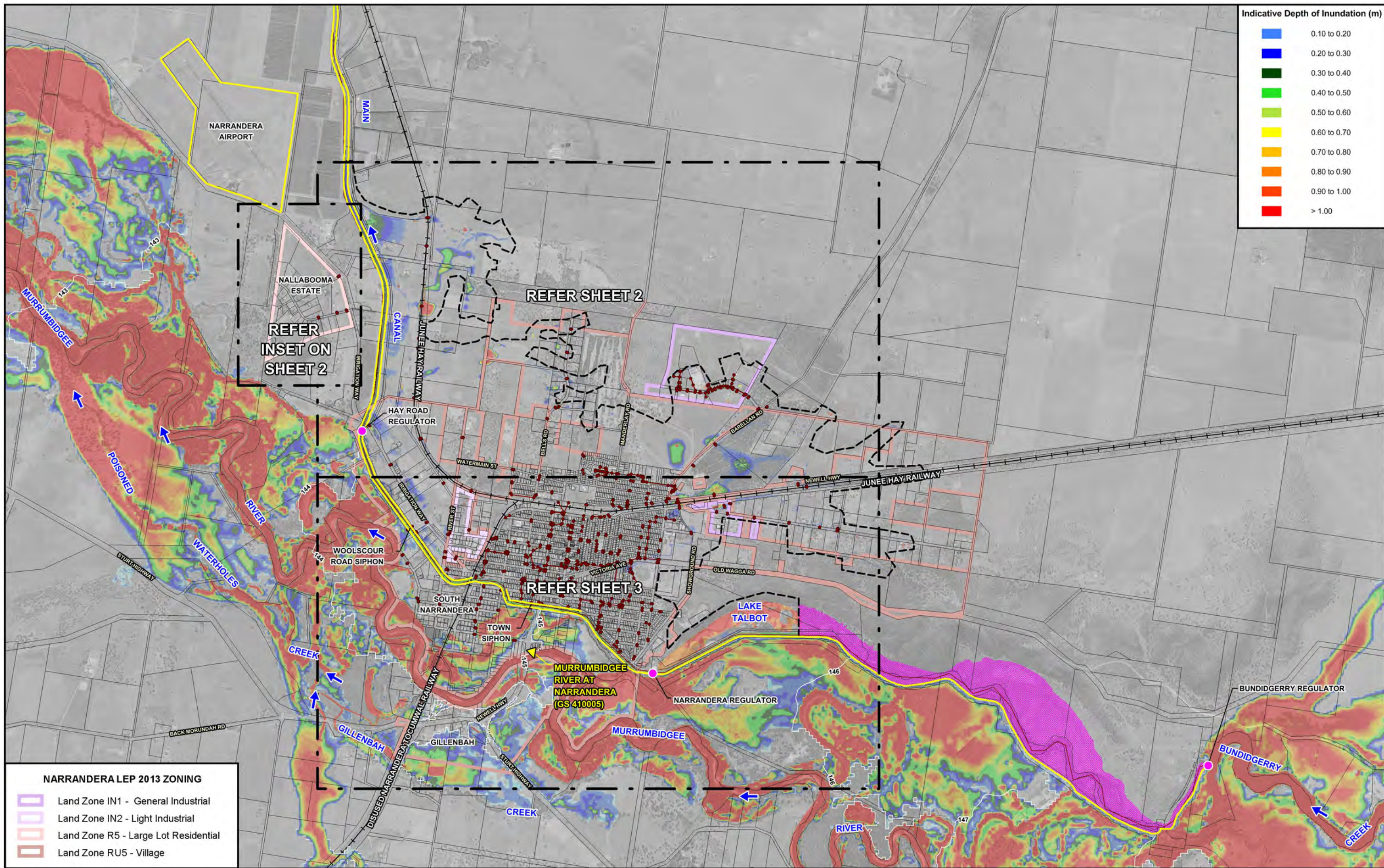
N
 20 0 20 40 60 m
 Scale: 1:2,000

LEGEND

- Modelled Stormwater Network
- - - Building Outlines

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.2

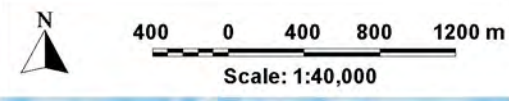


Indicative Depth of Inundation (m)

Blue	0.10 to 0.20
Dark Blue	0.20 to 0.30
Green	0.30 to 0.40
Light Green	0.40 to 0.50
Yellow-Green	0.50 to 0.60
Yellow	0.60 to 0.70
Orange	0.70 to 0.80
Red-Orange	0.80 to 0.90
Red	0.90 to 1.00
Dark Red	> 1.00

NARRANDERA LEP 2013 ZONING

Blue outline	Land Zone IN1 - General Industrial
Purple outline	Land Zone IN2 - Light Industrial
Light Red outline	Land Zone R5 - Large Lot Residential
Dark Red outline	Land Zone RU5 - Village

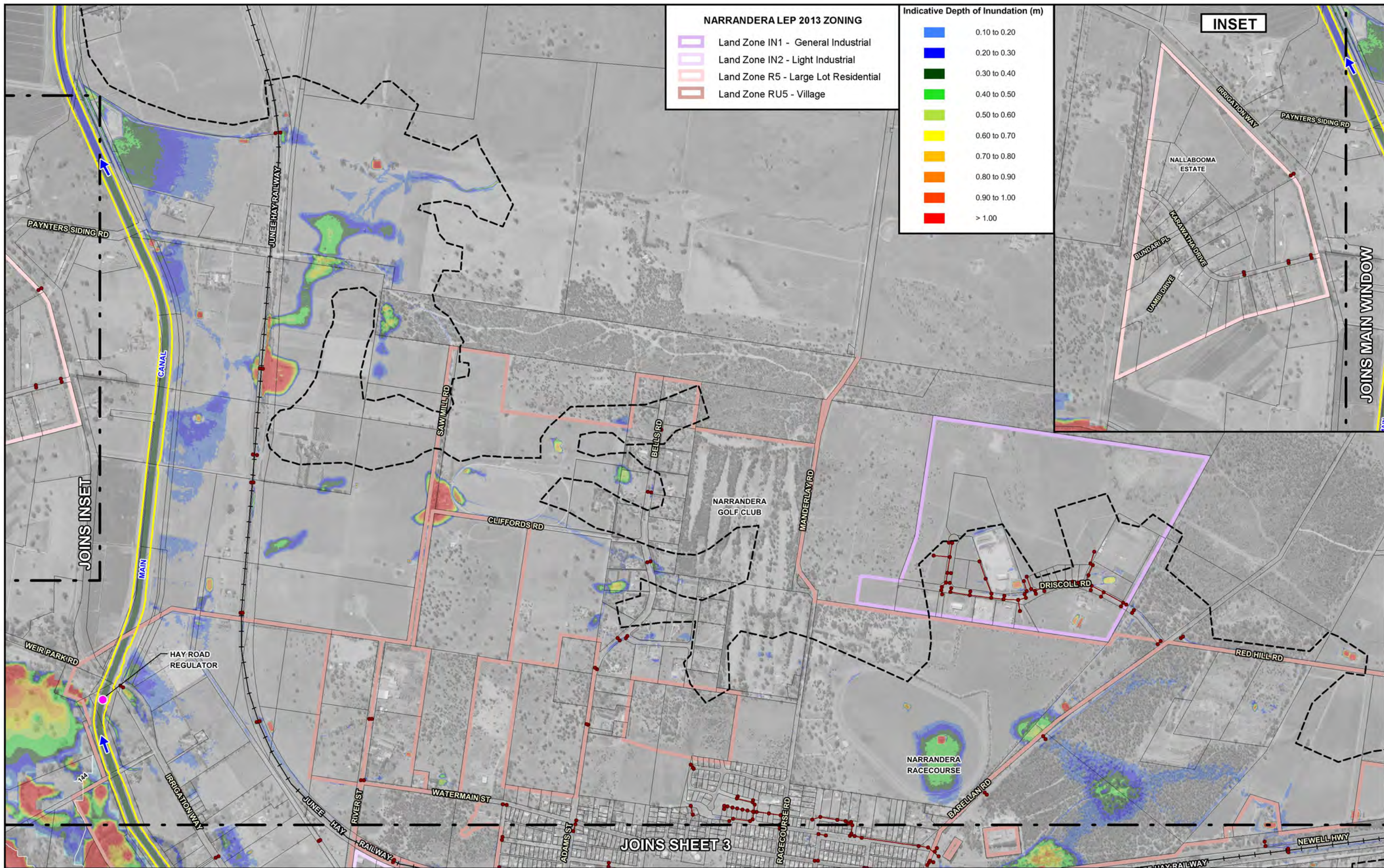


NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

Red line with dots	Modelled Stormwater Network	Yellow triangle	WaterNSW Stream Gauge
Yellow line	Existing Canal Embankment / Levee	Pink dot	Murrumbidgee Irrigation Operated Regulator
Black line with cross-ticks	Railway	Red line with number	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Dashed black line	Limit of Overland Flow Mapping	Pink shaded area	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
Figure B3.3 (Sheet 1 of 3)
TUFLOW MODEL RESULTS
20% AEP

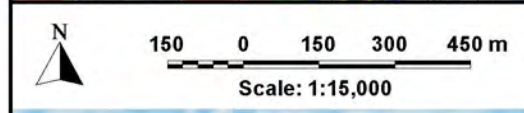


NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

Indicative Depth of Inundation (m)

	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



NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

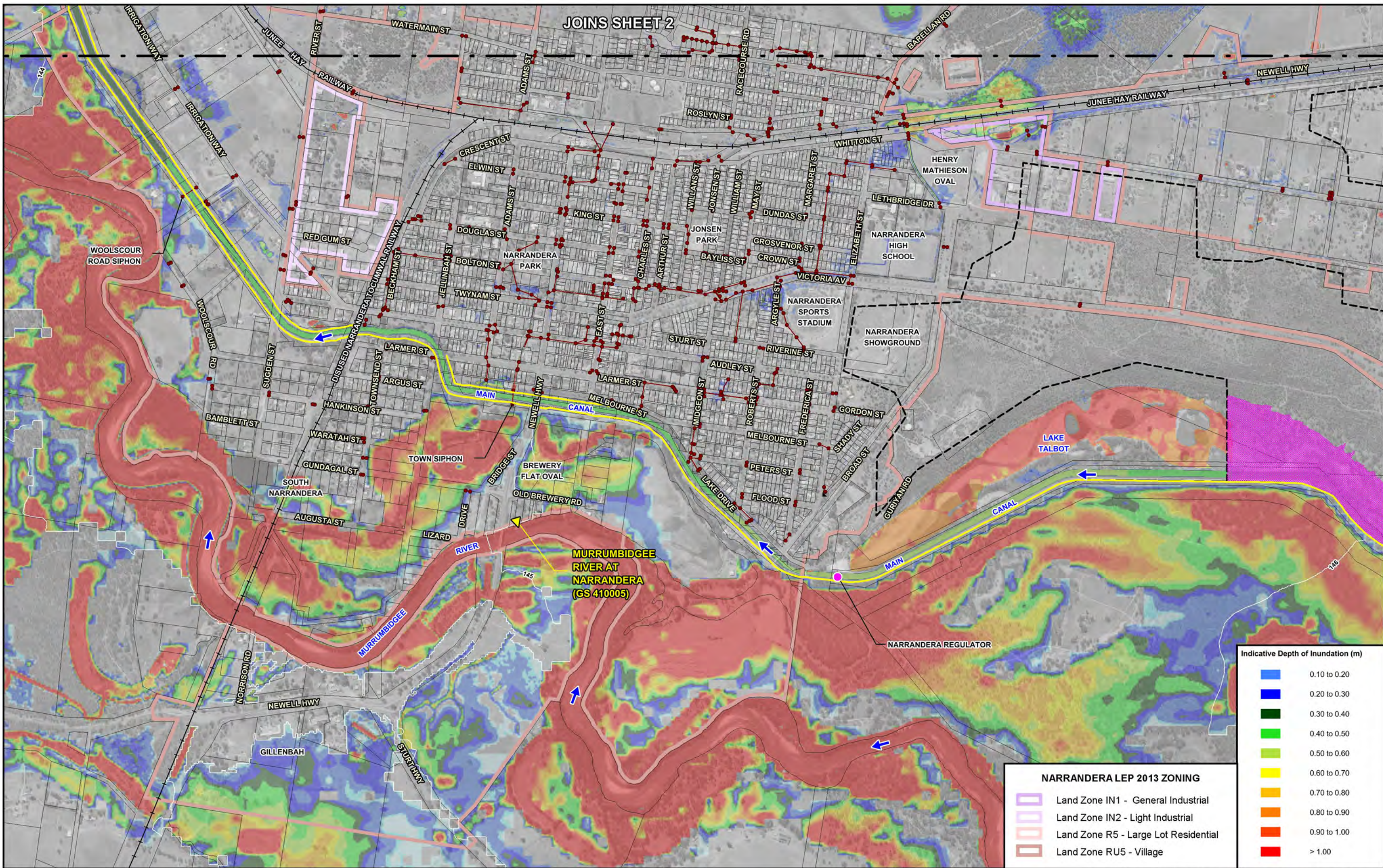
LEGEND

	Modelled Stormwater Network		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Railway		
	Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.3 (Sheet 2 of 3)

TUFLOW MODEL RESULTS 20% AEP

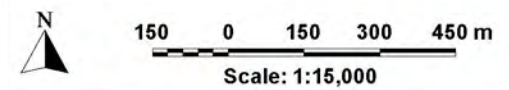


JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

Indicative Depth of Inundation (m)	
Light Blue	0.10 to 0.20
Blue	0.20 to 0.30
Dark Blue	0.30 to 0.40
Green	0.40 to 0.50
Light Green	0.50 to 0.60
Yellow	0.60 to 0.70
Orange	0.70 to 0.80
Red-Orange	0.80 to 0.90
Red	0.90 to 1.00
Dark Red	> 1.00

NARRANDERA LEP 2013 ZONING	
Purple outline	Land Zone IN1 - General Industrial
Pink outline	Land Zone IN2 - Light Industrial
Light Red outline	Land Zone R5 - Large Lot Residential
Red outline	Land Zone RU5 - Village



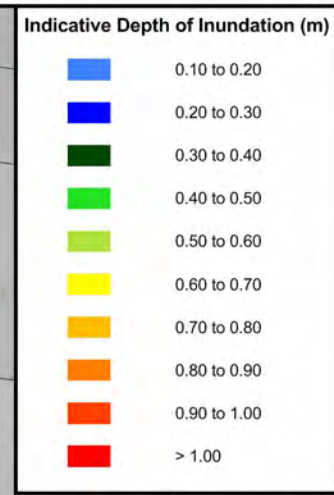
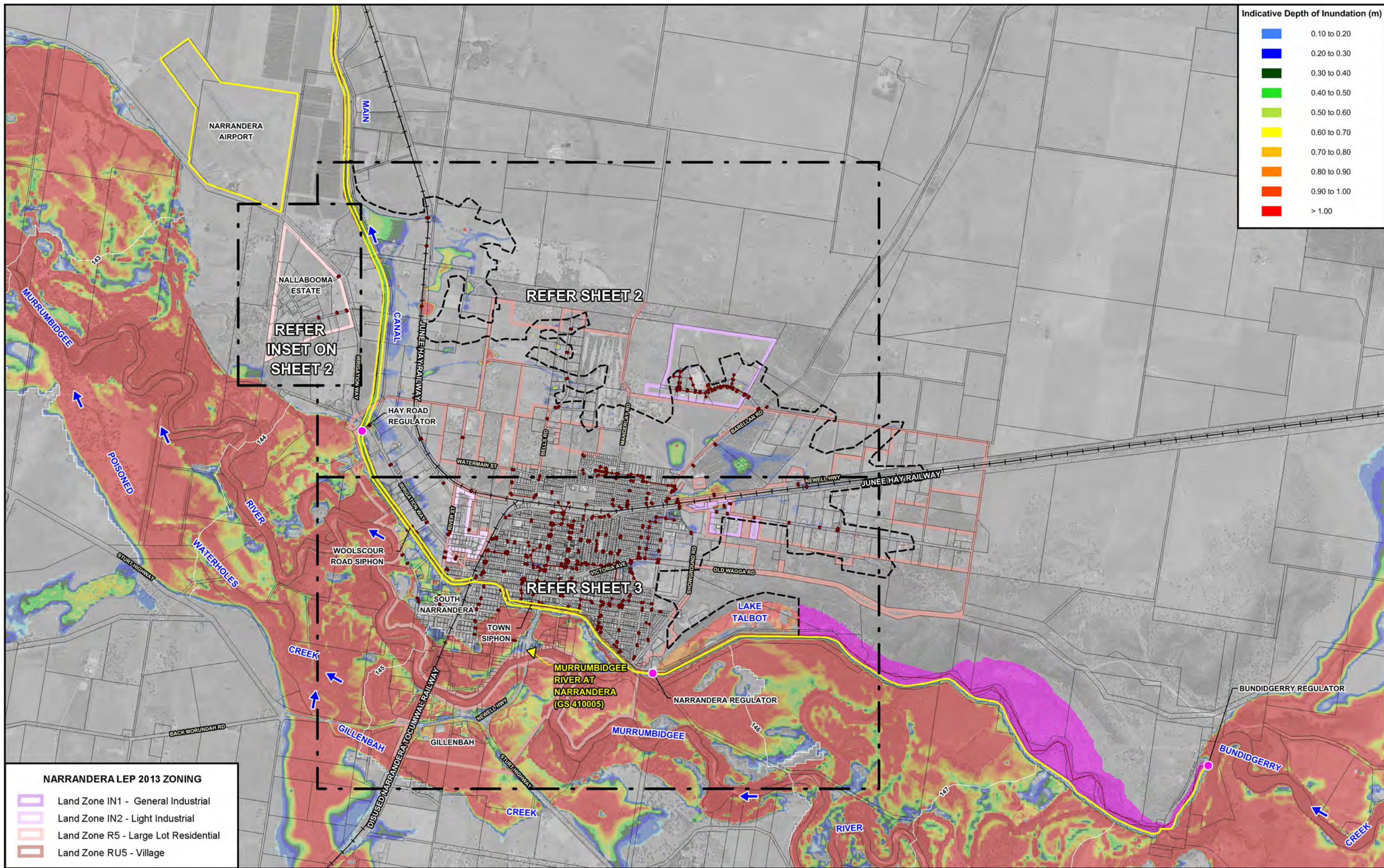
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND	
Red line with dots	Modelled Stormwater Network
Yellow line with dots	Existing Canal Embankment / Levee
Black line with cross-ticks	Railway
Dashed black line	Limit of Overland Flow Mapping
Yellow triangle	WaterNSW Stream Gauge
Pink circle	Murrumbidgee Irrigation Operated Regulator
Red line with '147'	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Purple area	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

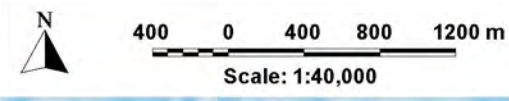
Figure B3.3 (Sheet 3 of 3)

TUFLOW MODEL RESULTS
20% AEP



NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

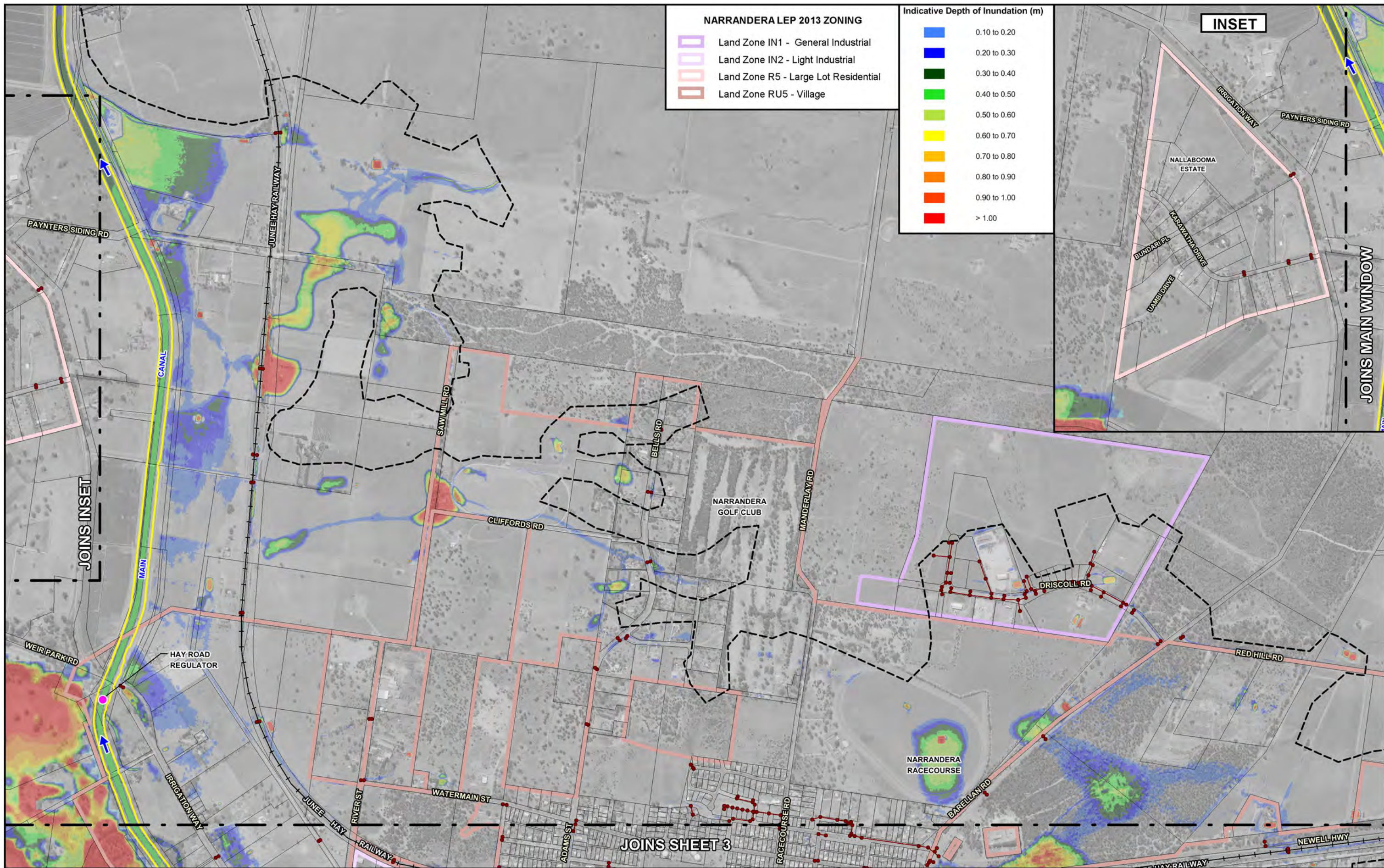


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

	Modelled Stormwater Network		WaterNSW Stream Gauge
	Existing Canal Embankment / Levee		Murrumbidgee Irrigation Operated Regulator
	Railway		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Limit of Overland Flow Mapping		Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure B3.4 (Sheet 1 of 3)
 TUFLOW MODEL RESULTS
 10% AEP

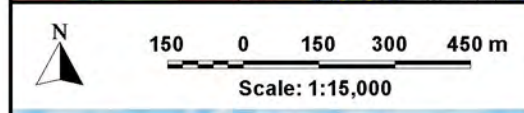


NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

Indicative Depth of Inundation (m)

	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

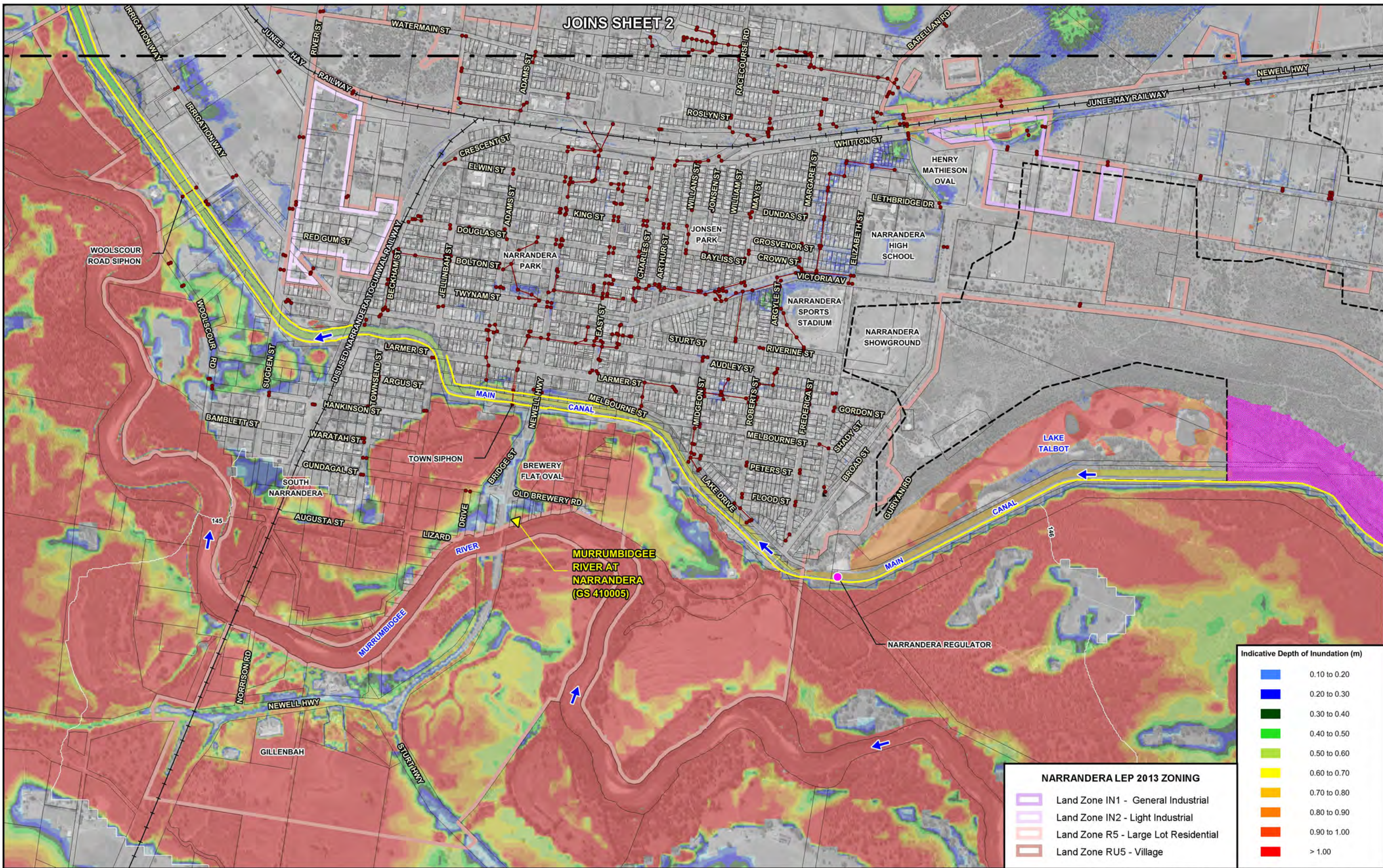


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

	Modelled Stormwater Network		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Railway		
	Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN



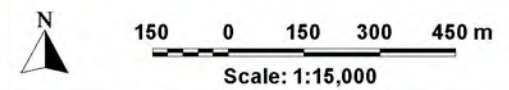
JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

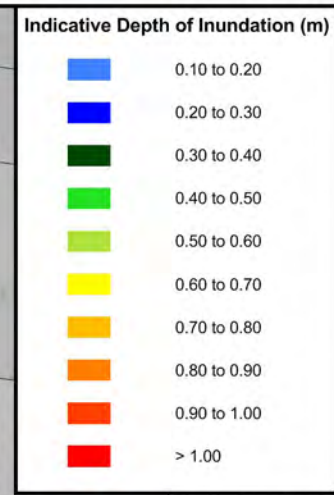
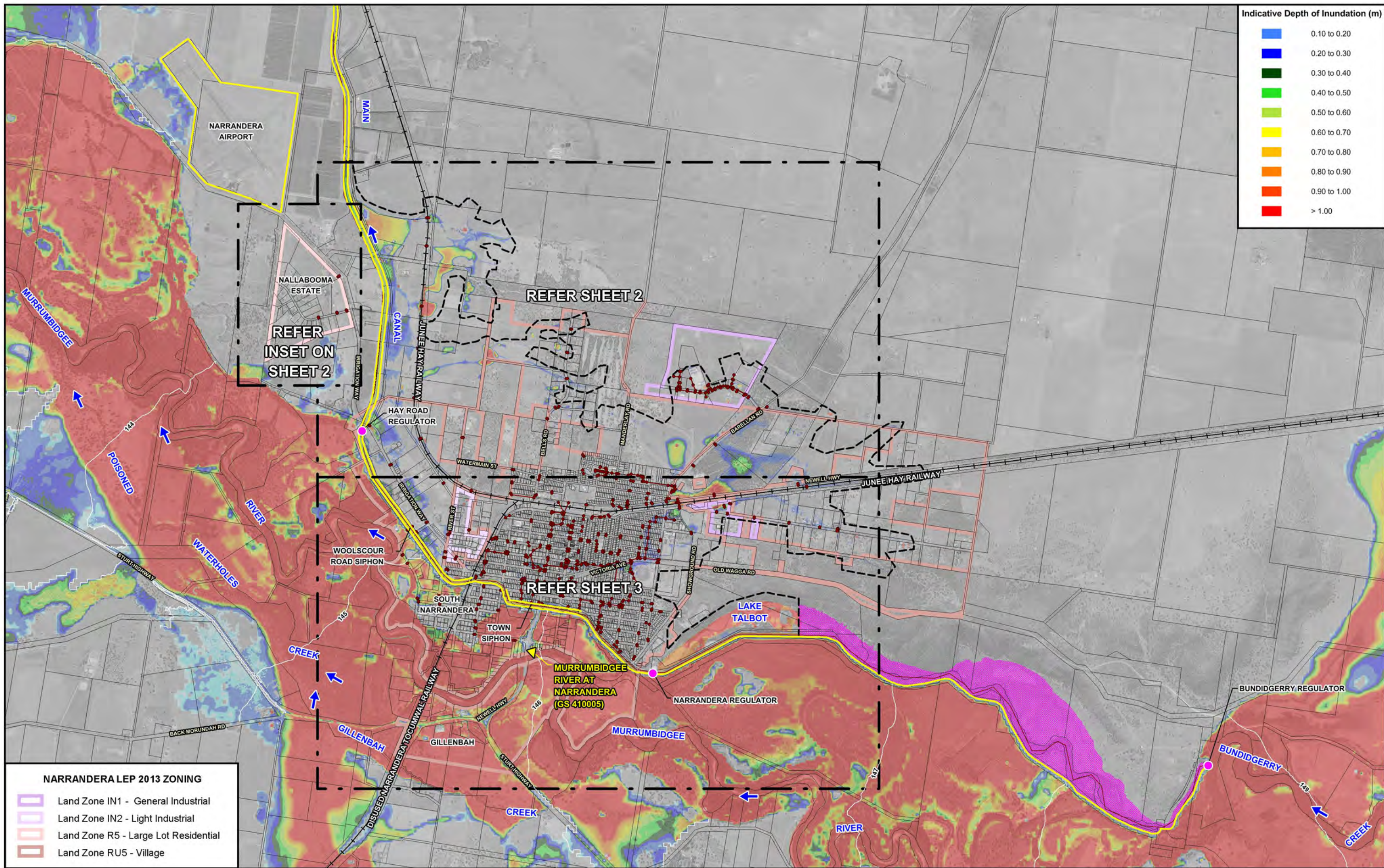
Figure B3.4 (Sheet 3 of 3)

TUFLOW MODEL RESULTS 10% AEP



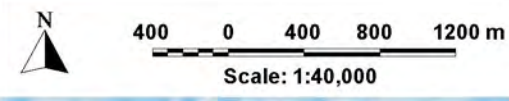
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

Lyal & Associates



NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

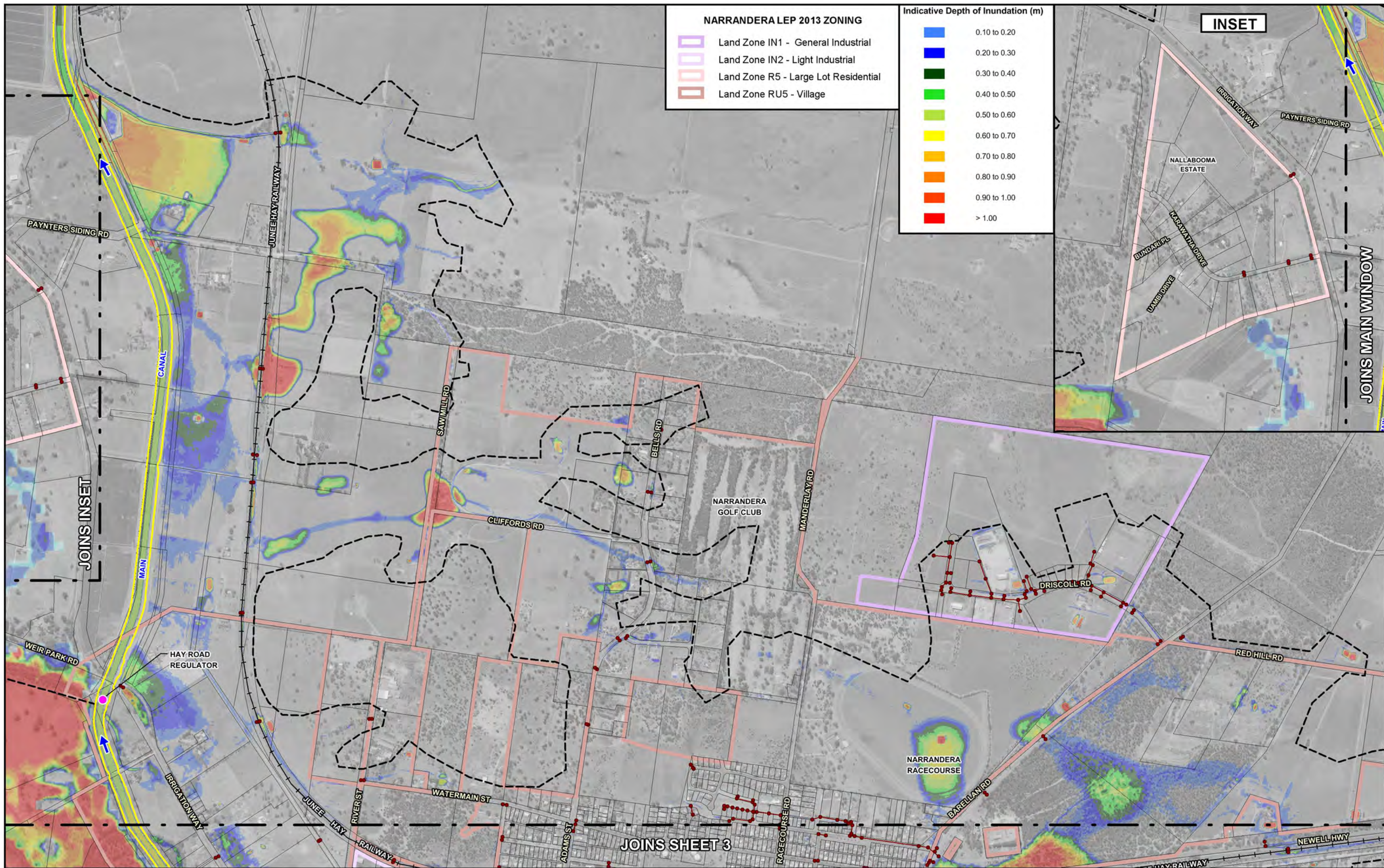


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

	Modelled Stormwater Network		WaterNSW Stream Gauge
	Existing Canal Embankment / Levee		Murrumbidgee Irrigation Operated Regulator
	Railway		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Limit of Overland Flow Mapping		Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure B3.5 (Sheet 1 of 3)
 TUFLOW MODEL RESULTS
 5% AEP

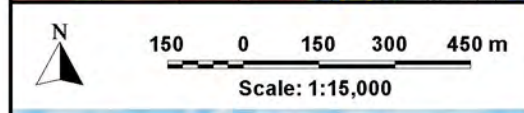


NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

Indicative Depth of Inundation (m)

	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

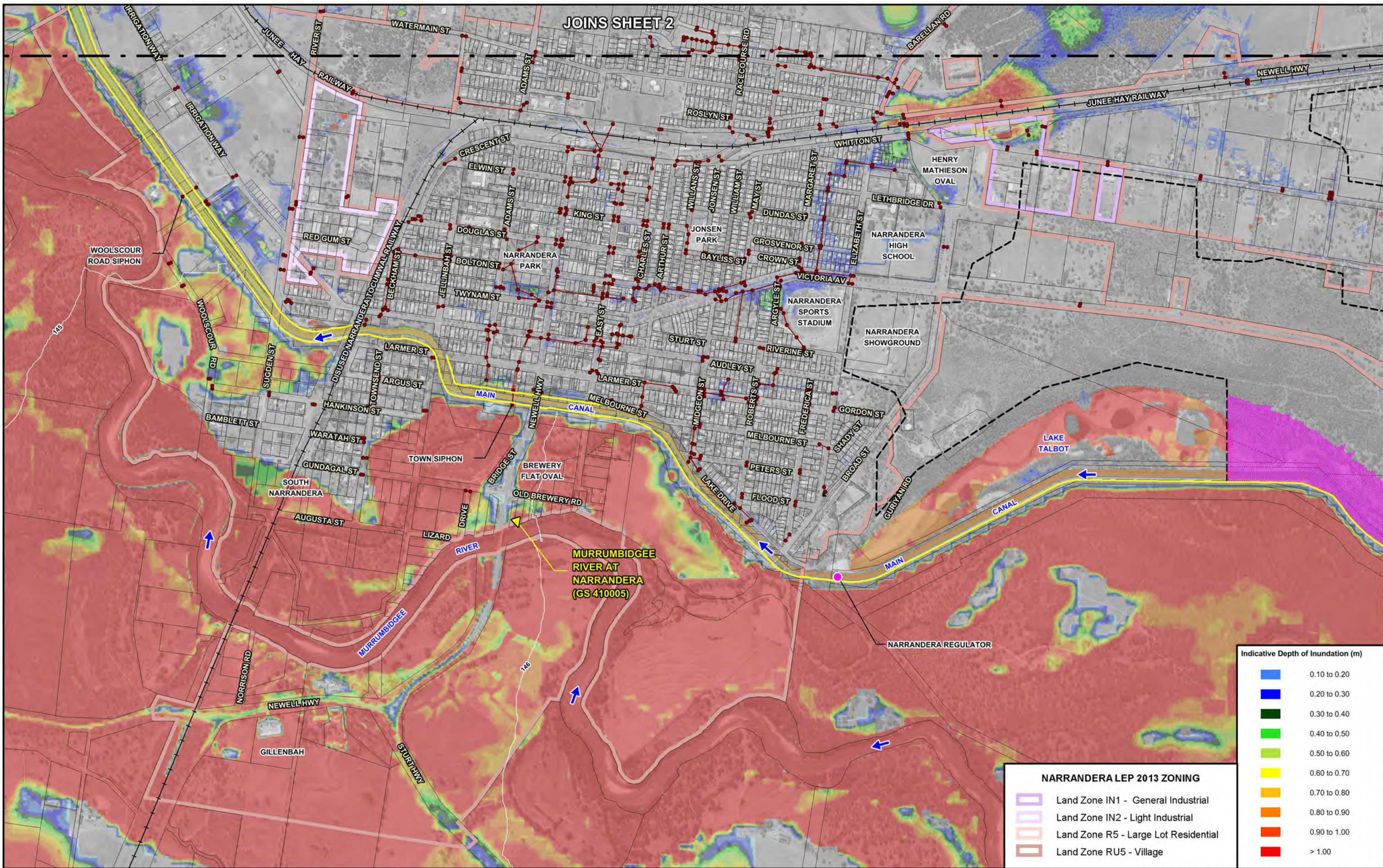


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

	Modelled Stormwater Network		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Railway		
	Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN



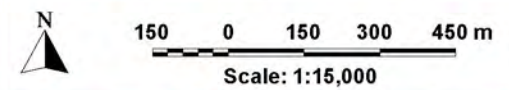
JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.5 (Sheet 3 of 3)

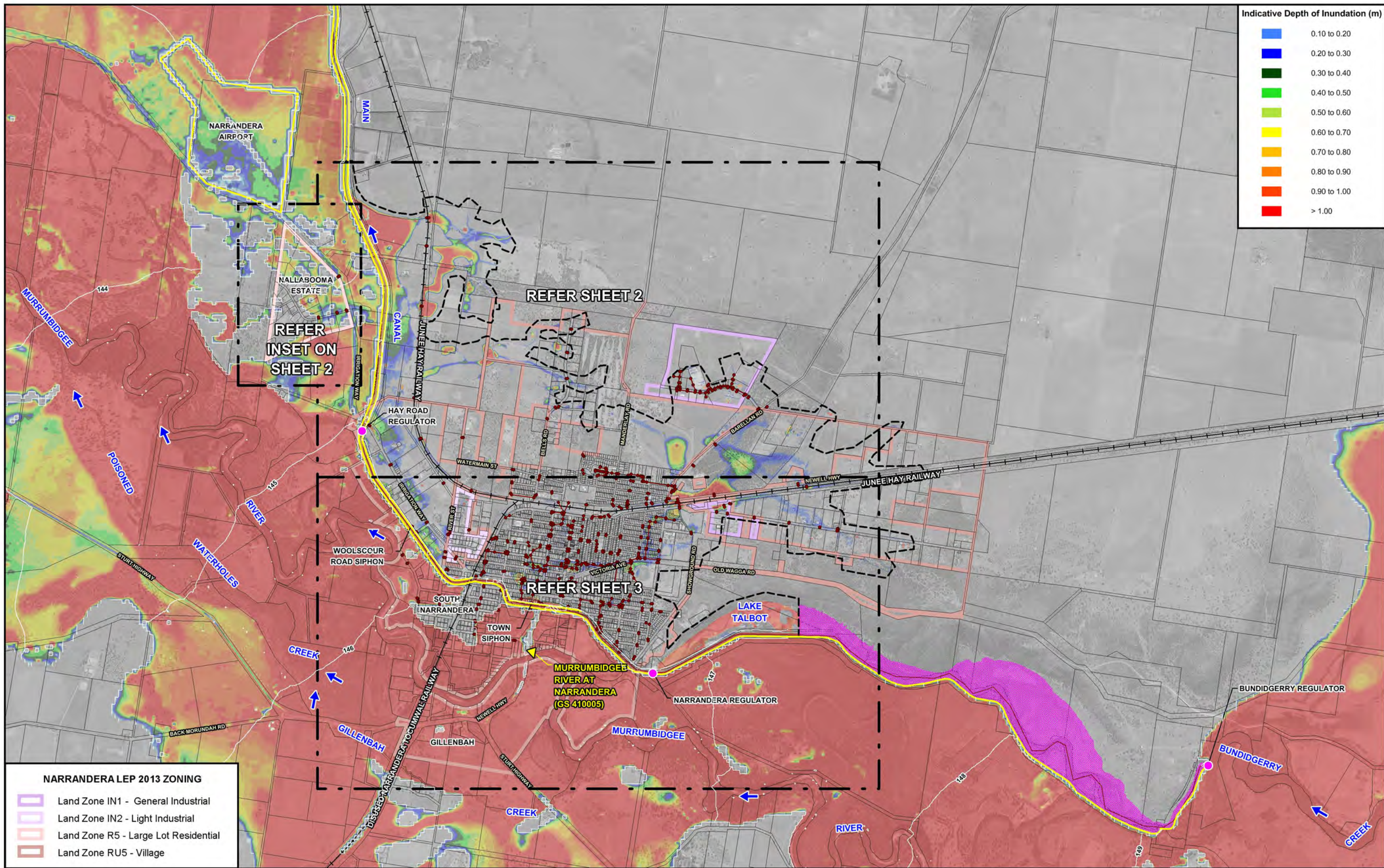
TUFLOW MODEL RESULTS 5% AEP



NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

- LEGEND**
- Modelled Stormwater Network
 - Existing Canal Embankment / Levee
 - Railway
 - Limit of Overland Flow Mapping
 - WaterNSW Stream Gauge
 - Murrumbidgee Irrigation Operated Regulator
 - Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
 - Flood Behaviour Not Defined Over This Area

Lyall & Associates

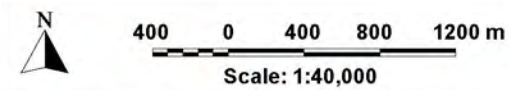


Indicative Depth of Inundation (m)

Blue	0.10 to 0.20
Dark Blue	0.20 to 0.30
Green	0.30 to 0.40
Light Green	0.40 to 0.50
Yellow-Green	0.50 to 0.60
Yellow	0.60 to 0.70
Orange	0.70 to 0.80
Red-Orange	0.80 to 0.90
Red	0.90 to 1.00
Dark Red	> 1.00

NARRANDERA LEP 2013 ZONING

Blue outline	Land Zone IN1 - General Industrial
Purple outline	Land Zone IN2 - Light Industrial
Orange outline	Land Zone R5 - Large Lot Residential
Red outline	Land Zone RU5 - Village

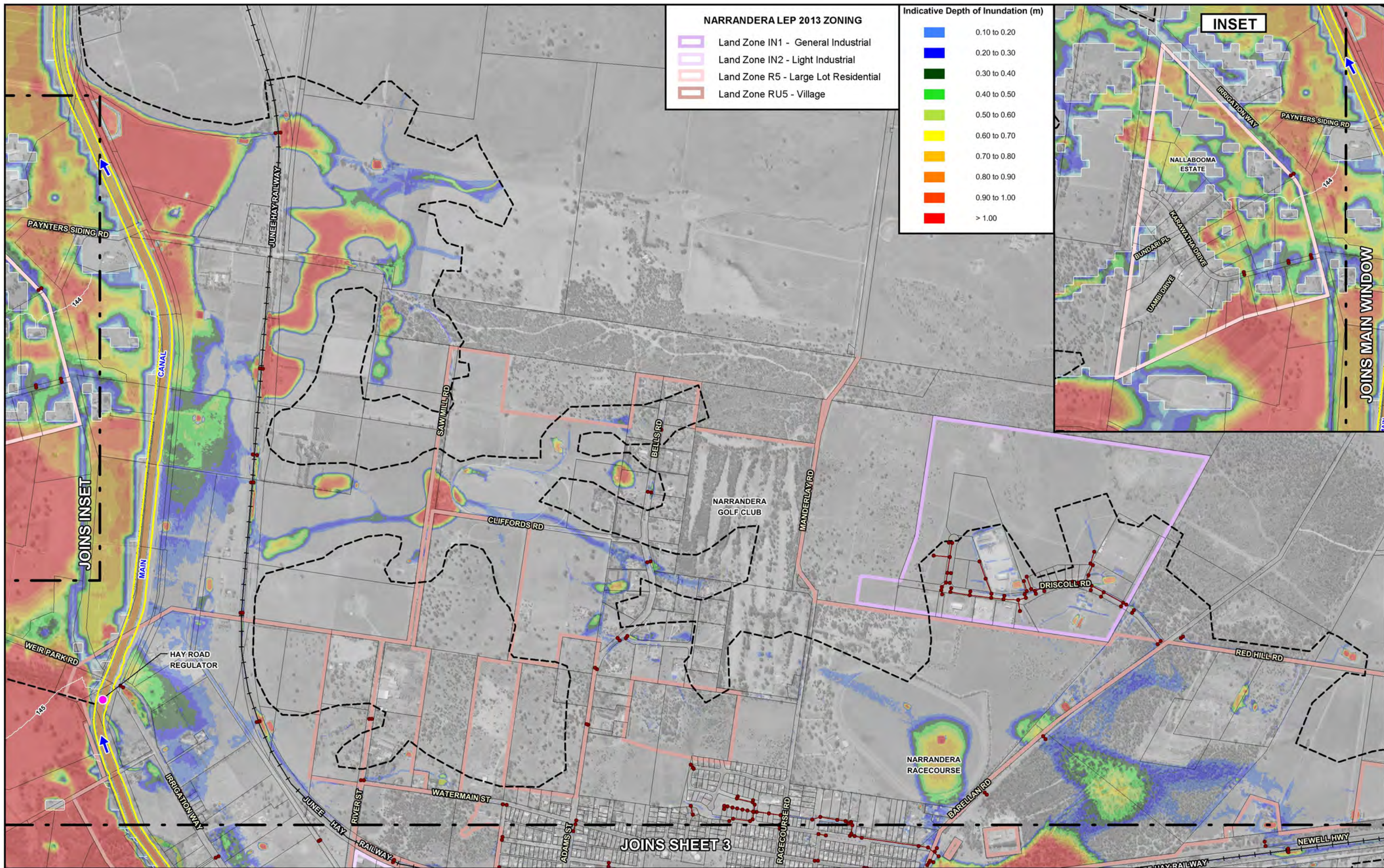


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

Red line with dots	Modelled Stormwater Network	Yellow triangle	WaterNSW Stream Gauge
Yellow line	Existing Canal Embankment / Levee	Pink dot	Murrumbidgee Irrigation Operated Regulator
Black line with cross-ticks	Railway	Red line with '148'	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Dashed black line	Limit of Overland Flow Mapping	Pink shaded area	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure B3.6 (Sheet 1 of 3)
 TUFLOW MODEL RESULTS
 1% AEP

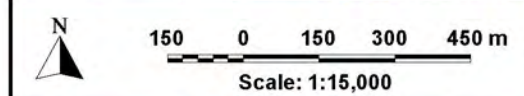
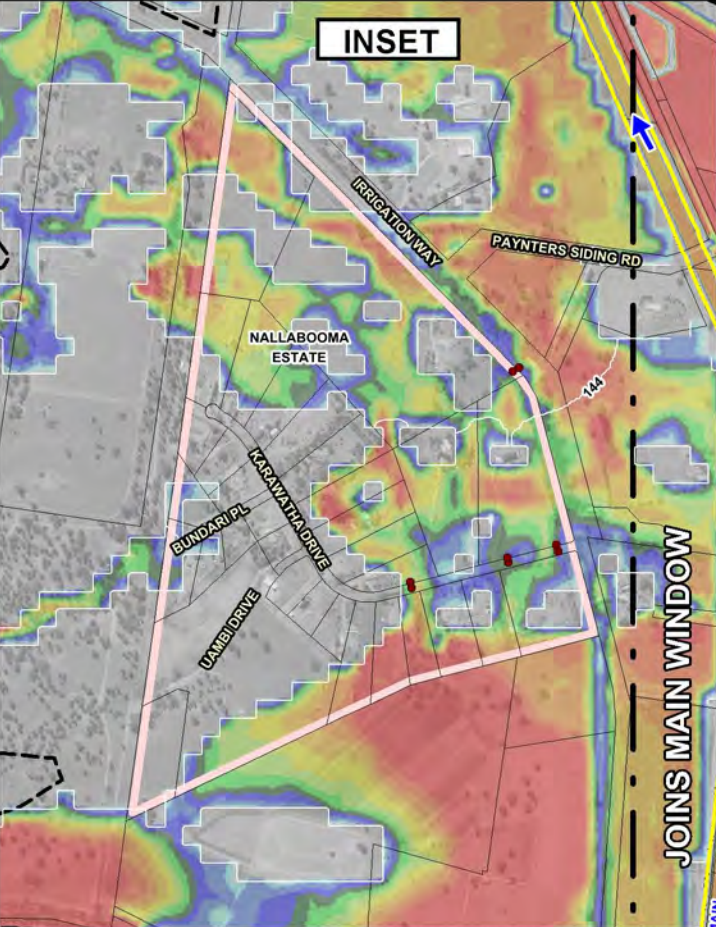


NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

Indicative Depth of Inundation (m)

	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



NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

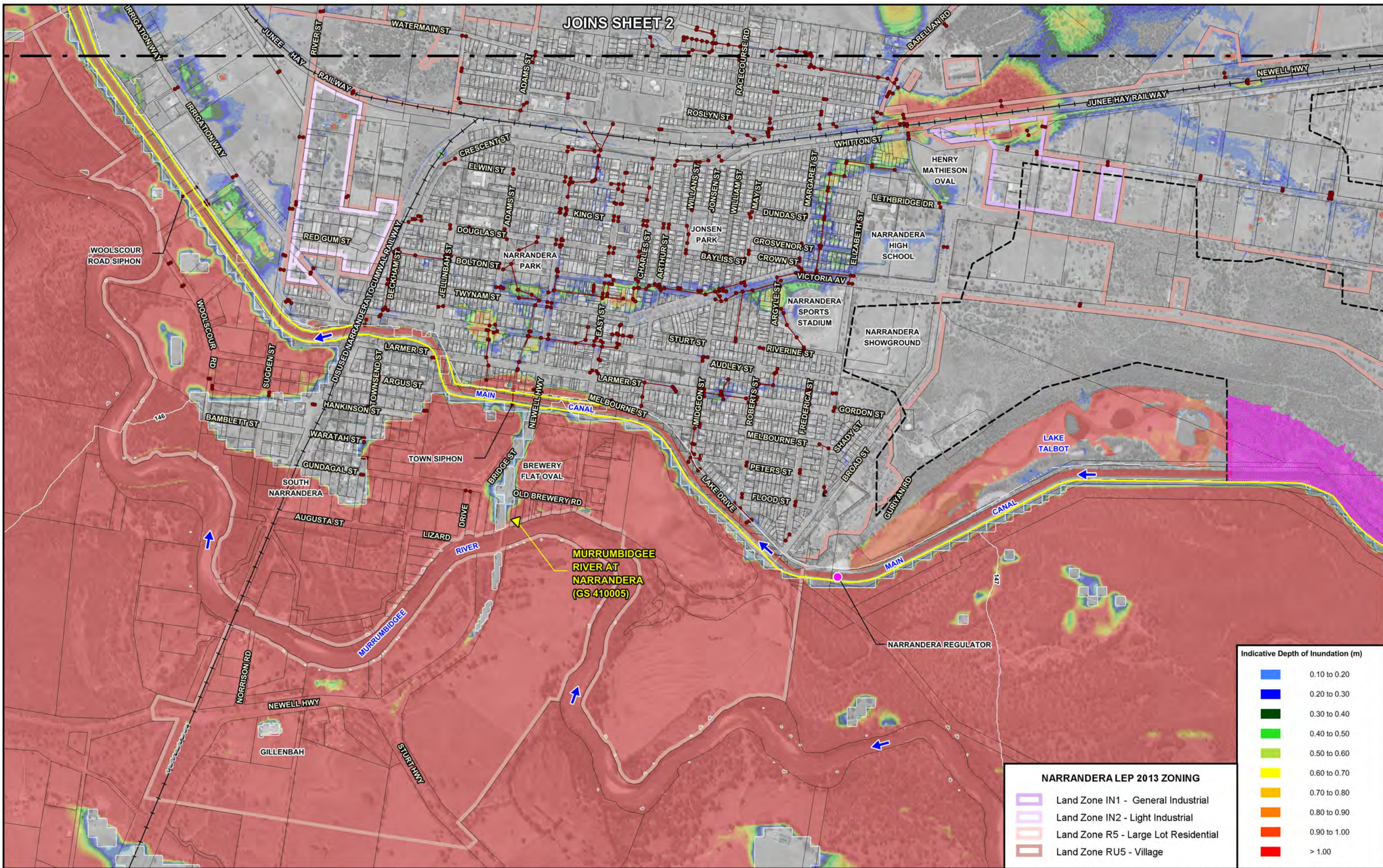
LEGEND

	Modelled Stormwater Network		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Railway		
	Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.6 (Sheet 2 of 3)

TUFLOW MODEL RESULTS 1% AEP

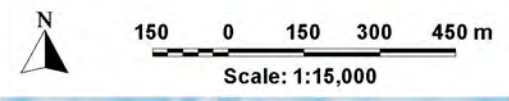


JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

Indicative Depth of Inundation (m)	
■	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

NARRANDERA LEP 2013 ZONING	
	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village



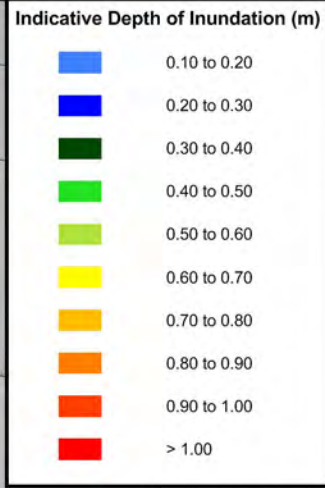
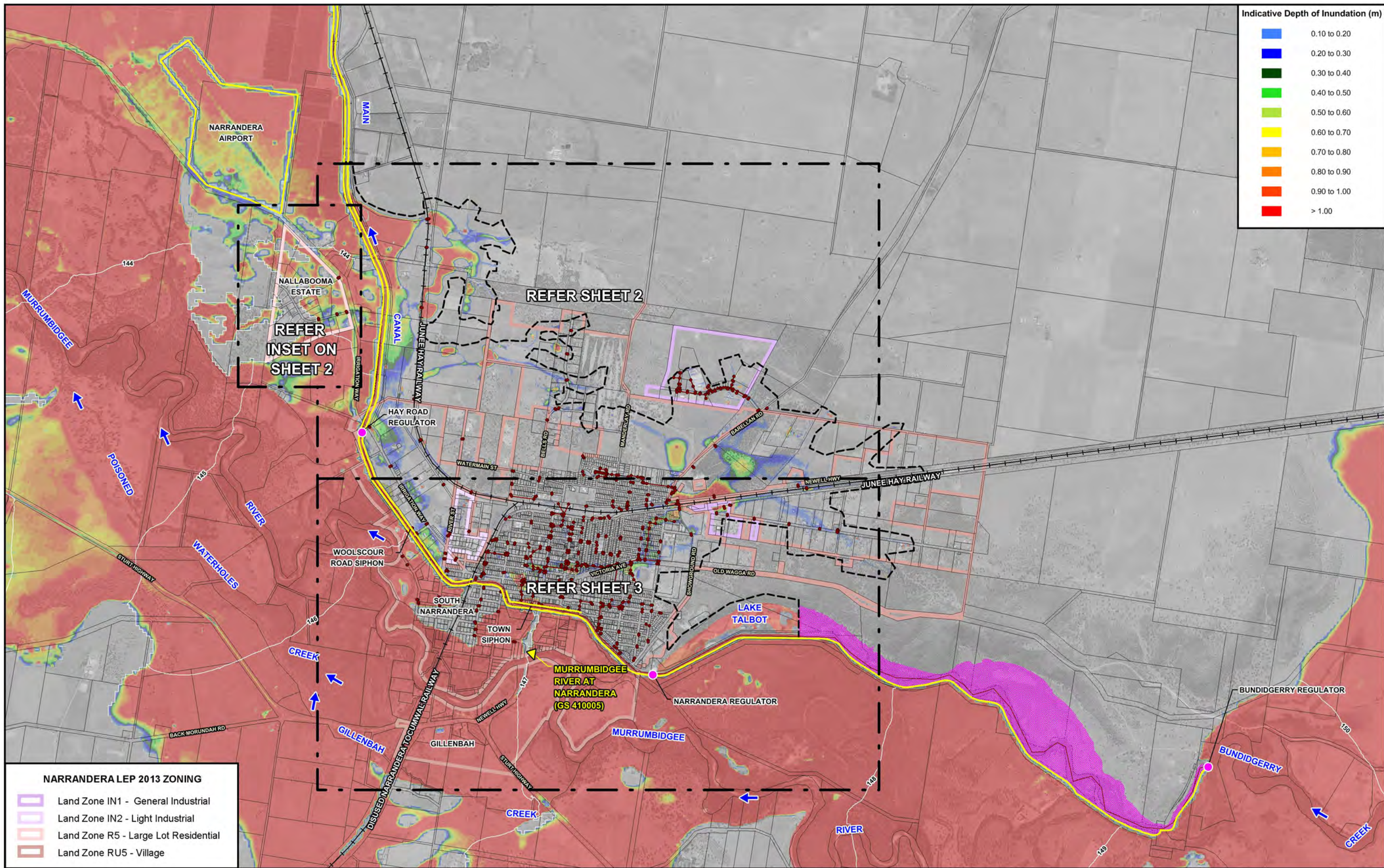
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND	
—●—	Modelled Stormwater Network
	Existing Canal Embankment / Levee
	Railway
	Limit of Overland Flow Mapping
▲	WaterNSW Stream Gauge
●	Murrumbidgee Irrigation Operated Regulator
	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

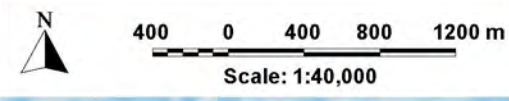
Figure B3.6 (Sheet 3 of 3)

TUFLOW MODEL RESULTS
1% AEP



NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

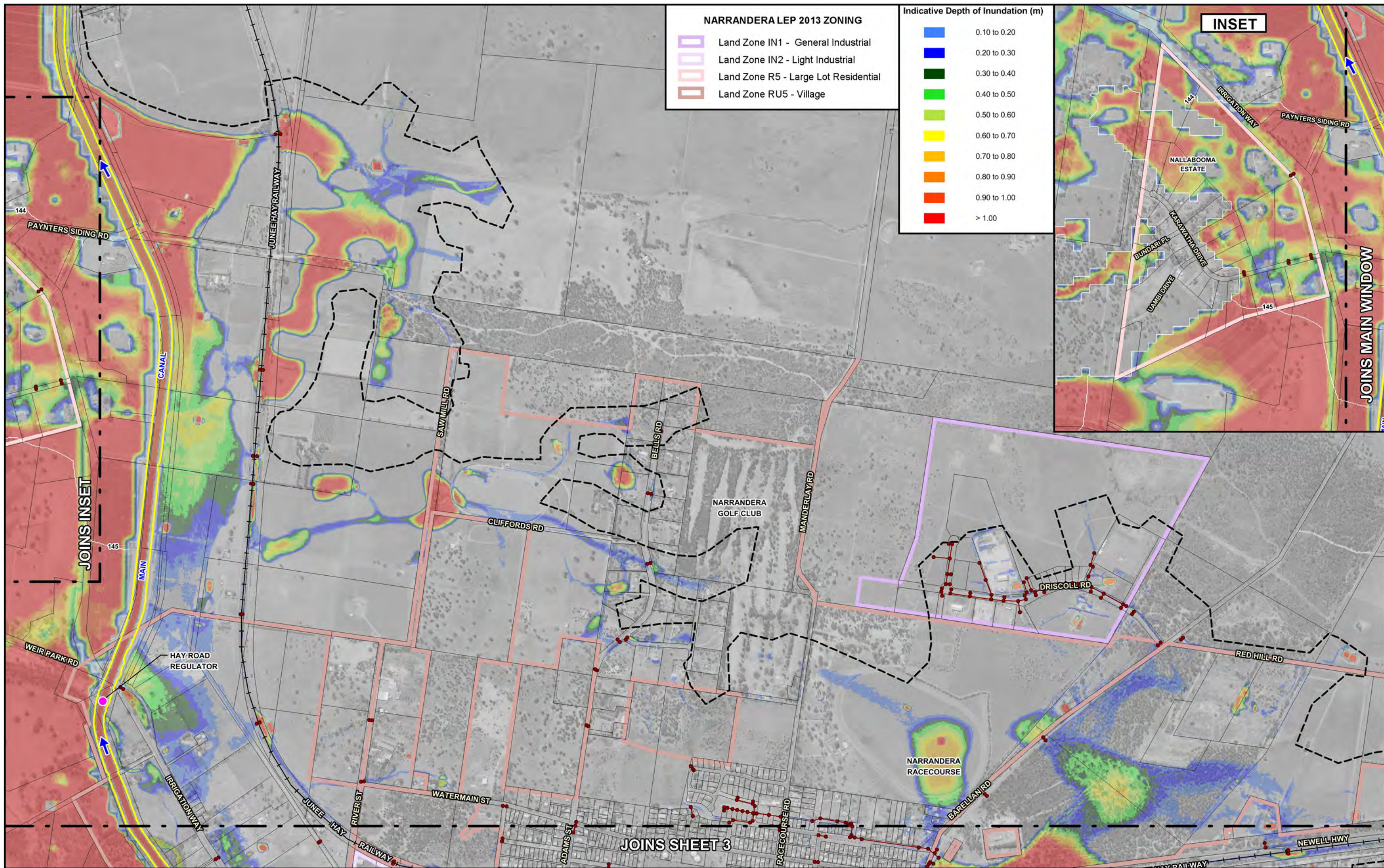


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

	Modelled Stormwater Network		WaterNSW Stream Gauge
	Existing Canal Embankment / Levee		Murrumbidgee Irrigation Operated Regulator
	Railway		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Limit of Overland Flow Mapping		Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure B3.7 (Sheet 1 of 3)
 TUFLOW MODEL RESULTS
 0.5% AEP

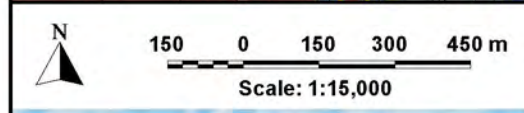


NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

Indicative Depth of Inundation (m)

	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

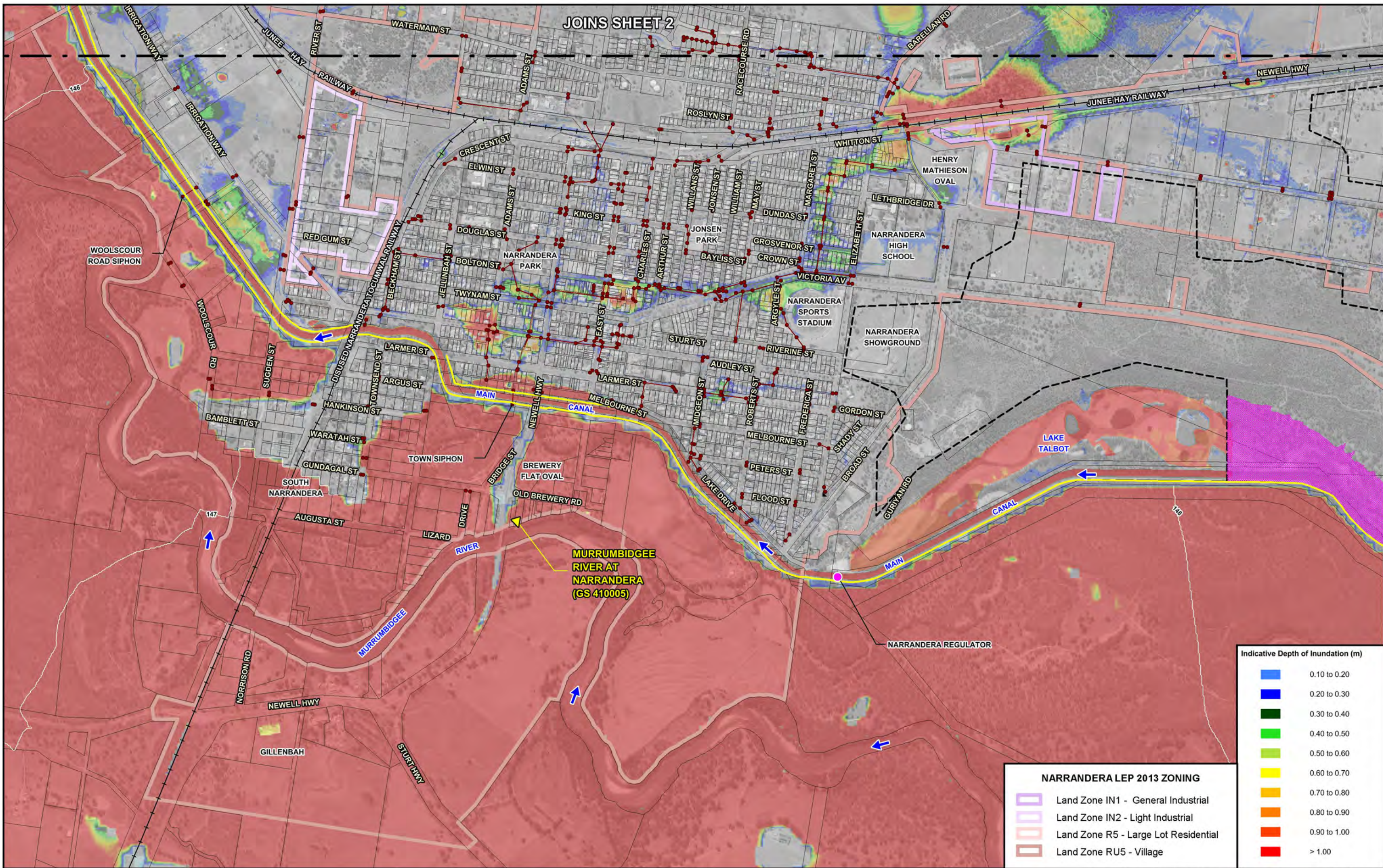


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

	Modelled Stormwater Network		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Railway		
	Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

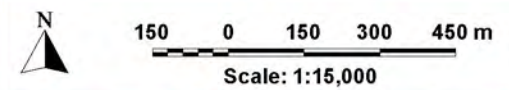


JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

Indicative Depth of Inundation (m)	
Light Blue	0.10 to 0.20
Blue	0.20 to 0.30
Dark Blue	0.30 to 0.40
Green	0.40 to 0.50
Light Green	0.50 to 0.60
Yellow	0.60 to 0.70
Orange	0.70 to 0.80
Red-Orange	0.80 to 0.90
Red	0.90 to 1.00
Dark Red	> 1.00

NARRANDERA LEP 2013 ZONING	
Purple outline	Land Zone IN1 - General Industrial
Pink outline	Land Zone IN2 - Light Industrial
Light Pink outline	Land Zone R5 - Large Lot Residential
Brown outline	Land Zone RU5 - Village



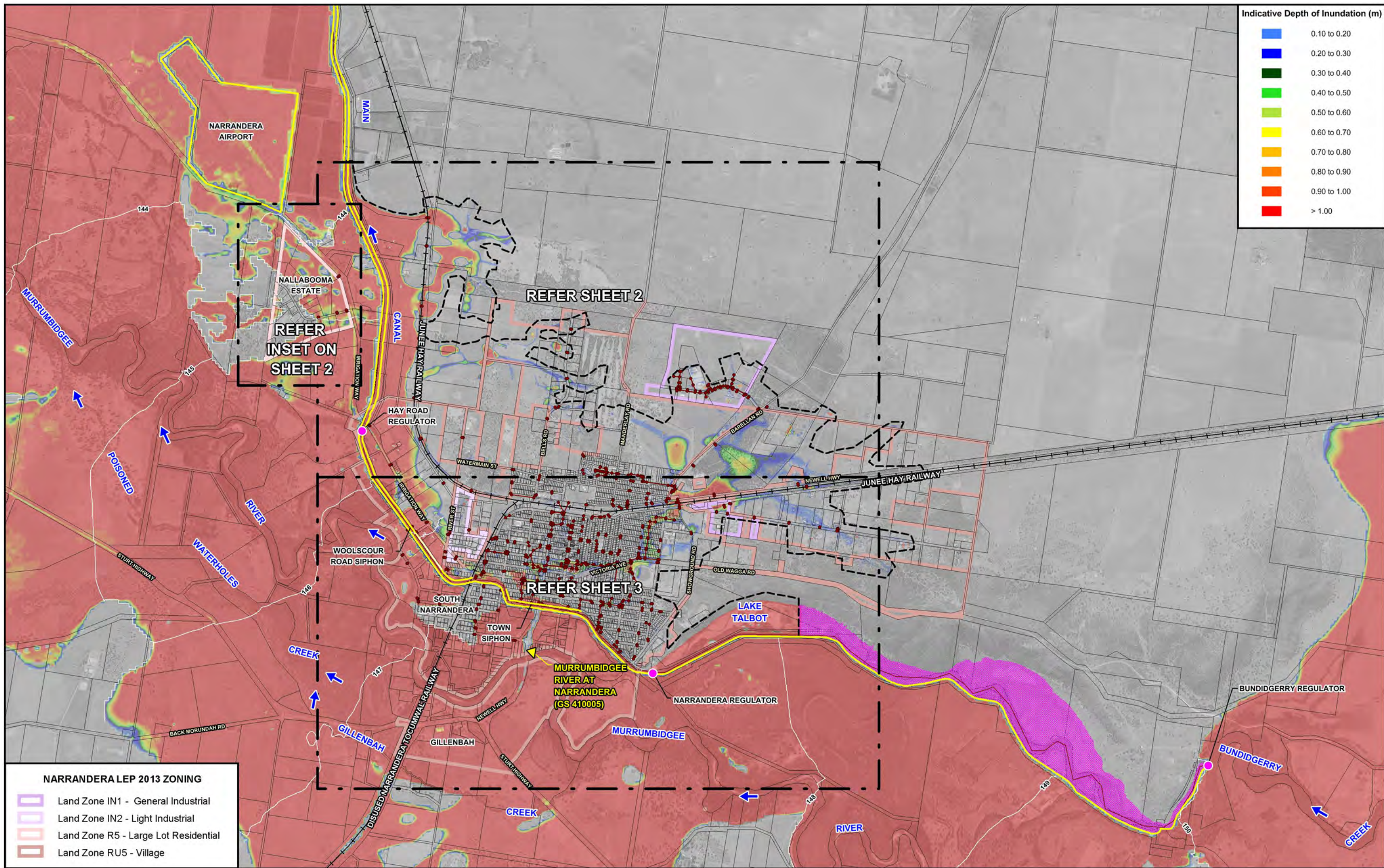
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND	
Red line with dots	Modelled Stormwater Network
Yellow line with dots	Existing Canal Embankment / Levee
Black line with cross-ticks	Railway
Dashed black line	Limit of Overland Flow Mapping
Yellow triangle	WaterNSW Stream Gauge
Pink circle	Murrumbidgee Irrigation Operated Regulator
Red line with '147'	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Purple shaded area	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.7 (Sheet 3 of 3)

TUFLOW MODEL RESULTS
0.5% AEP

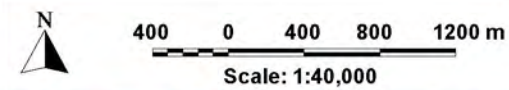


Indicative Depth of Inundation (m)

Blue	0.10 to 0.20
Dark Blue	0.20 to 0.30
Green	0.30 to 0.40
Light Green	0.40 to 0.50
Yellow	0.50 to 0.60
Orange	0.60 to 0.70
Red-Orange	0.70 to 0.80
Red	0.80 to 0.90
Dark Red	0.90 to 1.00
Red	> 1.00

NARRANDERA LEP 2013 ZONING

Blue outline	Land Zone IN1 - General Industrial
Purple outline	Land Zone IN2 - Light Industrial
Orange outline	Land Zone R5 - Large Lot Residential
Red outline	Land Zone RU5 - Village

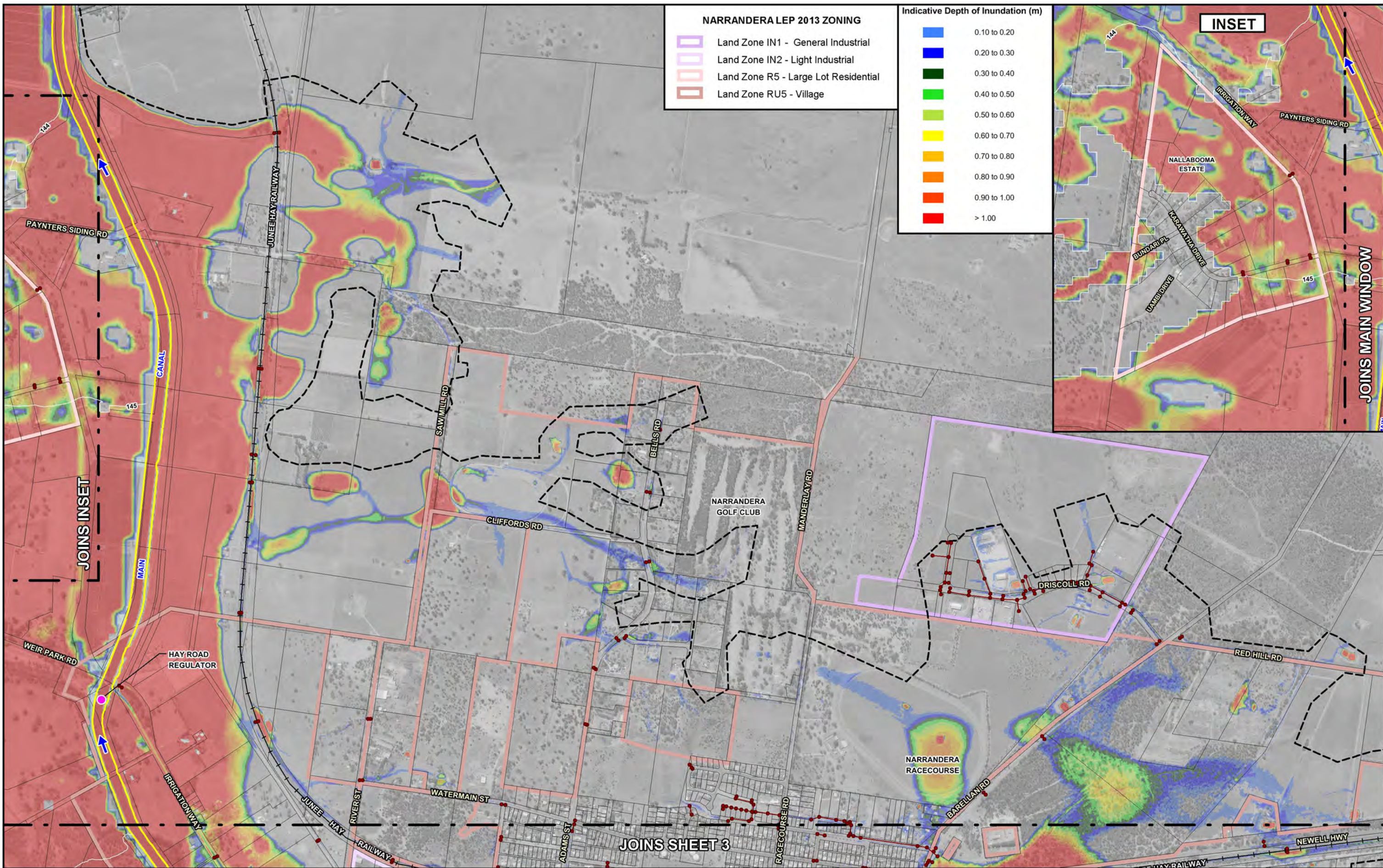


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

Red line with dots	Modelled Stormwater Network	Yellow triangle	WaterNSW Stream Gauge
Grey line	Existing Canal Embankment / Levee	Pink dot	Murrumbidgee Irrigation Operated Regulator
Black line with cross-ticks	Railway	Red line with '148'	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Dashed black line	Limit of Overland Flow Mapping	Pink shaded area	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure B3.8 (Sheet 1 of 3)
 TUFLOW MODEL RESULTS
 0.2% AEP

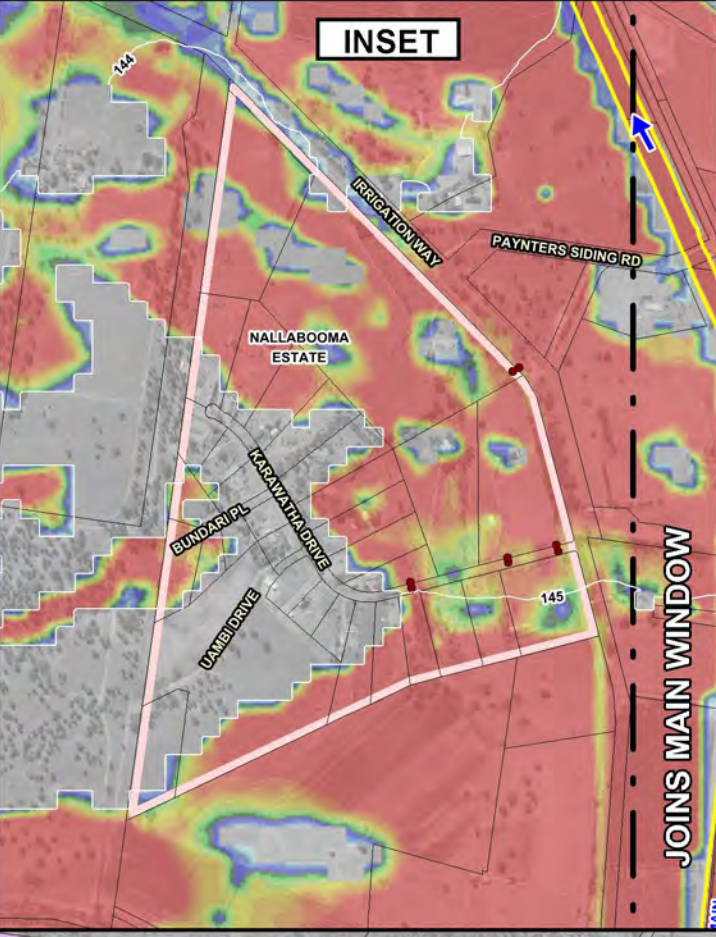


NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

Indicative Depth of Inundation (m)

	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



NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

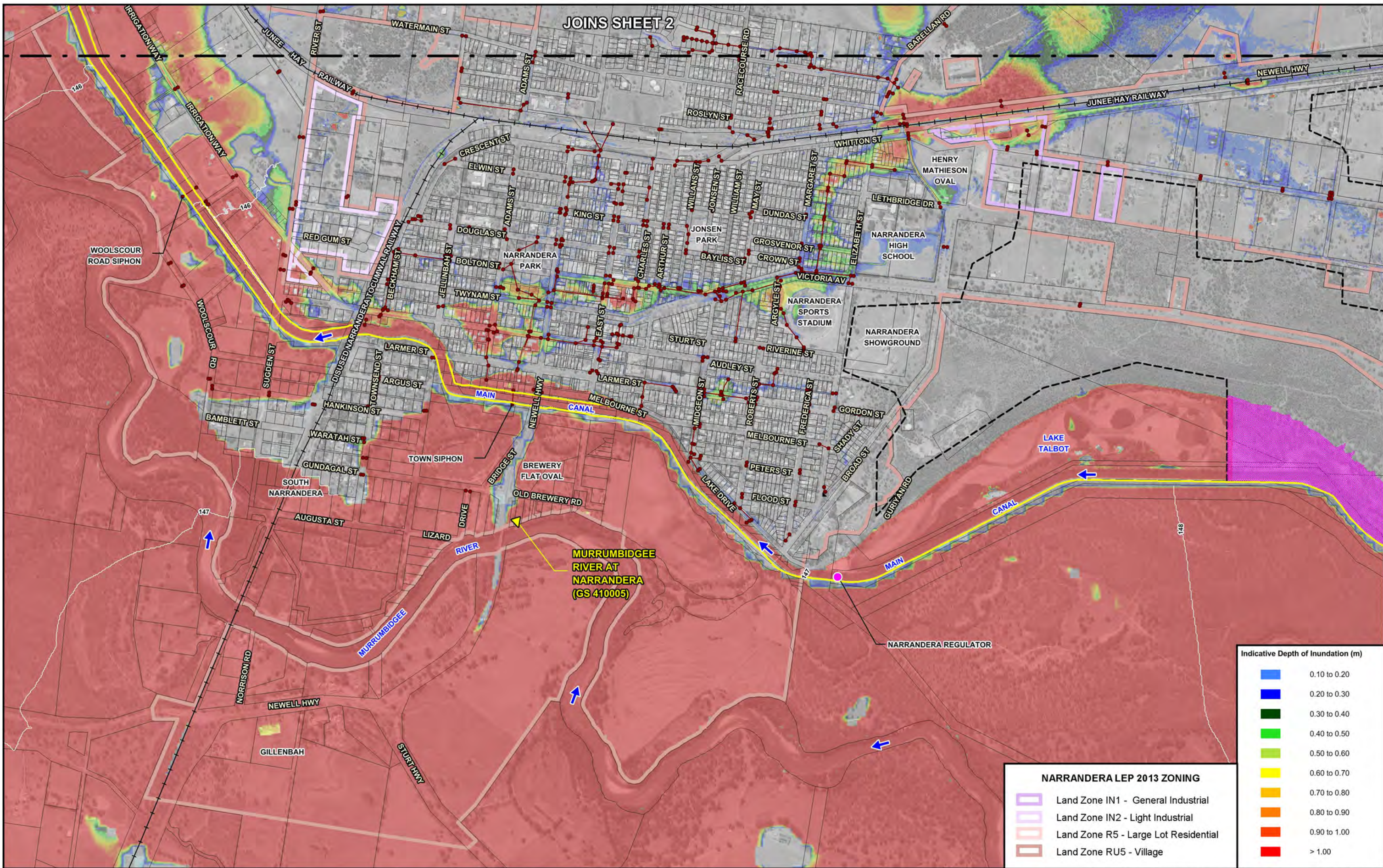
LEGEND

	Modelled Stormwater Network		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Railway		
	Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.8 (Sheet 2 of 3)

TUFLOW MODEL RESULTS
 0.2% AEP

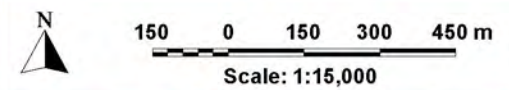


JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

Indicative Depth of Inundation (m)	
■	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

NARRANDERA LEP 2013 ZONING	
□	Land Zone IN1 - General Industrial
□	Land Zone IN2 - Light Industrial
□	Land Zone R5 - Large Lot Residential
□	Land Zone RU5 - Village



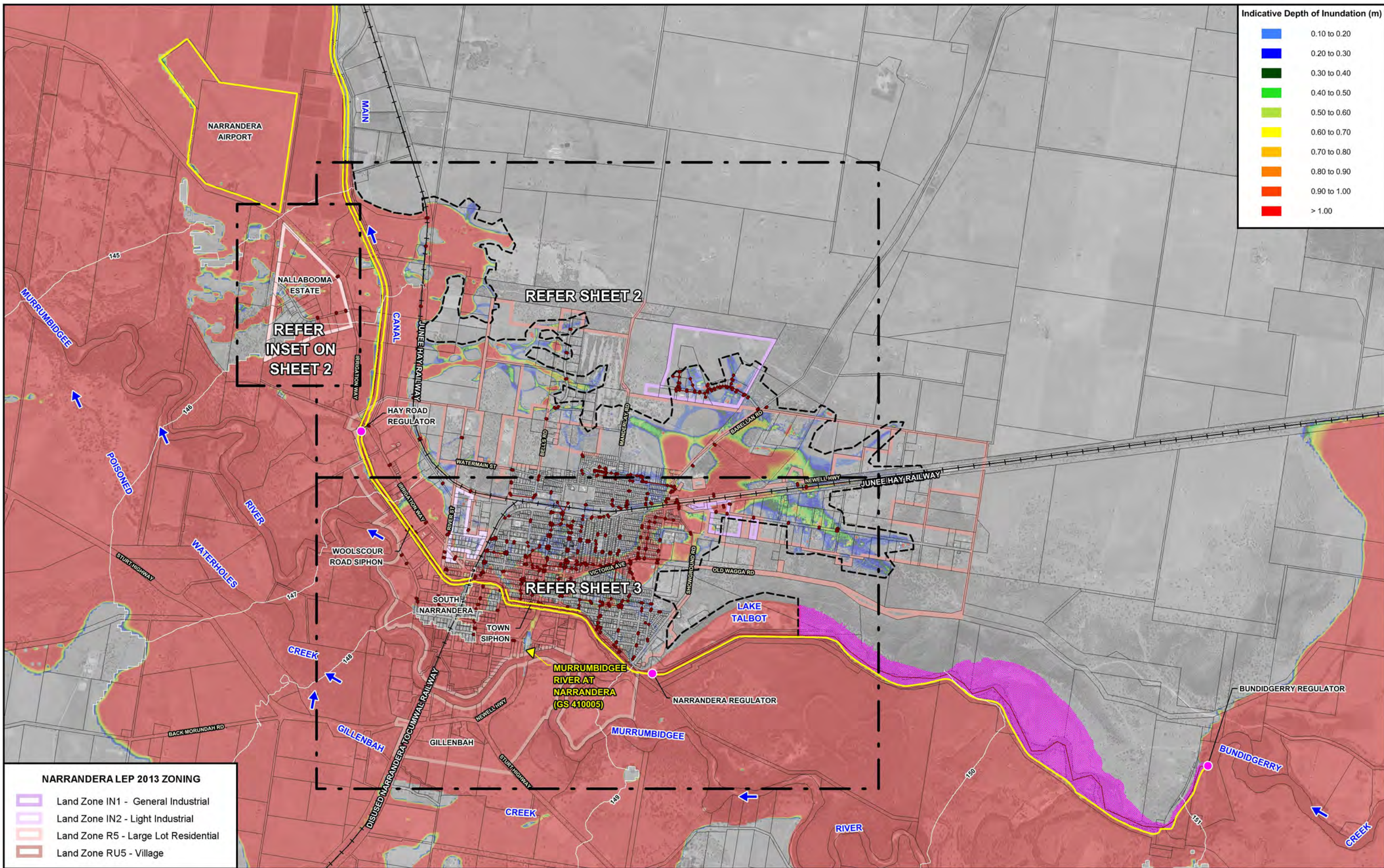
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND	
—●—	Modelled Stormwater Network
—	Existing Canal Embankment / Levee
—	Railway
—	Limit of Overland Flow Mapping
▼	WaterNSW Stream Gauge
●	Murrumbidgee Irrigation Operated Regulator
147	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

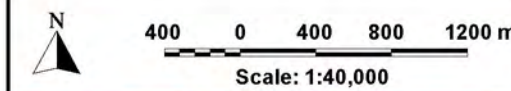
Figure B3.8 (Sheet 3 of 3)

TUFLOW MODEL RESULTS
0.2% AEP



Indicative Depth of Inundation (m)	
Light Blue	0.10 to 0.20
Blue	0.20 to 0.30
Dark Blue	0.30 to 0.40
Green	0.40 to 0.50
Light Green	0.50 to 0.60
Yellow	0.60 to 0.70
Orange	0.70 to 0.80
Red-Orange	0.80 to 0.90
Red	0.90 to 1.00
Dark Red	> 1.00

NARRANDERA LEP 2013 ZONING	
Light Purple	Land Zone IN1 - General Industrial
Medium Purple	Land Zone IN2 - Light Industrial
Light Orange	Land Zone R5 - Large Lot Residential
Dark Orange	Land Zone RU5 - Village

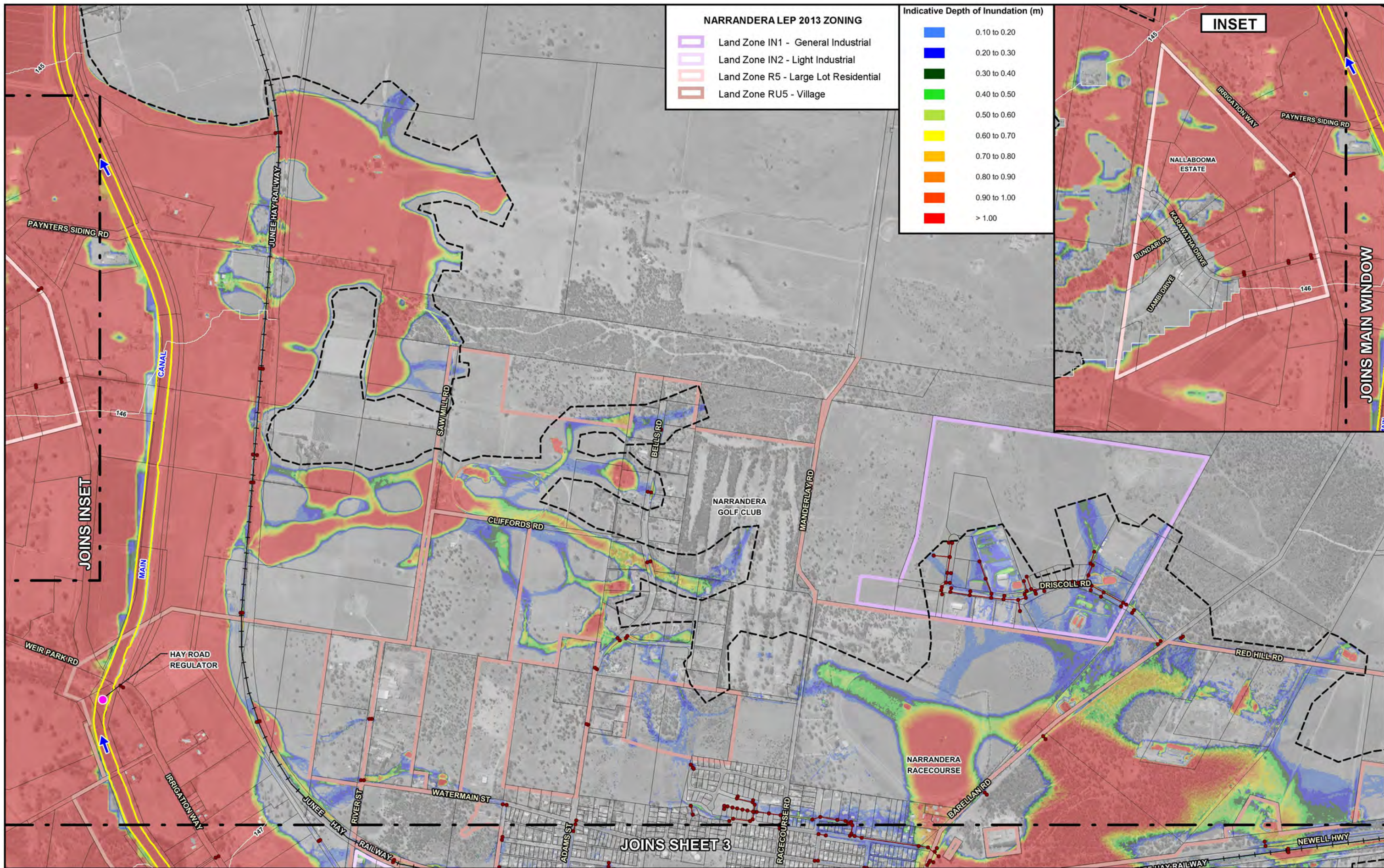


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND	
Red line with dots	Modelled Stormwater Network
Yellow line	Existing Canal Embankment / Levee
Black line with cross-ticks	Railway
Dashed black line	Limit of Overland Flow Mapping
Yellow triangle	WaterNSW Stream Gauge
Pink dot	Murrumbidgee Irrigation Operated Regulator
Red line with '148'	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Pink shaded area	Flood Behaviour Not Defined Over This Area



REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure B3.9 (Sheet 1 of 3)
 TUFLOW MODEL RESULTS
 EXTREME FLOOD

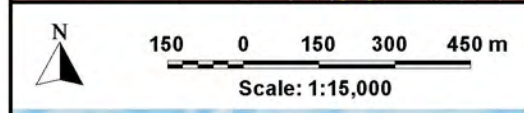
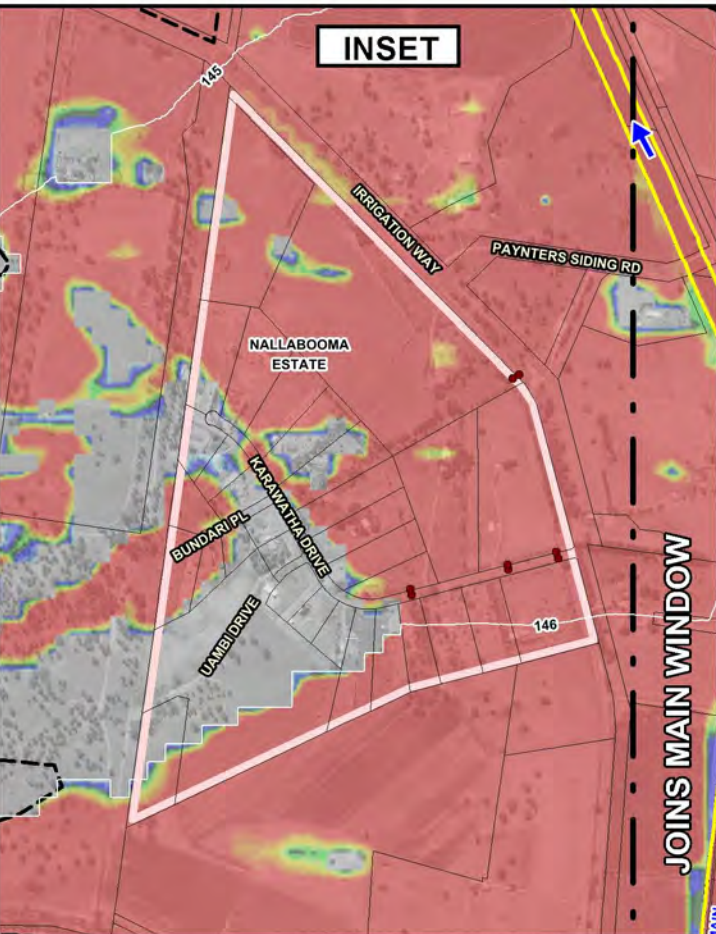


NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village

Indicative Depth of Inundation (m)

	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



NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

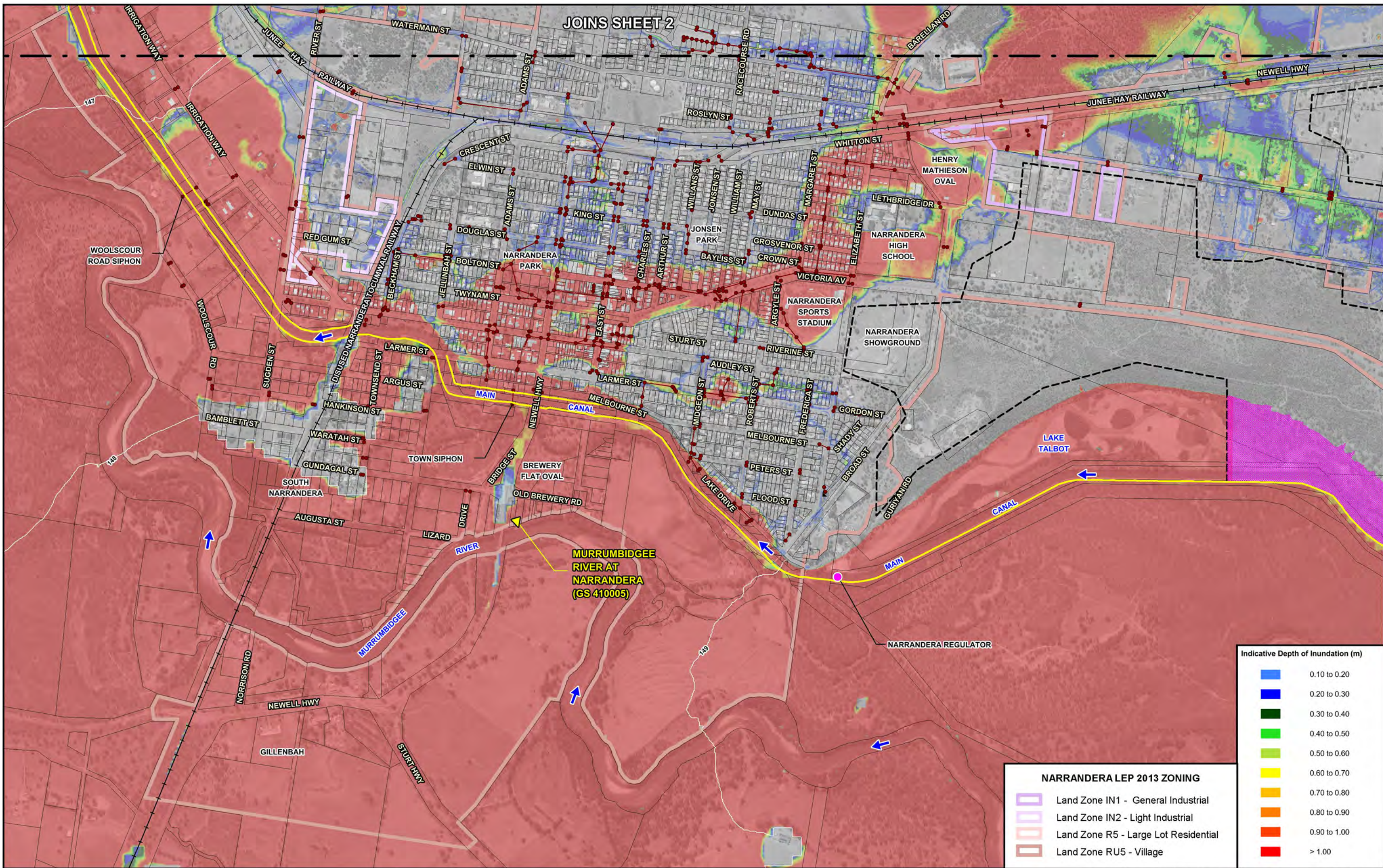
LEGEND

	Modelled Stormwater Network		Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
	Existing Canal Embankment / Levee		Limit of Overland Flow Mapping
	Railway		Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.9 (Sheet 2 of 3)

TUFLOW MODEL RESULTS
 EXTREME FLOOD

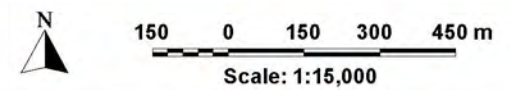


JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

Indicative Depth of Inundation (m)	
Light Blue	0.10 to 0.20
Blue	0.20 to 0.30
Dark Blue	0.30 to 0.40
Green	0.40 to 0.50
Light Green	0.50 to 0.60
Yellow	0.60 to 0.70
Orange	0.70 to 0.80
Red-Orange	0.80 to 0.90
Red	0.90 to 1.00
Dark Red	> 1.00

NARRANDERA LEP 2013 ZONING	
Purple outline	Land Zone IN1 - General Industrial
Pink outline	Land Zone IN2 - Light Industrial
Light Pink outline	Land Zone R5 - Large Lot Residential
Brown outline	Land Zone RU5 - Village



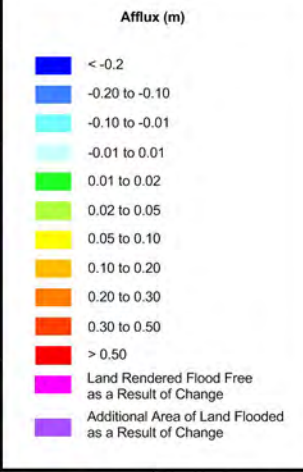
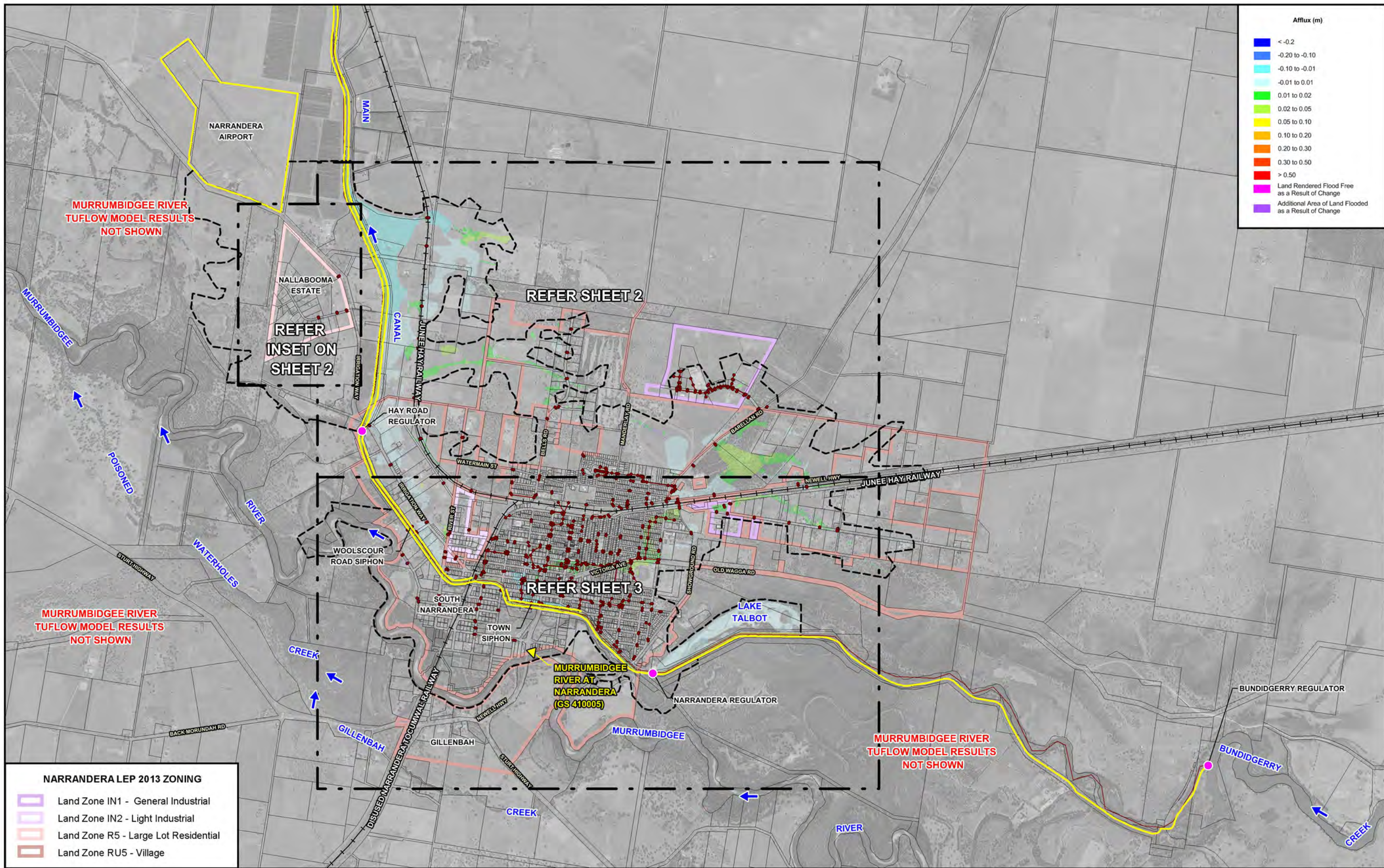
NOTE:
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LEGEND	
Red line with dots	Modelled Stormwater Network
Yellow line	Existing Canal Embankment / Levee
Black line with cross-ticks	Railway
Dashed black line	Limit of Overland Flow Mapping
Yellow triangle	WaterNSW Stream Gauge
Pink circle	Murrumbidgee Irrigation Operated Regulator
Red line with '147'	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Purple area	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

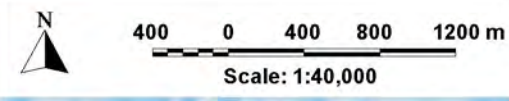
Figure B3.9 (Sheet 3 of 3)

TUFLOW MODEL RESULTS
EXTREME FLOOD



NARRANDERA LEP 2013 ZONING

	Land Zone IN1 - General Industrial
	Land Zone IN2 - Light Industrial
	Land Zone R5 - Large Lot Residential
	Land Zone RU5 - Village



NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

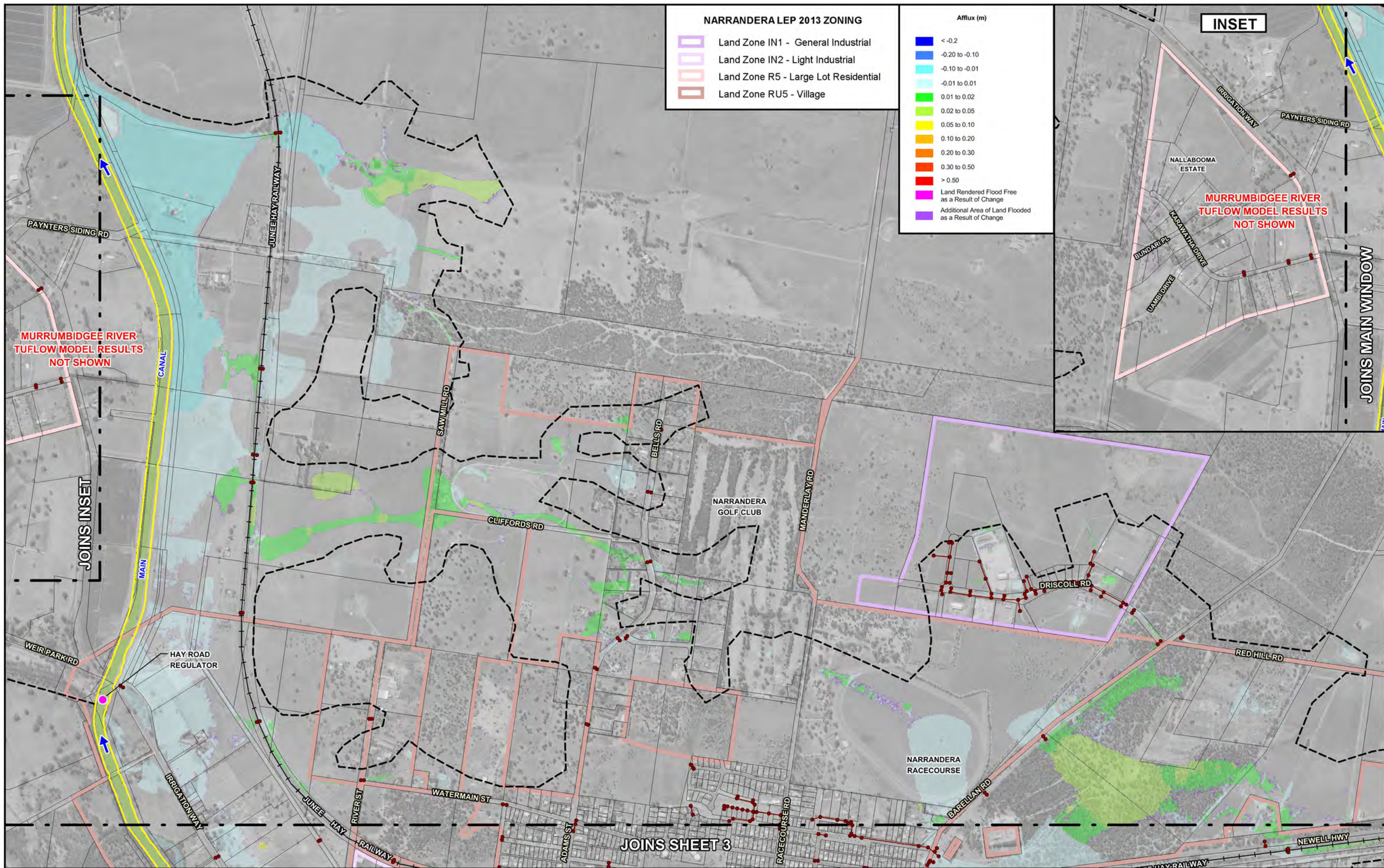
LEGEND

	Modelled Stormwater Network		WaterNSW Stream Gauge
	Local Catchment TUFLOW Model Extent		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		
	Railway		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

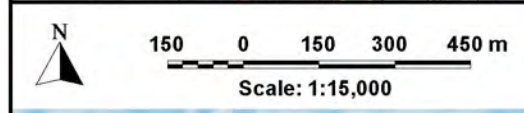
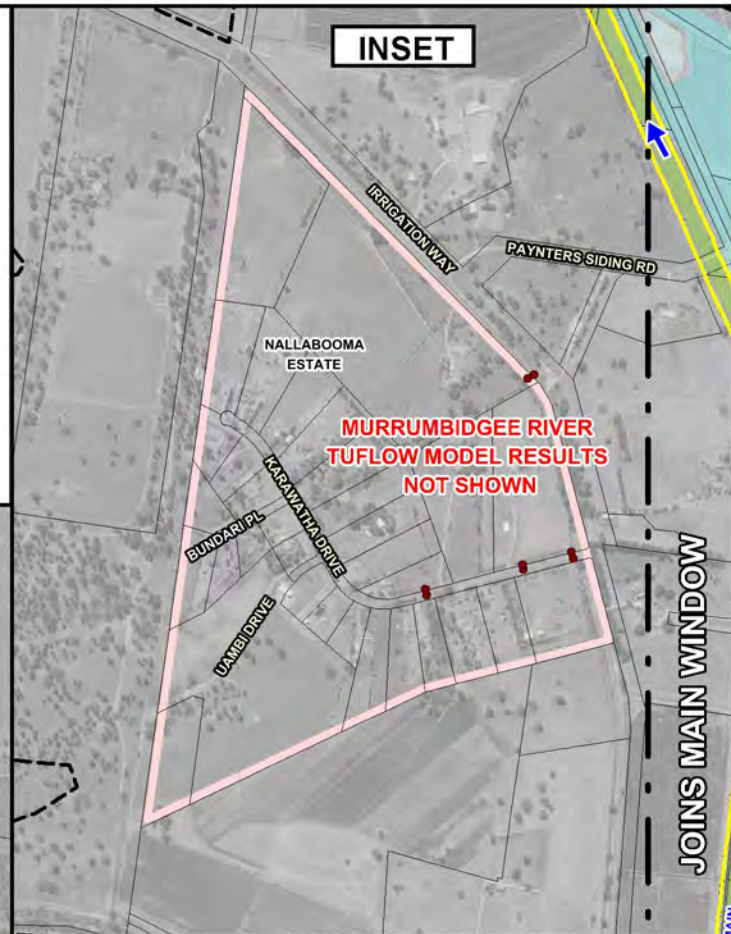
Figure B3.10
 (Sheet 1 of 3)

SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO 20% INCREASE IN HYDRAULIC ROUGHNESS VALUES - 1% AEP



- NARRANDERA LEP 2013 ZONING**
- Land Zone IN1 - General Industrial
 - Land Zone IN2 - Light Industrial
 - Land Zone R5 - Large Lot Residential
 - Land Zone RU5 - Village

- Afflux (m)**
- < -0.2
 - 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



NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

- LEGEND**
- Modelled Stormwater Network
 - Local Catchment TUFLOW Model Extent
 - Existing Canal Embankment / Levee
 - Railway
 - Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.10
 (Sheet 2 of 3)

SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO 20% INCREASE IN HYDRAULIC ROUGHNESS VALUES - 1% AEP