

MURRUMBIDGEE RIVER TUFLOW MODEL RESULTS NOT SHOWN

MURRUMBIDGEE RIVER TUFLOW MODEL RESULTS NOT SHOWN

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

MURRUMBIDGEE RIVER TUFLOW MODEL RESULTS NOT SHOWN

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

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

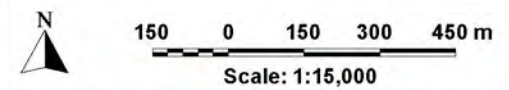
LEGEND

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

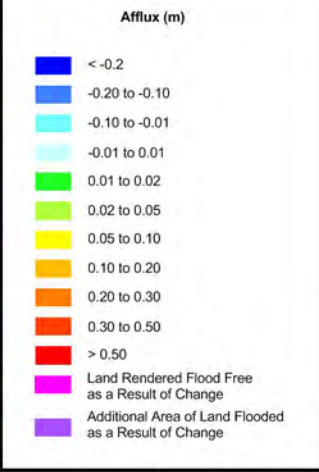
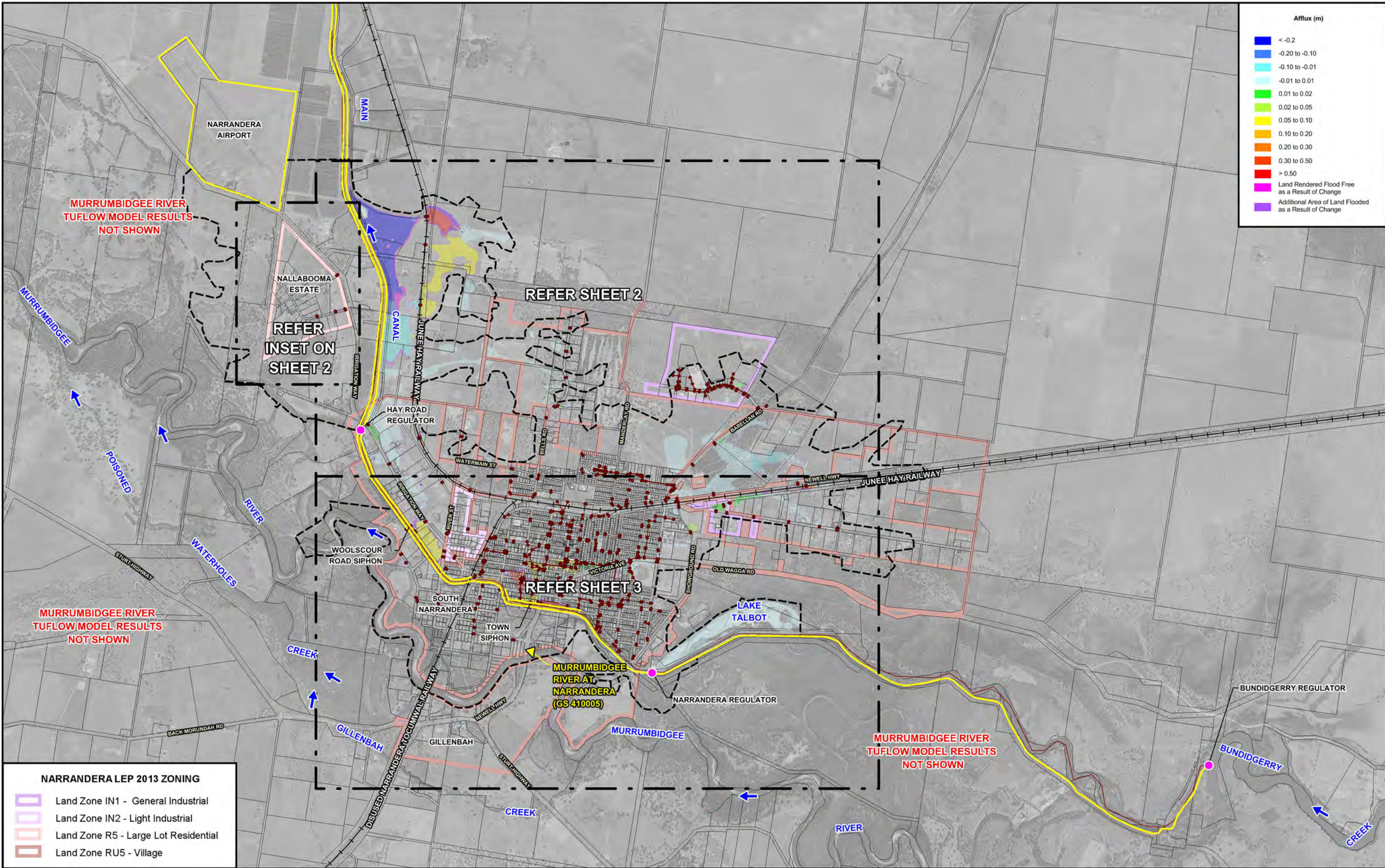
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.10 (Sheet 3 of 3)

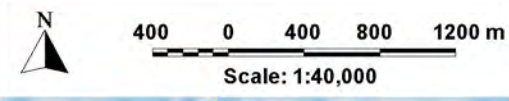
SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO 20% INCREASE IN HYDRAULIC ROUGHNESS VALUES - 1% AEP



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.



- #### 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.

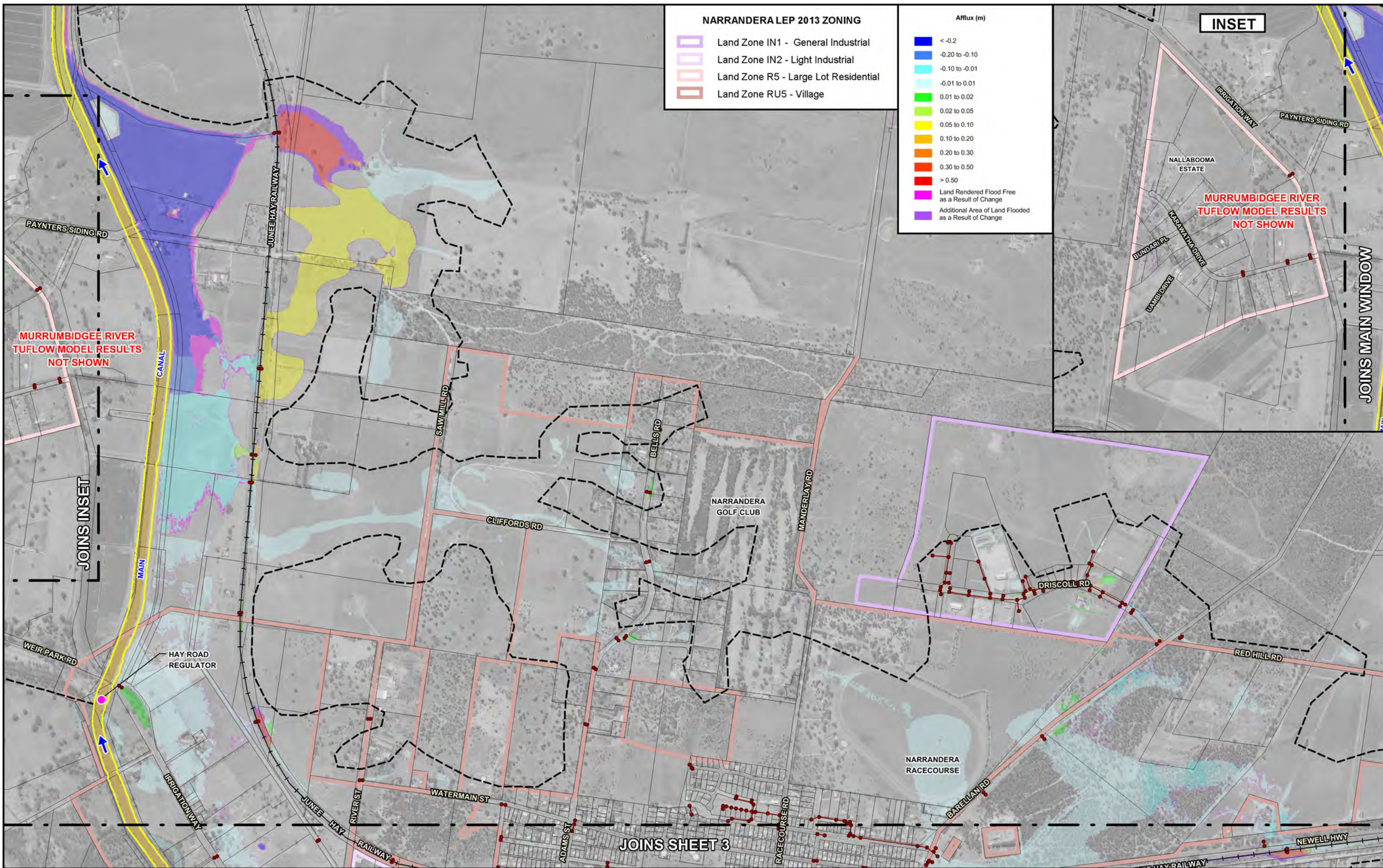
- #### LEGEND
- Modelled Stormwater Network
 - Local Catchment TUFLOW Model Extent
 - Existing Canal Embankment / Levee
 - Railway
 - WaterNSW Stream Gauge
 - Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.11
(Sheet 1 of 3)

SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO PARTIAL BLOCKAGE OF ALL HYDRAULIC STRUCTURES - 1% AEP



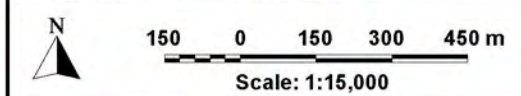
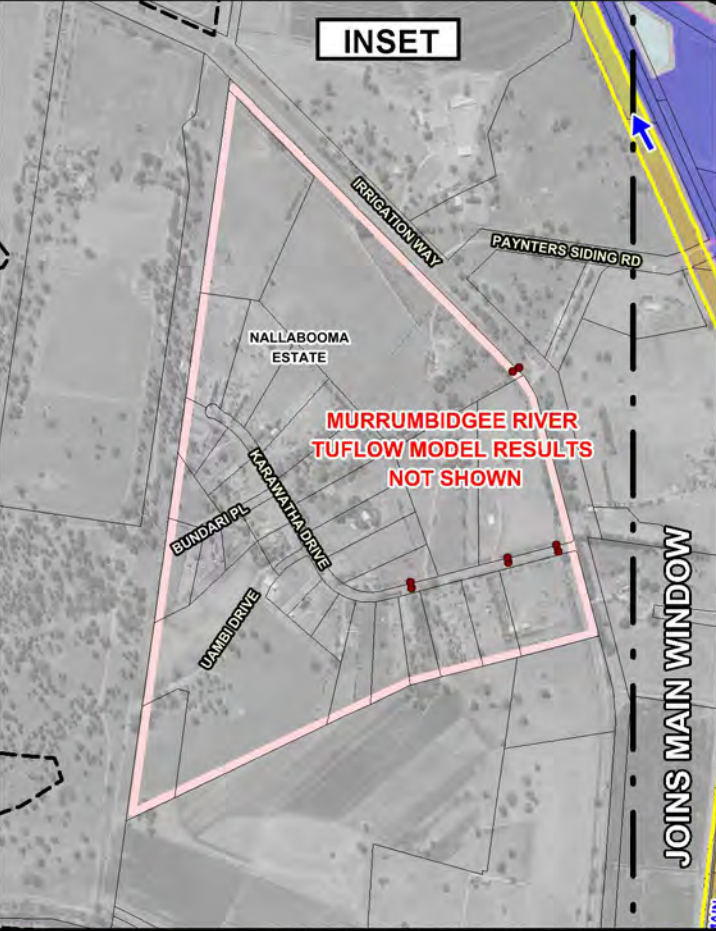


NARRANDERA LEP 2013 ZONING

- 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.

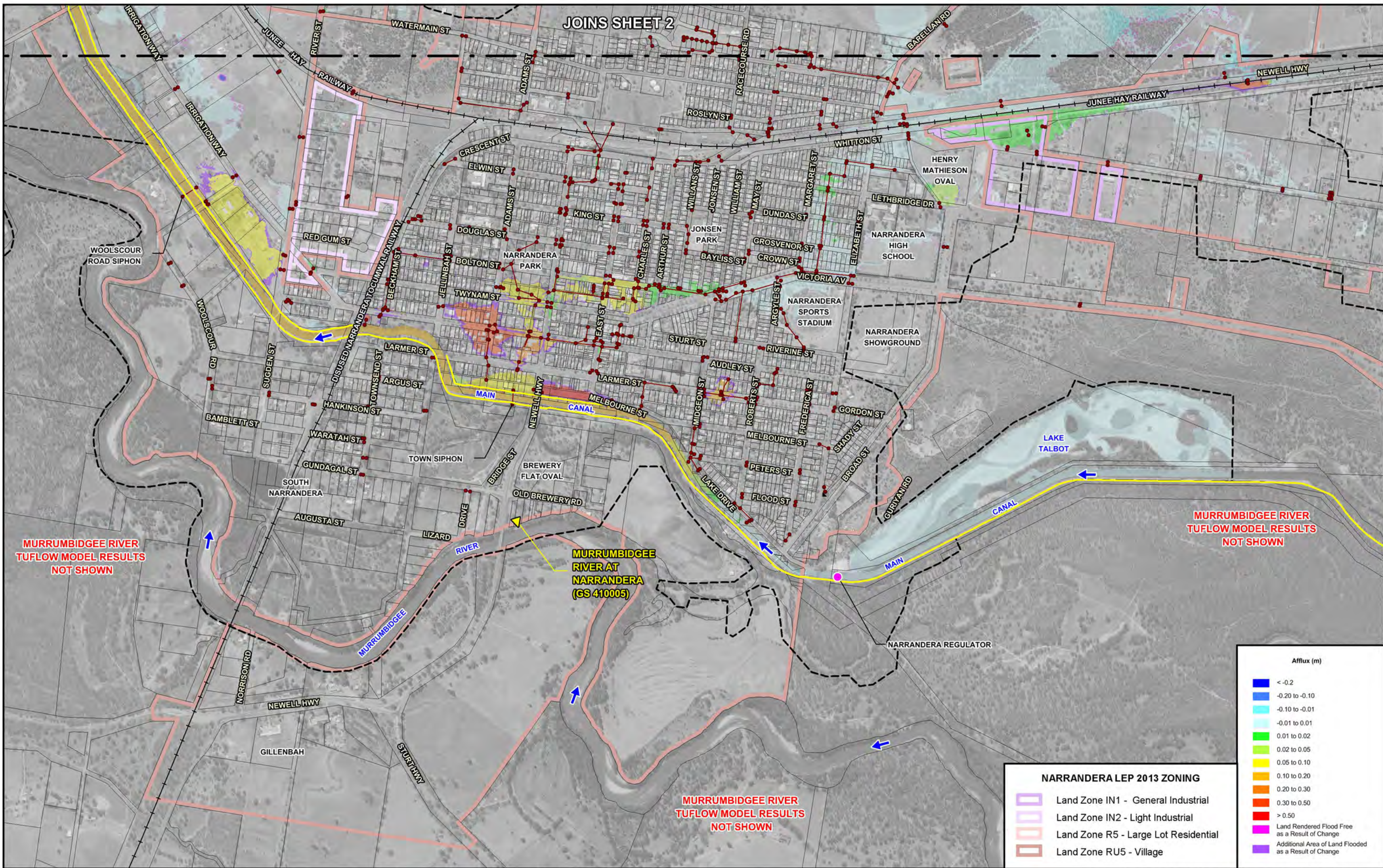
LEGEND

- 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 B3.11 (Sheet 2 of 3)

SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO PARTIAL BLOCKAGE OF ALL HYDRAULIC STRUCTURES - 1% AEP

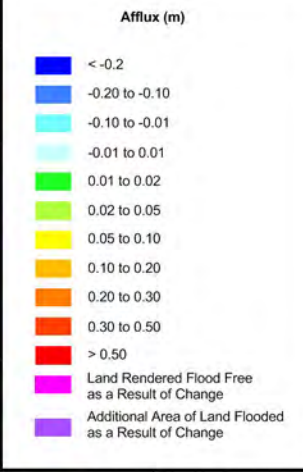
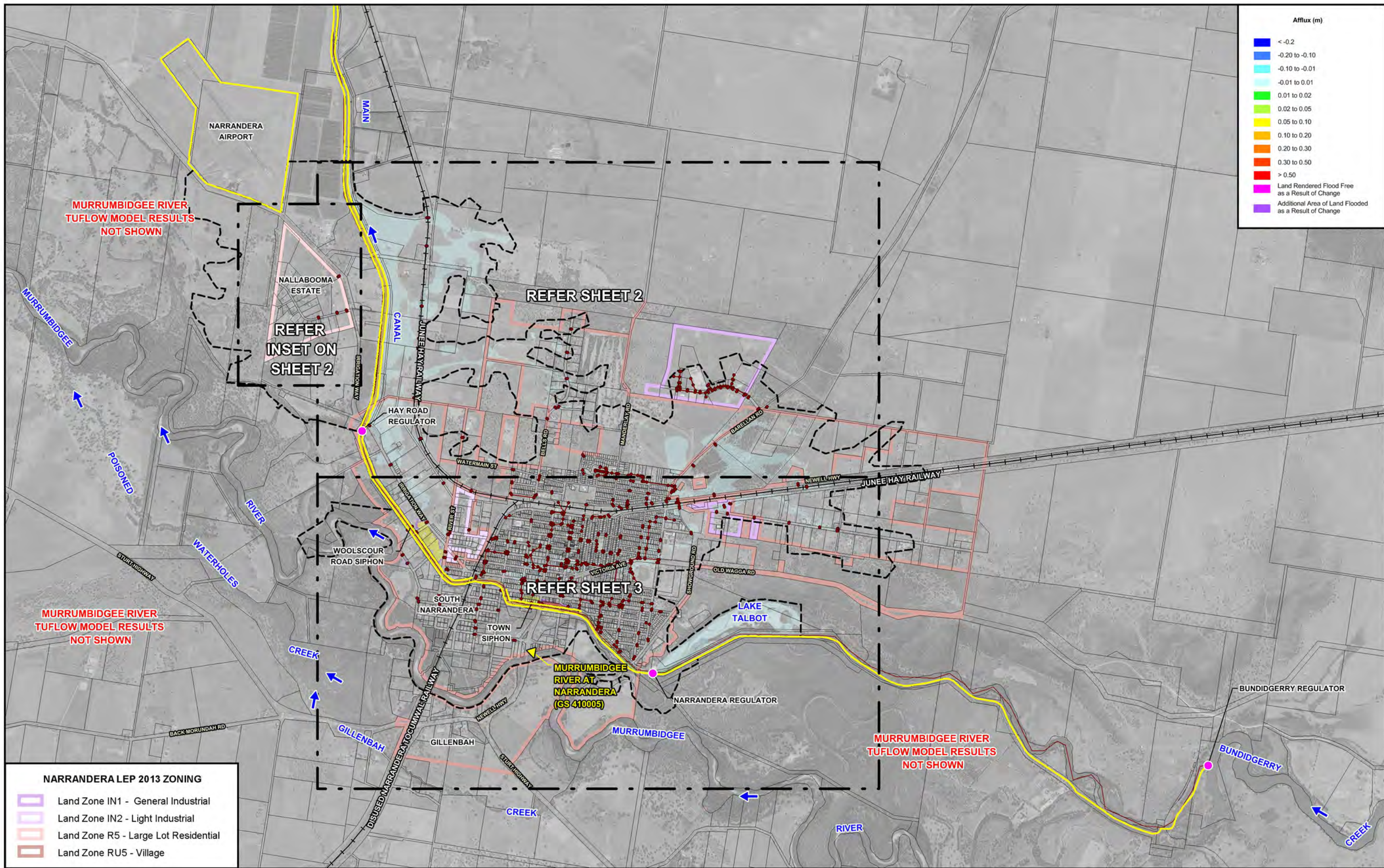


NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

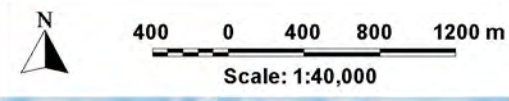
Figure B3.11 (Sheet 3 of 3)

SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO PARTIAL BLOCKAGE OF ALL HYDRAULIC STRUCTURES - 1% AEP



NARRANDERA LEP 2013 ZONING

Light Purple	Land Zone IN1 - General Industrial
Light Blue	Land Zone IN2 - Light Industrial
Light Green	Land Zone R5 - Large Lot Residential
Light Yellow	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.

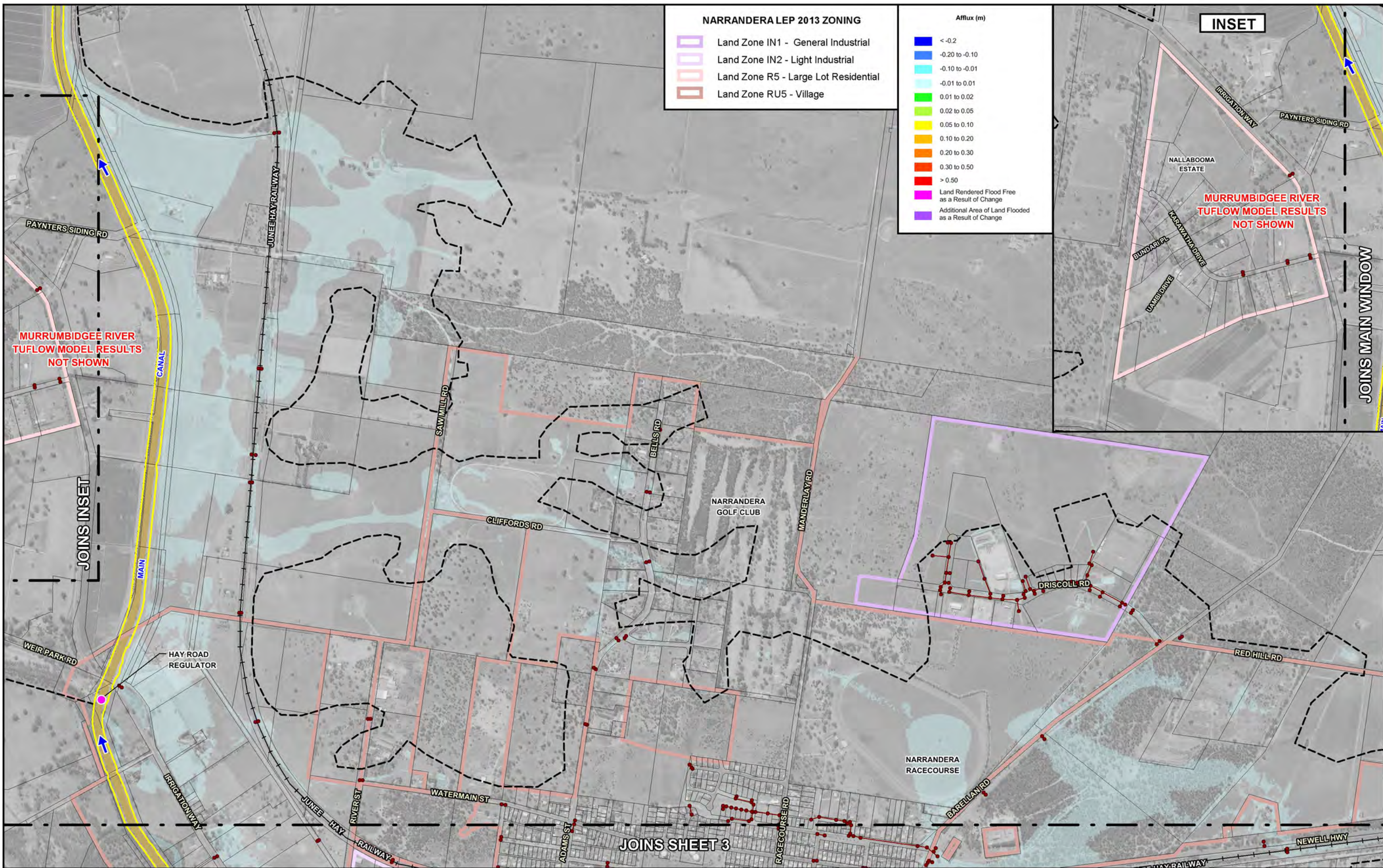
LEGEND

Red line with dots	Modelled Stormwater Network	Yellow triangle	WaterNSW Stream Gauge
Dashed black line	Local Catchment TUFLOW Model Extent	Pink dot	Murrumbidgee Irrigation Operated Regulator
Yellow line	Existing Canal Embankment / Levee		
Black line with cross-ticks	Railway		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.12
 (Sheet 1 of 3)

SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO FULL BLOCKAGE OF SIPHONS ONLY - 1% AEP

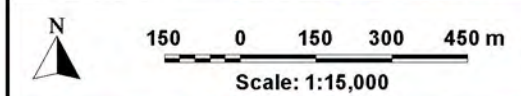
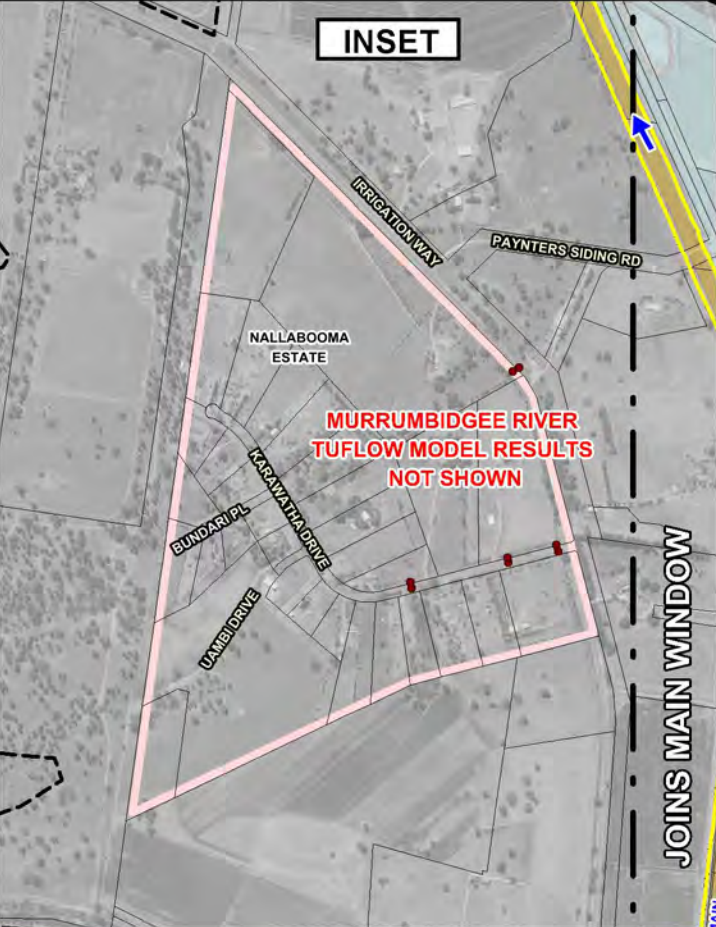


NARRANDERA LEP 2013 ZONING

- 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.

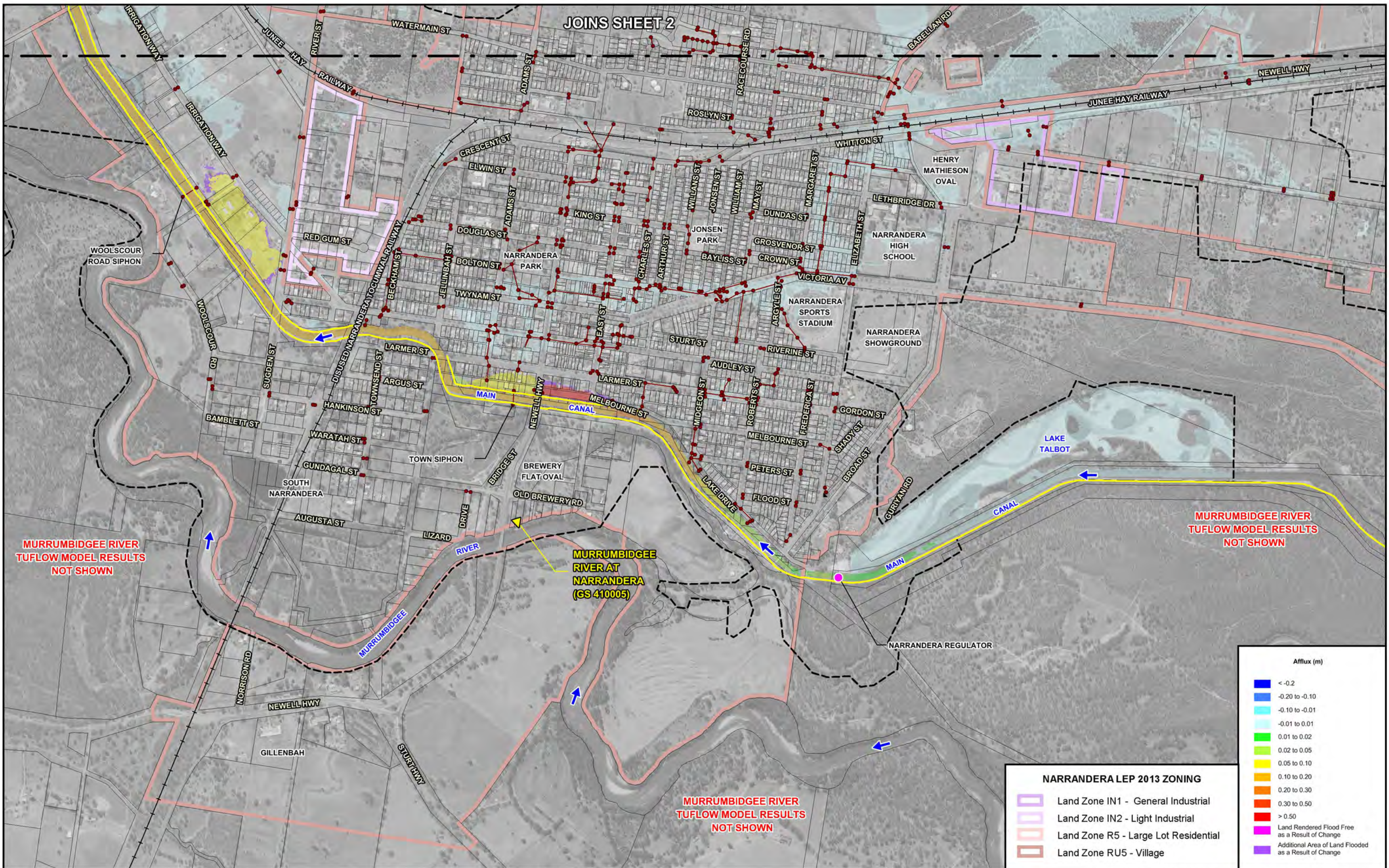
LEGEND

- 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 B3.12
 (Sheet 2 of 3)

SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO FULL BLOCKAGE OF SIPHONS ONLY - 1% AEP



MURRUMBIDGEE RIVER
TUFLOW MODEL RESULTS
NOT SHOWN

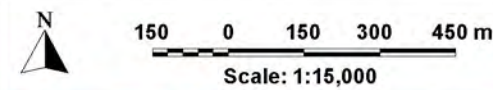
MURRUMBIDGEE RIVER
TUFLOW MODEL RESULTS
NOT SHOWN

MURRUMBIDGEE RIVER AT
NARRANDERA
(GS 410005)

MURRUMBIDGEE RIVER
TUFLOW MODEL RESULTS
NOT SHOWN

Afflux (m)	
Dark Blue	< -0.2
Blue	-0.20 to -0.10
Light Blue	-0.10 to -0.01
Cyan	-0.01 to 0.01
Green	0.01 to 0.02
Light 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

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
Dashed black line	Local Catchment TUFLOW Model Extent
Yellow and green line	Existing Canal Embankment / Levee
Black line with cross-ticks	Railway
Yellow triangle	WaterNSW Stream Gauge
Pink circle	Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure B3.12
(Sheet 3 of 3)

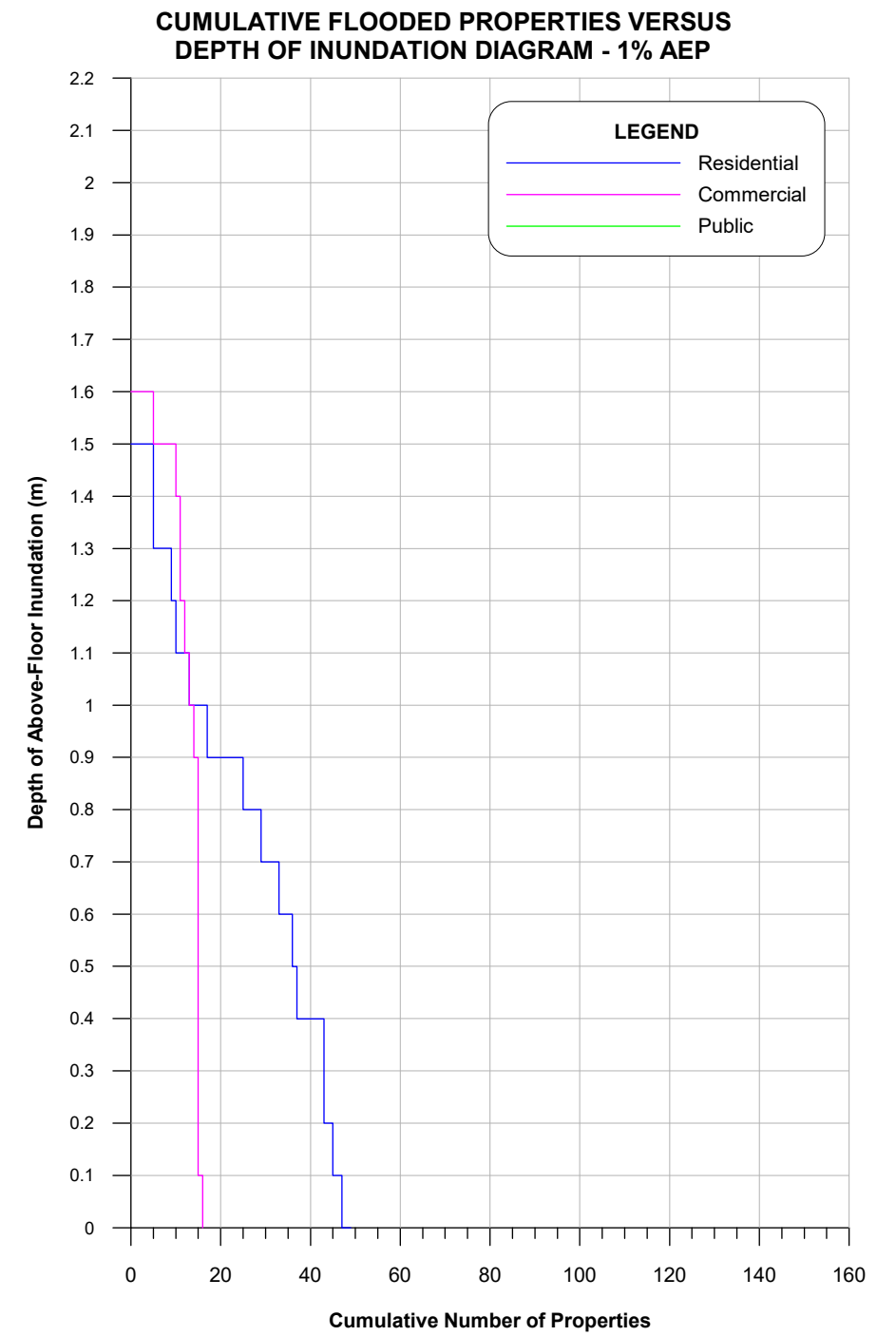
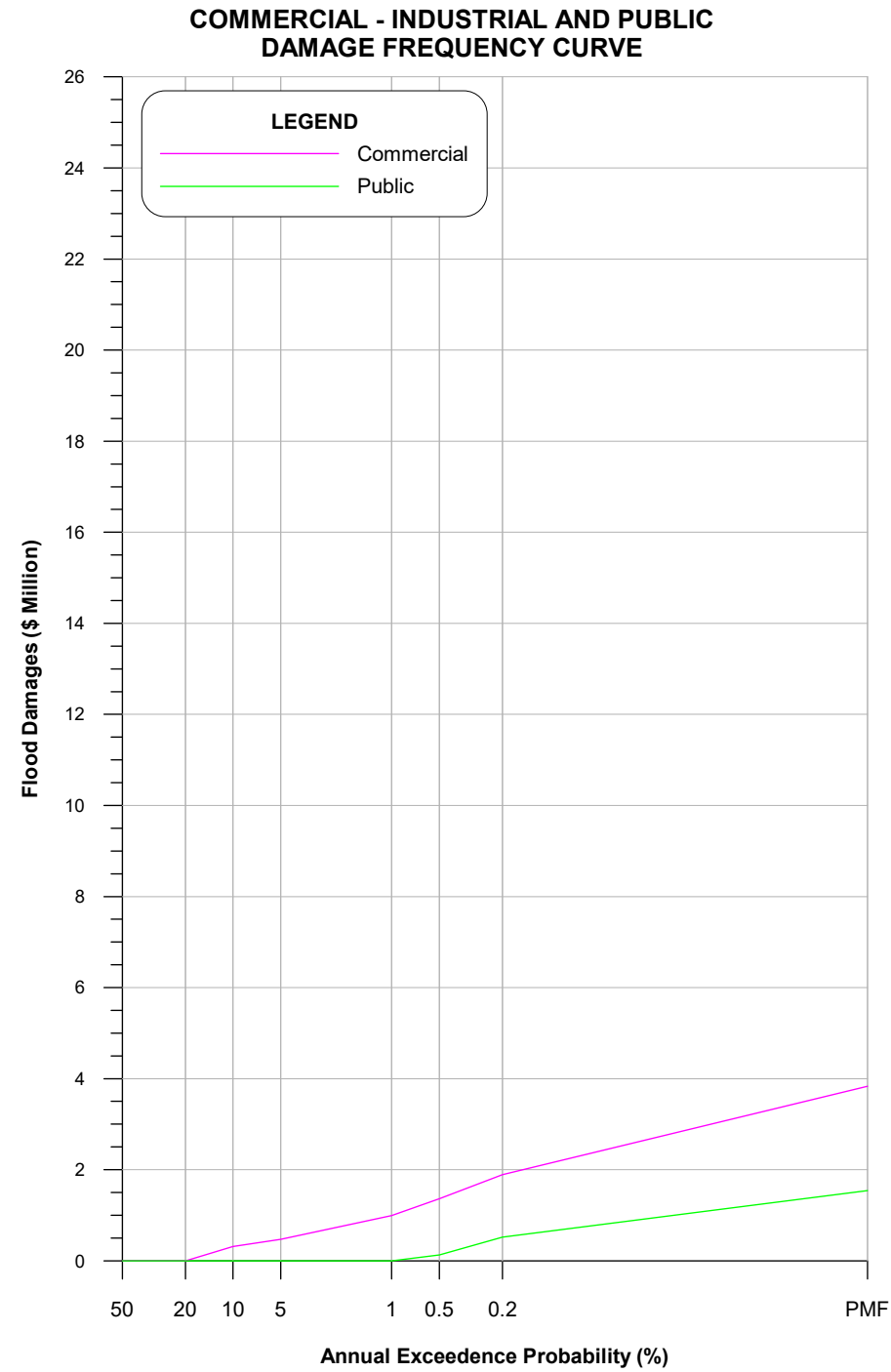
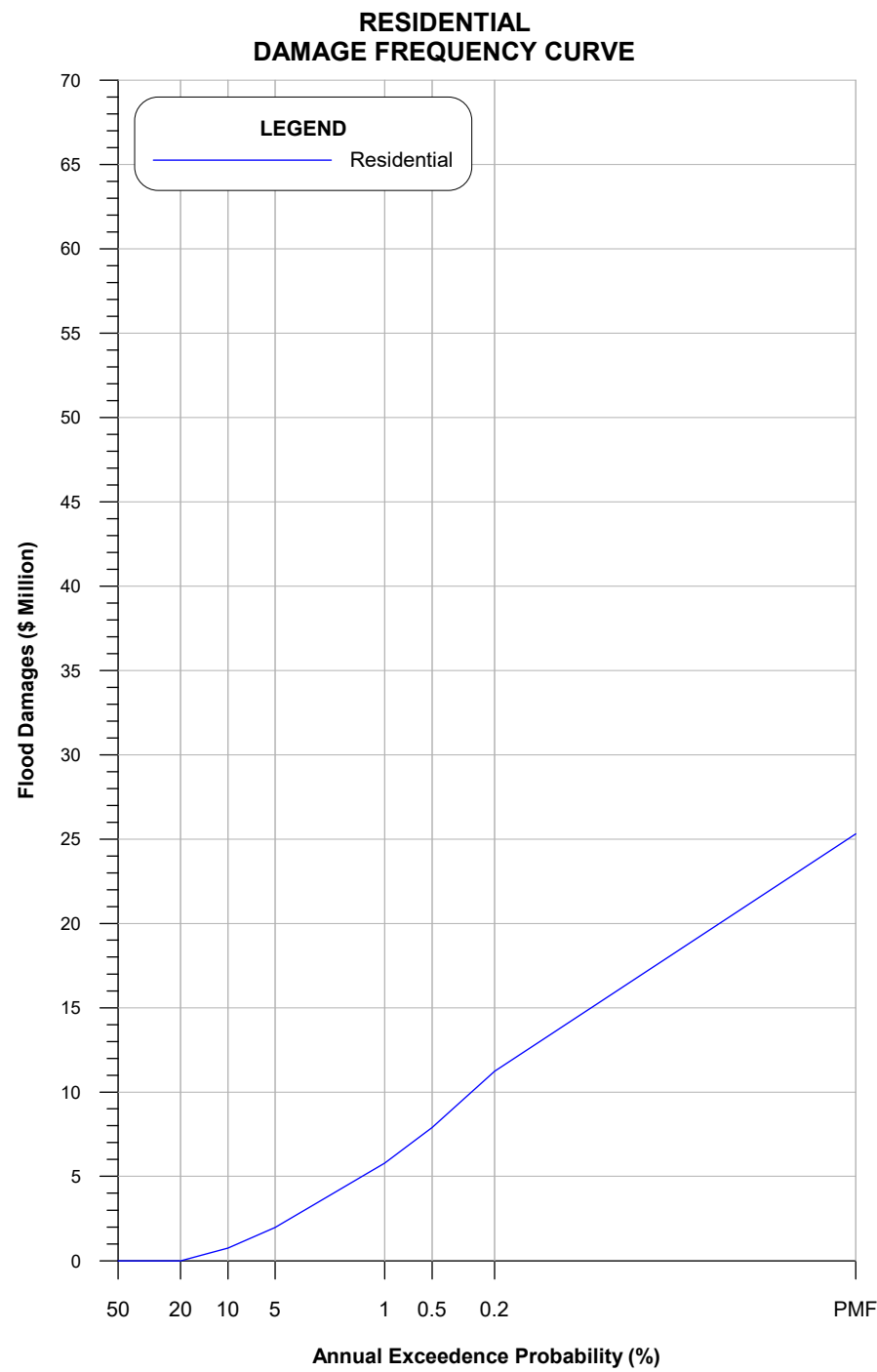
SENSITIVITY OF LOCAL CATCHMENT FLOOD BEHAVIOUR TO FULL BLOCKAGE OF SIPHONS ONLY - 1% AEP

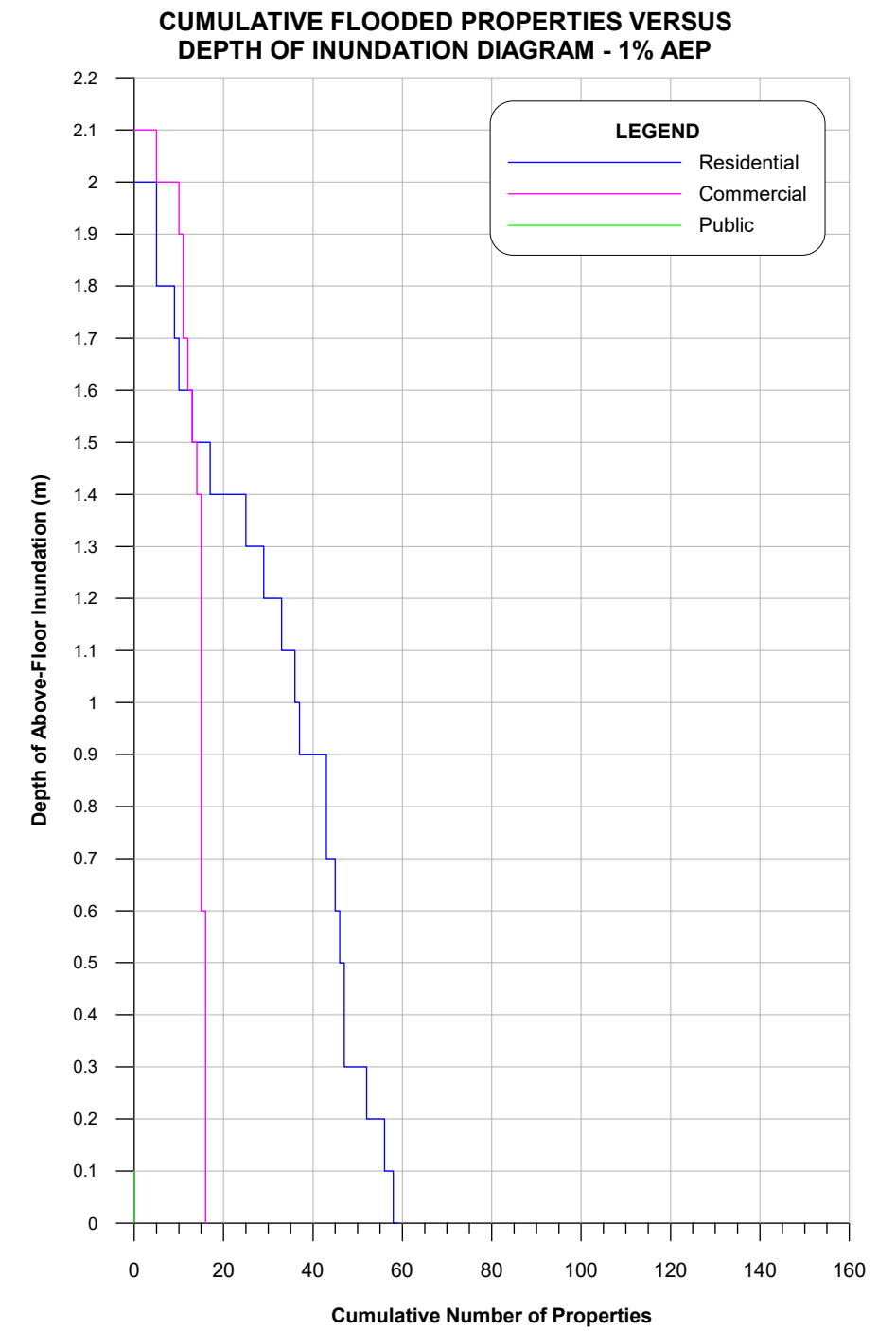
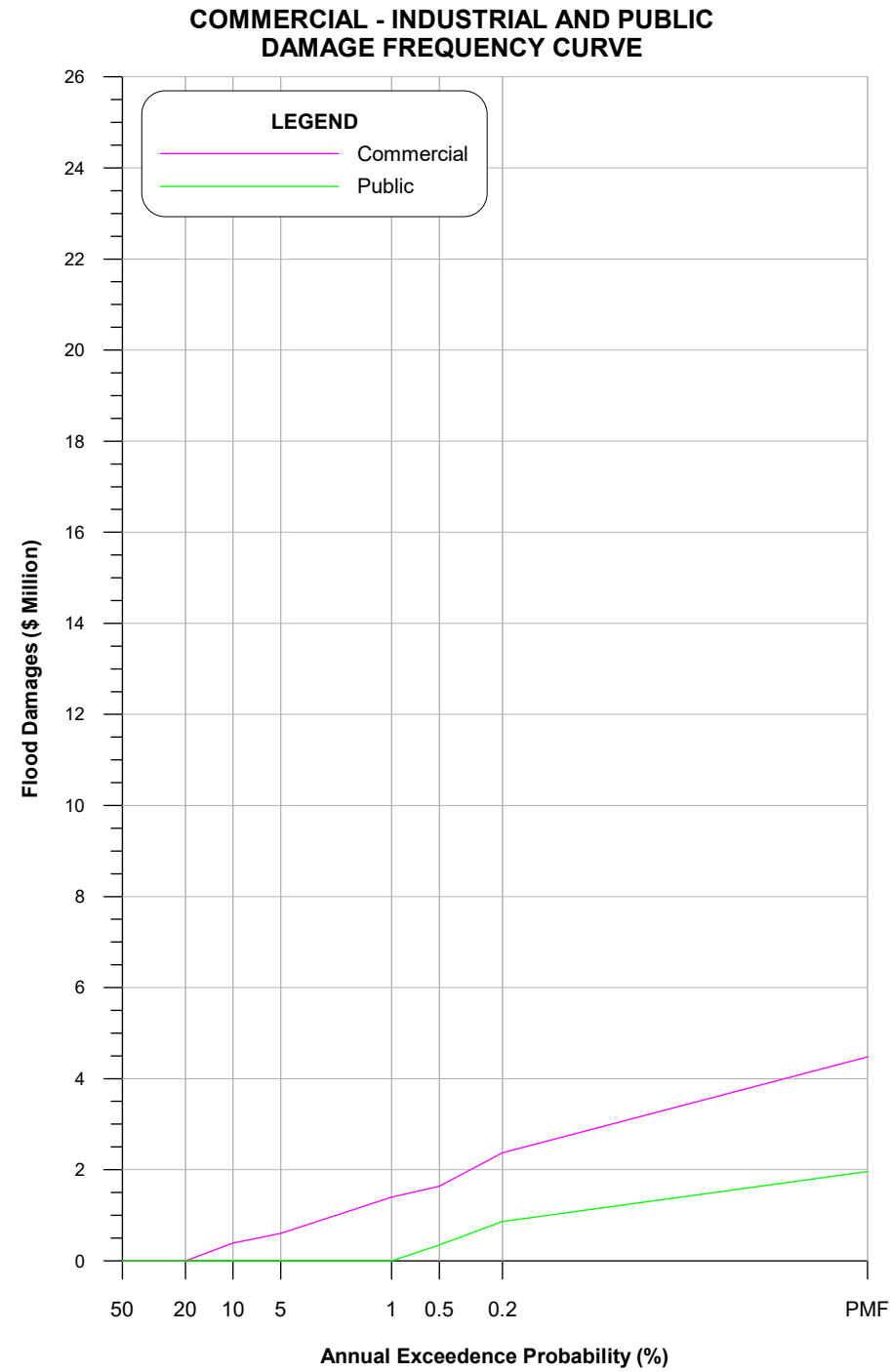
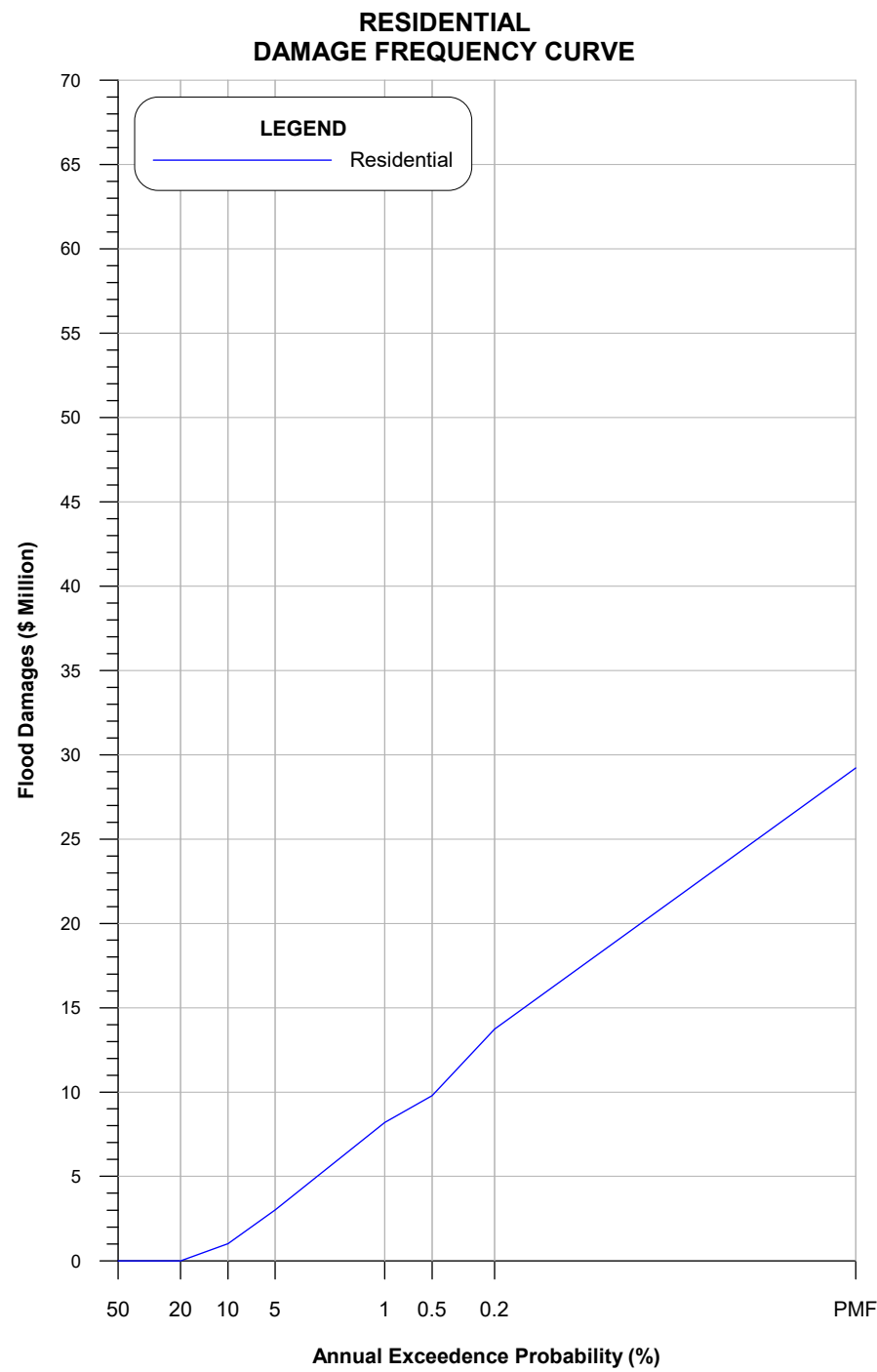
APPENDIX C

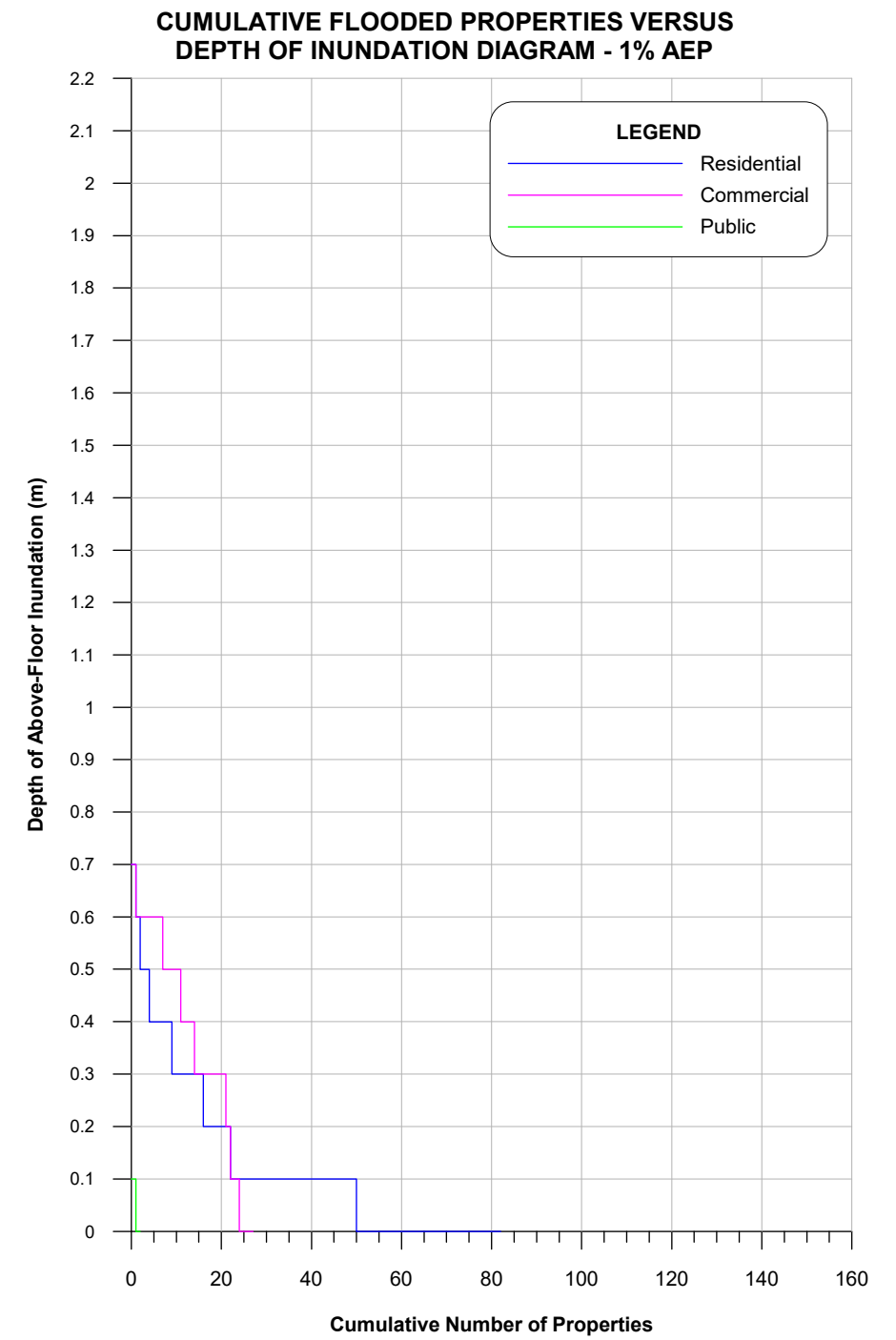
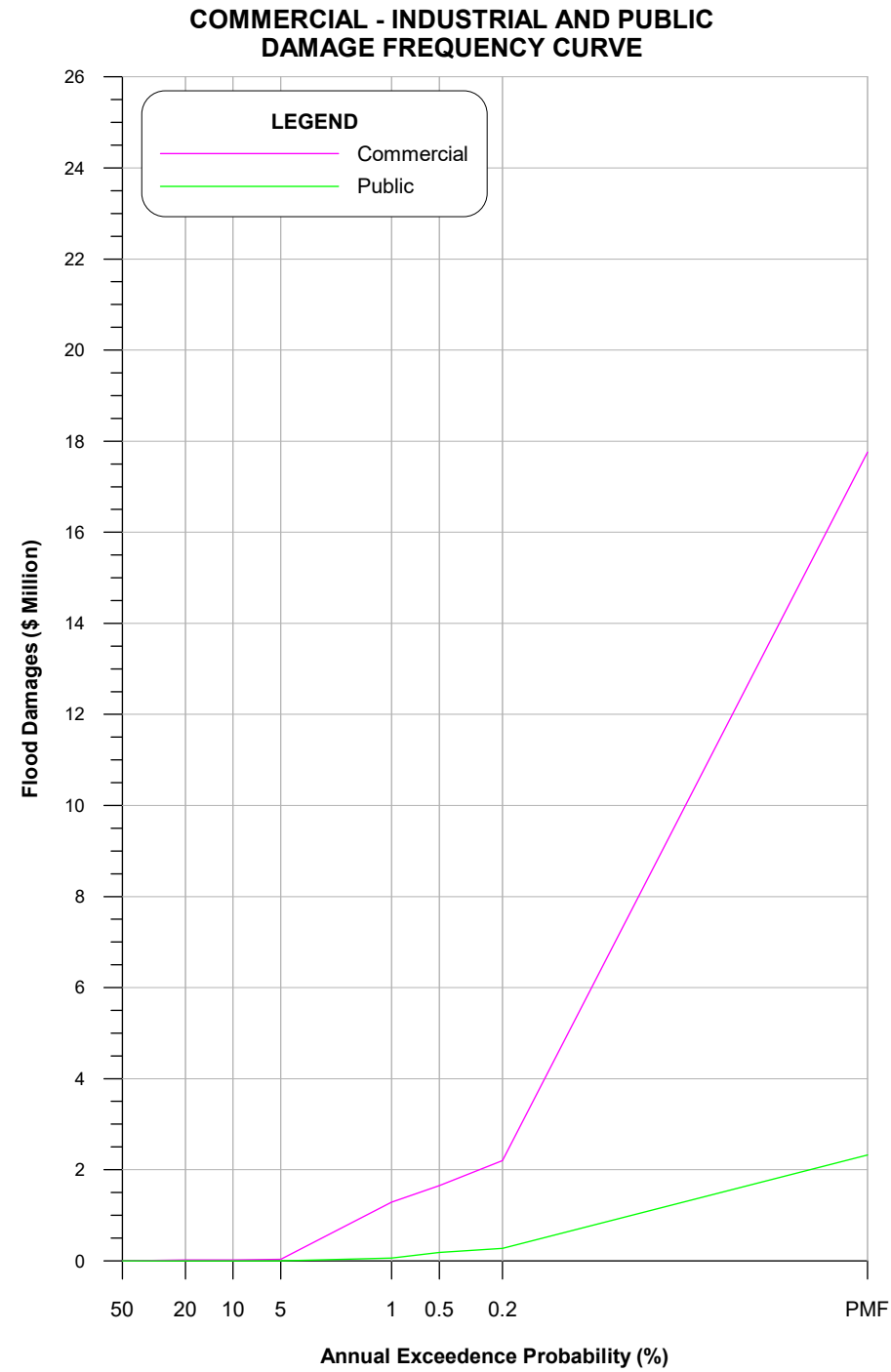
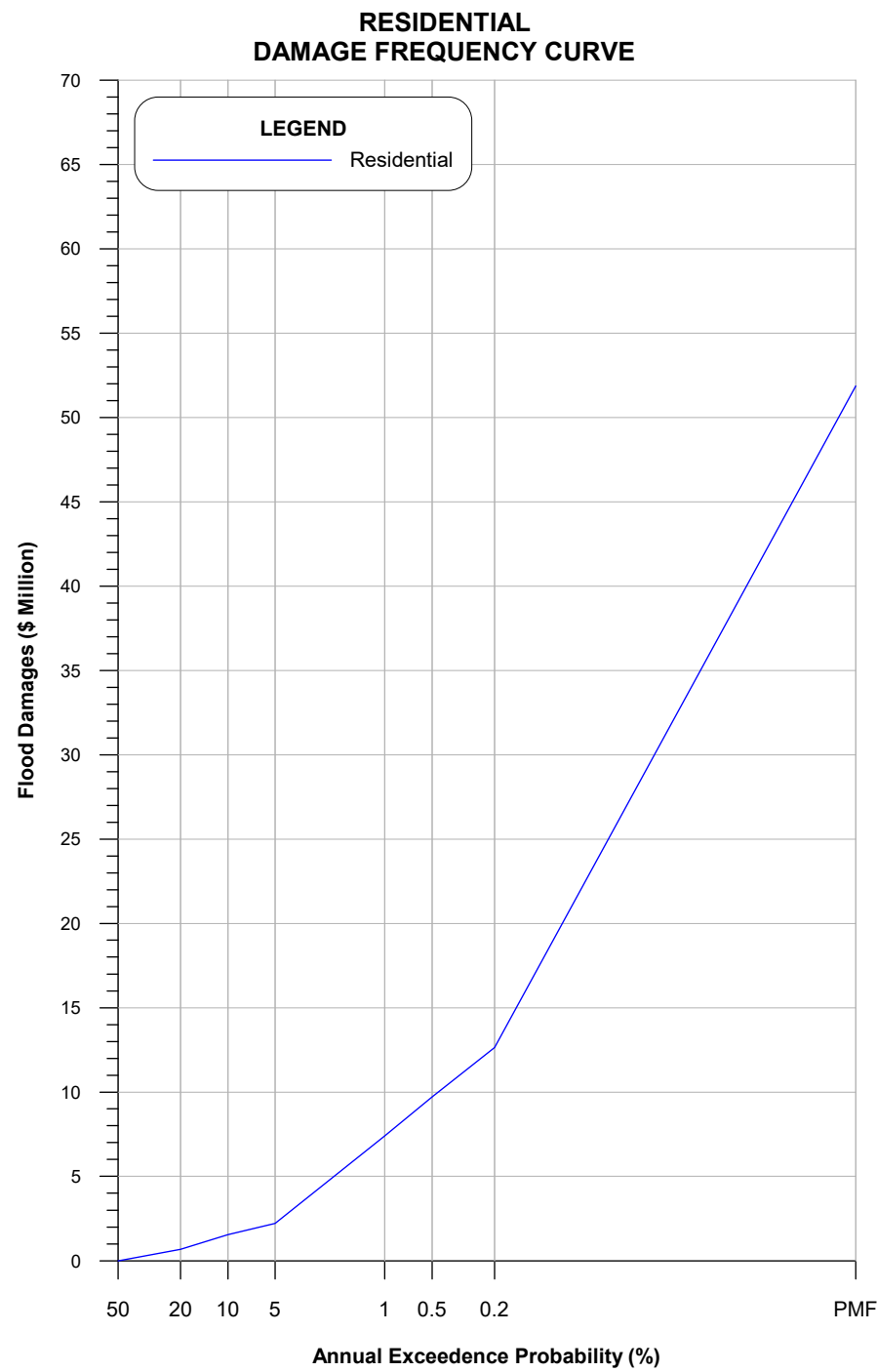
FLOOD DAMAGES

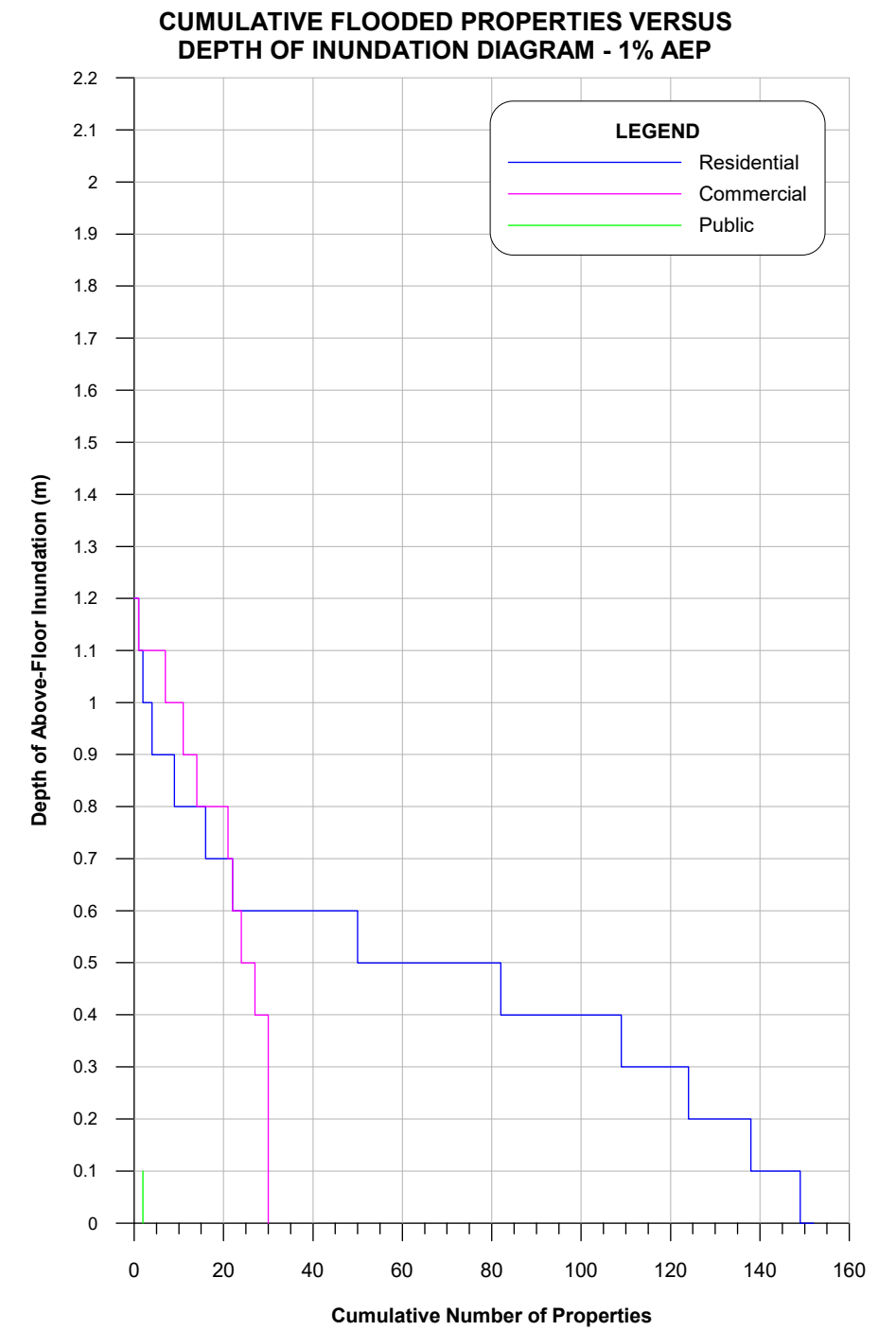
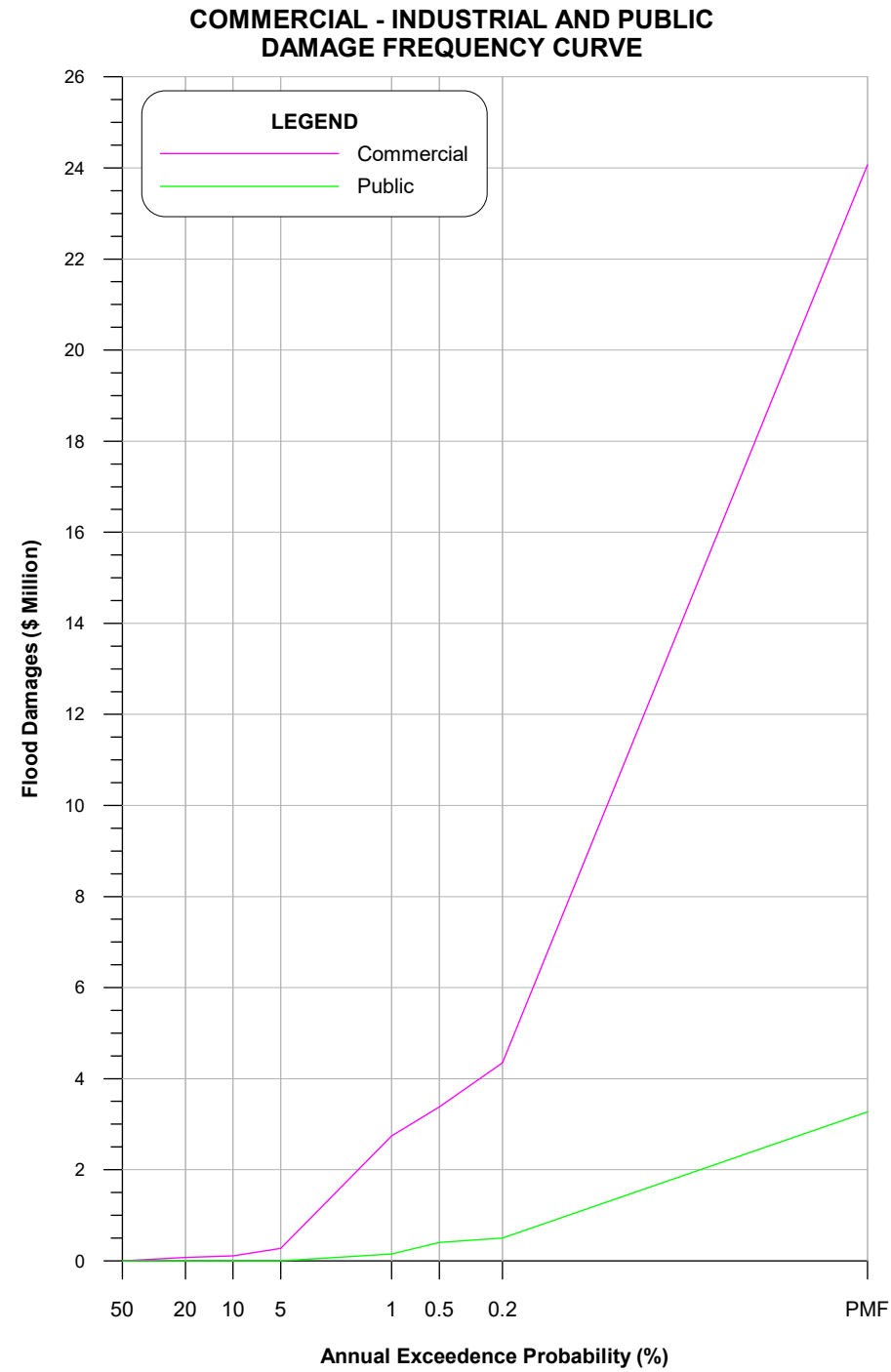
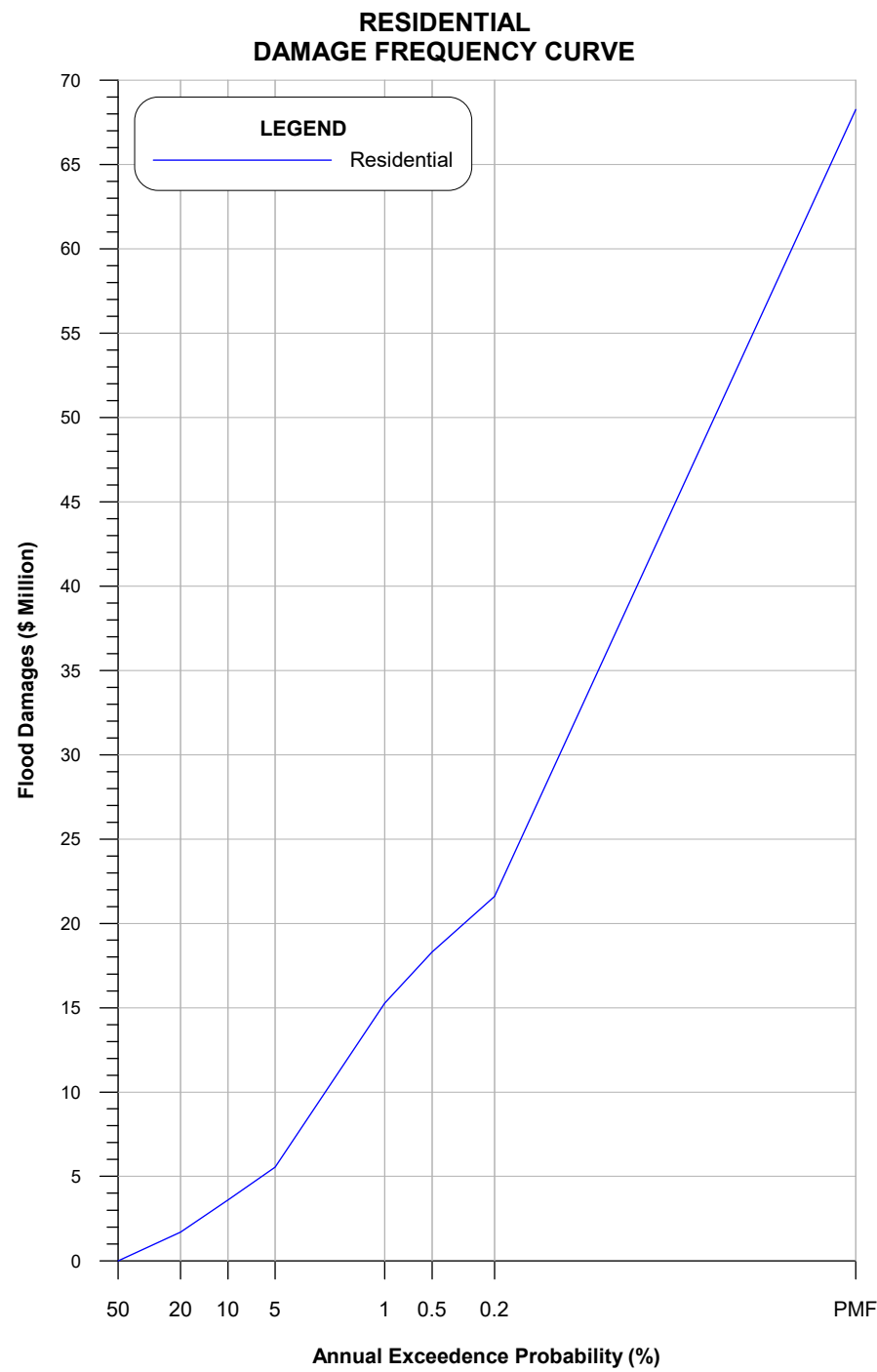
LIST OF FIGURES (APPENDIX C)

- C8.1 Damage - Frequency Curves and Cumulative Flooded Properties versus Depth of Inundation Diagram – 1% AEP Murrumbidgee River Flood (Nominal Flood Levels Case)
- C8.2 Damage - Frequency Curves and Cumulative Flooded Properties versus Depth of Inundation Diagram – 1% AEP Murrumbidgee River Flood (Freeboard Allowance Case)
- C8.3 Damage - Frequency Curves and Cumulative Flooded Properties versus Depth of Inundation Diagram – 1% AEP Local Catchment Flood (Nominal Flood Levels Case)
- C8.4 Damage - Frequency Curves and Cumulative Flooded Properties versus Depth of Inundation Diagram – 1% AEP Local Catchment Flood (Freeboard Allowance Case)







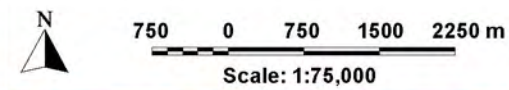
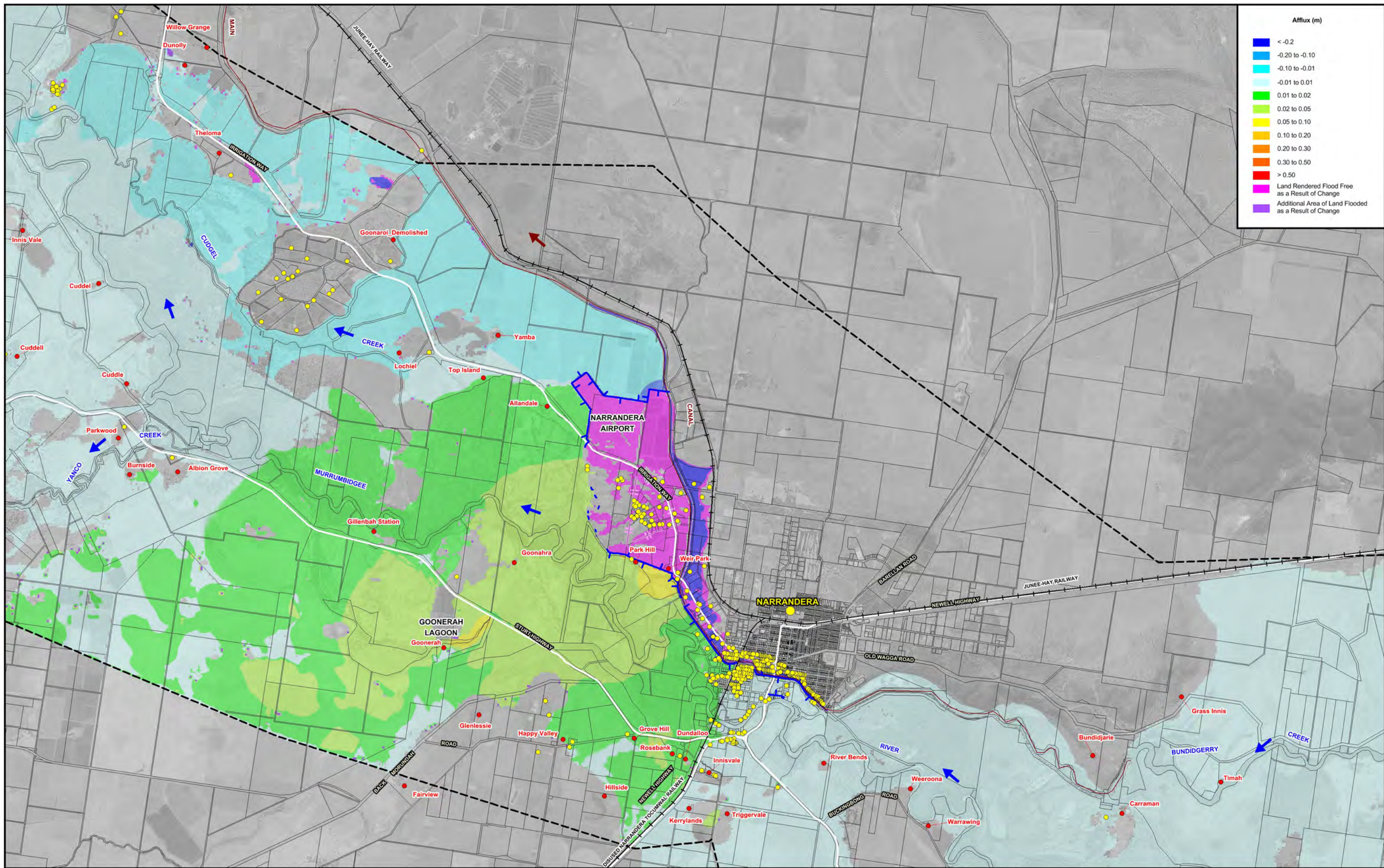


APPENDIX D

ASSESSED FLOOD MODIFICATION MEASURES

LIST OF FIGURES (APPENDIX D)

- D1.1 Impact of Ultimate Flood Protection Scheme on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.2 Impact of New Town Levee Option on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.3 Longitudinal Section along Southern Main Canal Embankment Showing Sections to be Raised (2 Sheets)
- D1.4 Impact of Southern Main Canal Embankment Upgrade Option on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.5 Longitudinal Section along Narrandera Airport Levee Showing Sections to be Raised
- D1.6 Impact of Narrandera Airport Levee Replacement Option on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.7 Impact of Narrandera Airport Levee Replacement and Irrigation Way Upgrade Options on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.8 Impact of Narrandera Airport Levee Replacement and New Airport Link Road (Paynters Siding Road) Options on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.9 Impact of Narrandera Airport Levee Replacement and Weir Park Road Levee Options on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.10 Impact of Narrandera Airport and Nallabooma Estate Ring Levee Option on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.11 Impact of Old Brewery Road Upgrade on Flooding Behaviour – 1% AEP Murrumbidgee River Flood
- D1.12 Impact of Town Siphon Works on Flooding Behaviour – 1% AEP Local Catchment Flood
- D1.13 Impact of Woolscour Road Siphon Works (Option 1) on Flooding Behaviour – 1% AEP Local Catchment Flood
- D1.14 Impact of Woolscour Road Siphon Works (Option 2) on Flooding Behaviour – 1% AEP Local Catchment Flood
- D1.15 Impact of Detention Basin Strategy (Option 1) on Flooding Behaviour – 1% AEP Local Catchment Flood
- D1.16 Impact of Detention Basin Strategy (Option 2) on Flooding Behaviour – 1% AEP Local Catchment Flood
- D1.17 Impact of Detention Basin Strategy (Option 3) on Flooding Behaviour – 1% AEP Local Catchment Flood
- D1.18 Extent of Flood Planning Area – Pre- and Post-Detention Basin Strategy (Option2) Conditions



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

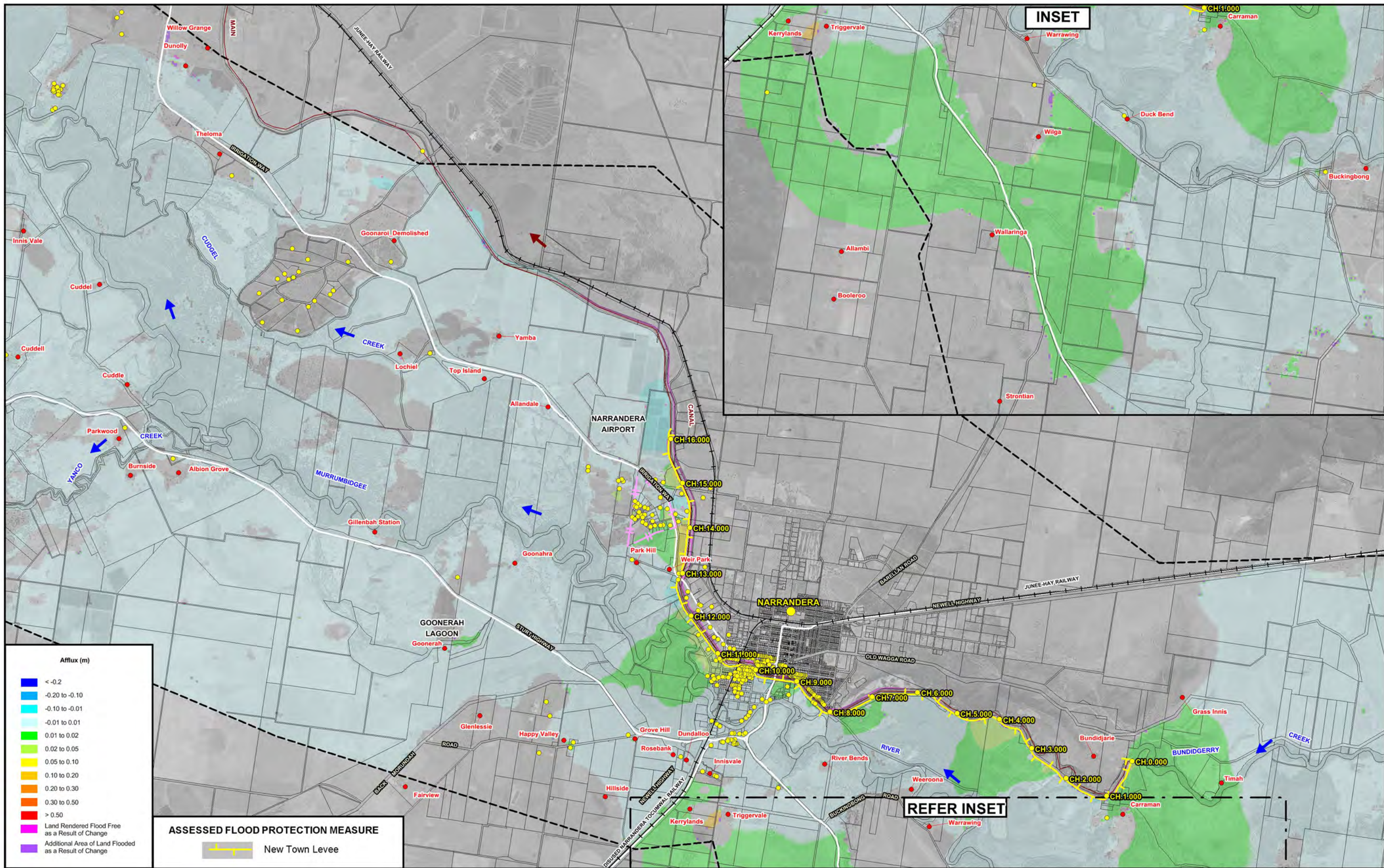
- LEGEND**
- TUFLOW Model Extent
 - Major Road
 - Railway
 - Nallabooma Estate Boundary
 - Burnside Homestead
 - Unnamed Residence
 - Extent of Works Comprising Ultimate Flood Protection Scheme

Lyal & Associates

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.1

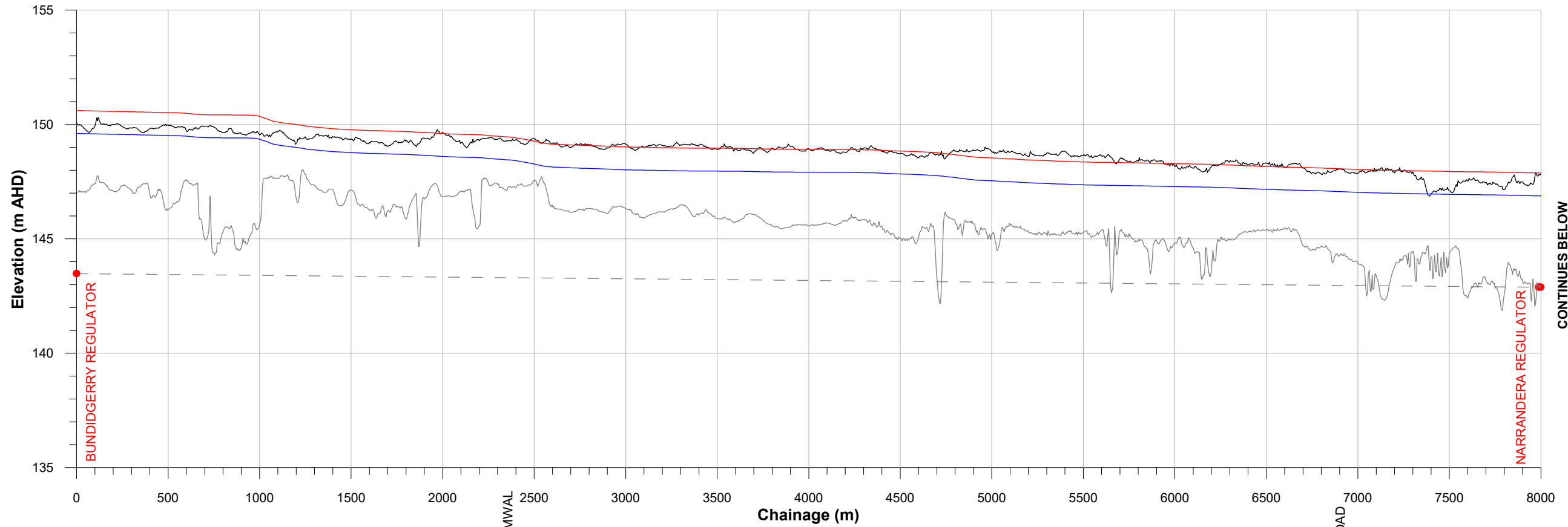
IMPACT OF ULTIMATE FLOOD PROTECTION SCHEME ON FLOODING BEHAVIOUR 1% AEP MURRUMBIDGEE RIVER FLOOD



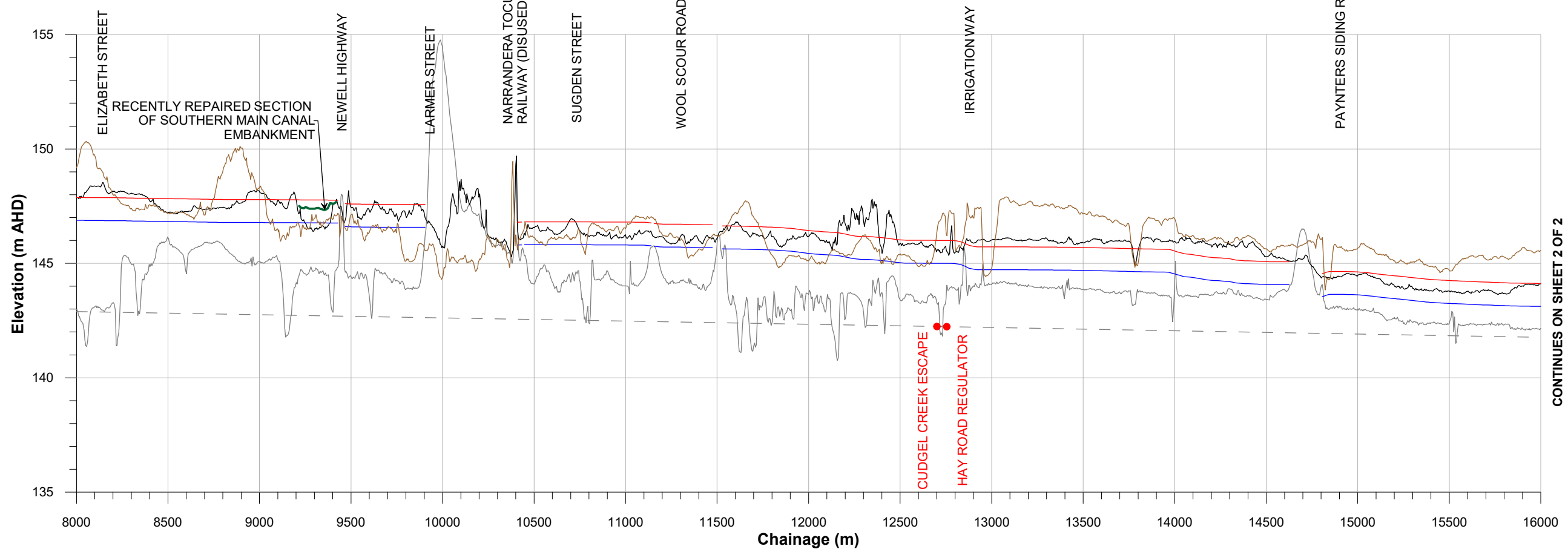
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.2

**IMPACT OF NEW TOWN LEVEE OPTION ON FLOODING BEHAVIOUR
 1% AEP MURRUMBIDGEE RIVER FLOOD**



CONTINUES BELOW



CONTINUES ON SHEET 2 OF 2

WATER SURFACE PROFILES
 — 1% AEP + 1.0m Freeboard
 — 1% AEP

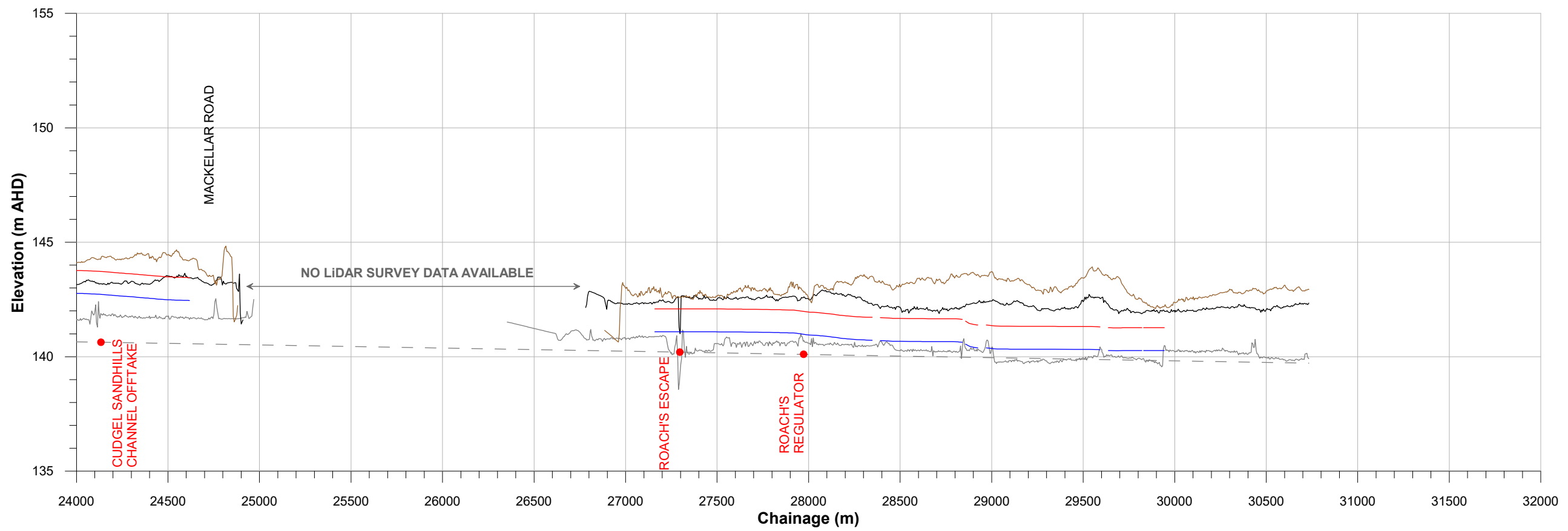
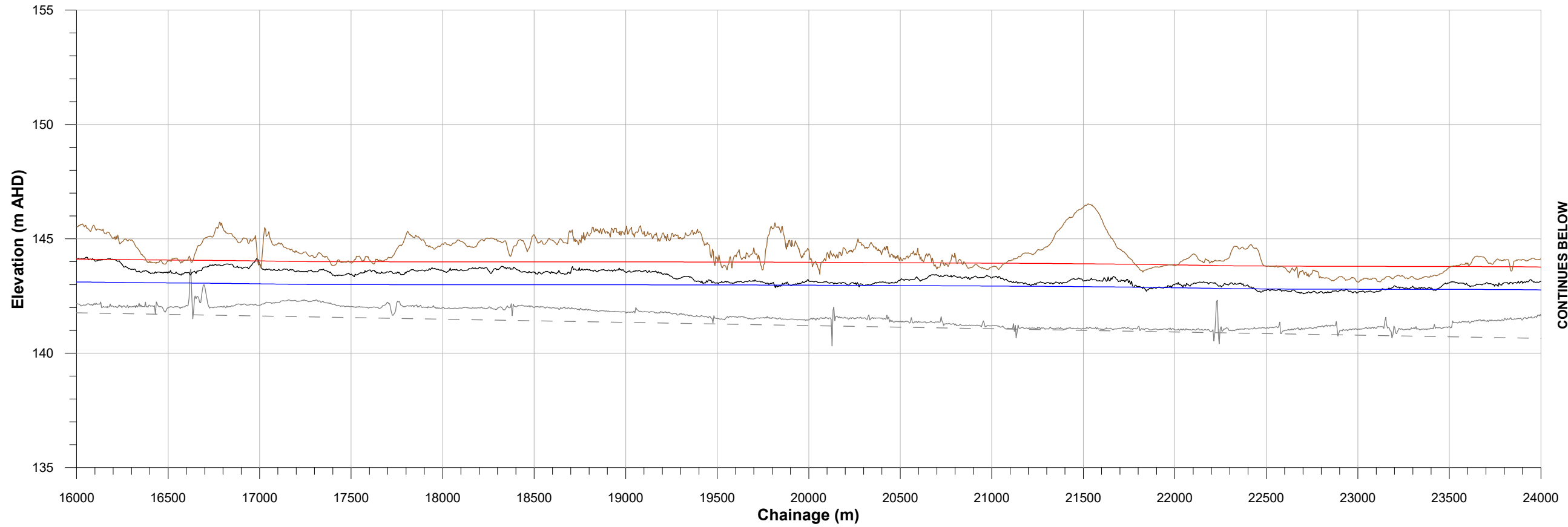
GROUND PROFILES
 — Crest Level of Northern Main Canal Embankment
 — Crest Level of Southern Main Canal Embankment
 — Level of Floodplain on River Side of Southern Main Canal Embankment
 - - - - - Invert Level of Main Canal (approx)

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.3
 (Sheet 1 of 2)

LONGITUDINAL SECTION ALONG SOUTHERN MAIN CANAL EMBANKMENT
 SHOWING SECTIONS TO BE RAISED





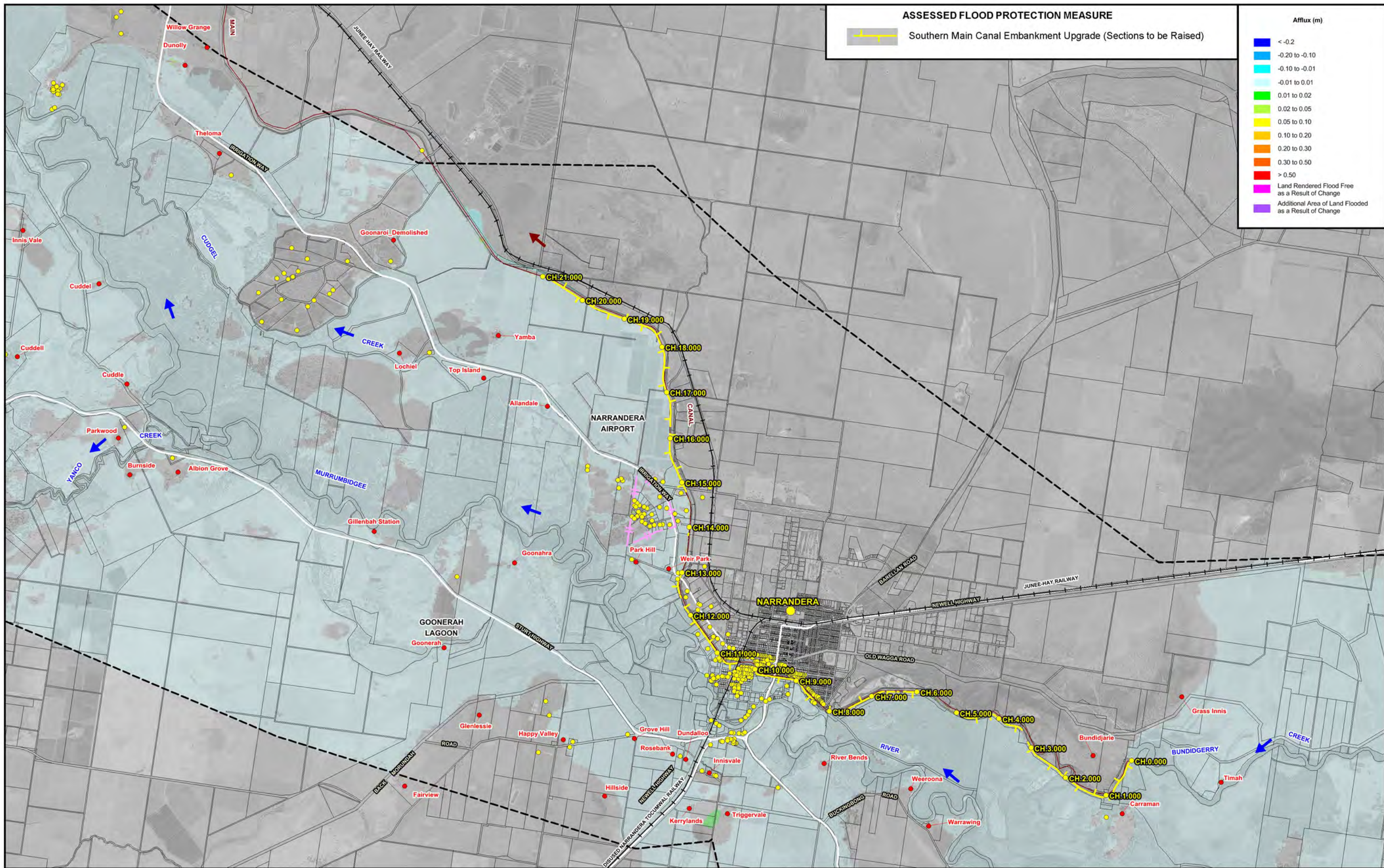
- | WATER SURFACE PROFILES | | GROUND PROFILES | |
|------------------------|-------------------------|-----------------|---|
| | 1% AEP + 1.0m Freeboard | | Crest Level of Northern Main Canal Embankment |
| | 1% AEP | | Crest Level of Southern Main Canal Embankment |
| | | | Level of Floodplain on River Side of Southern Main Canal Embankment |
| | | | Invert level of Main Canal (approx) |

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.3
(Sheet 2 of 2)

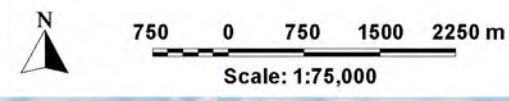
LONGITUDINAL SECTION ALONG SOUTHERN MAIN CANAL EMBANKMENT SHOWING SECTIONS TO BE RAISED





ASSESSED FLOOD PROTECTION MEASURE
 Southern Main Canal Embankment Upgrade (Sections to be Raised)

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
Light Yellow	0.02 to 0.05
Yellow	0.05 to 0.10
Orange	0.10 to 0.20
Dark 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

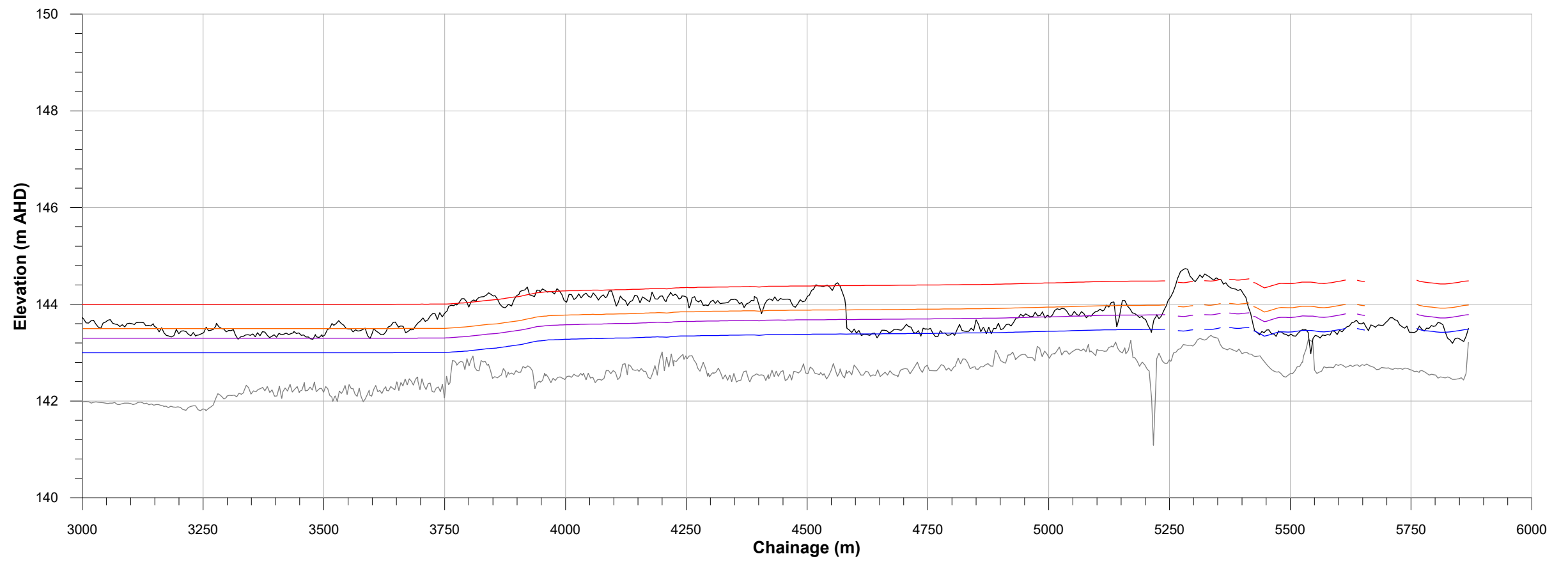
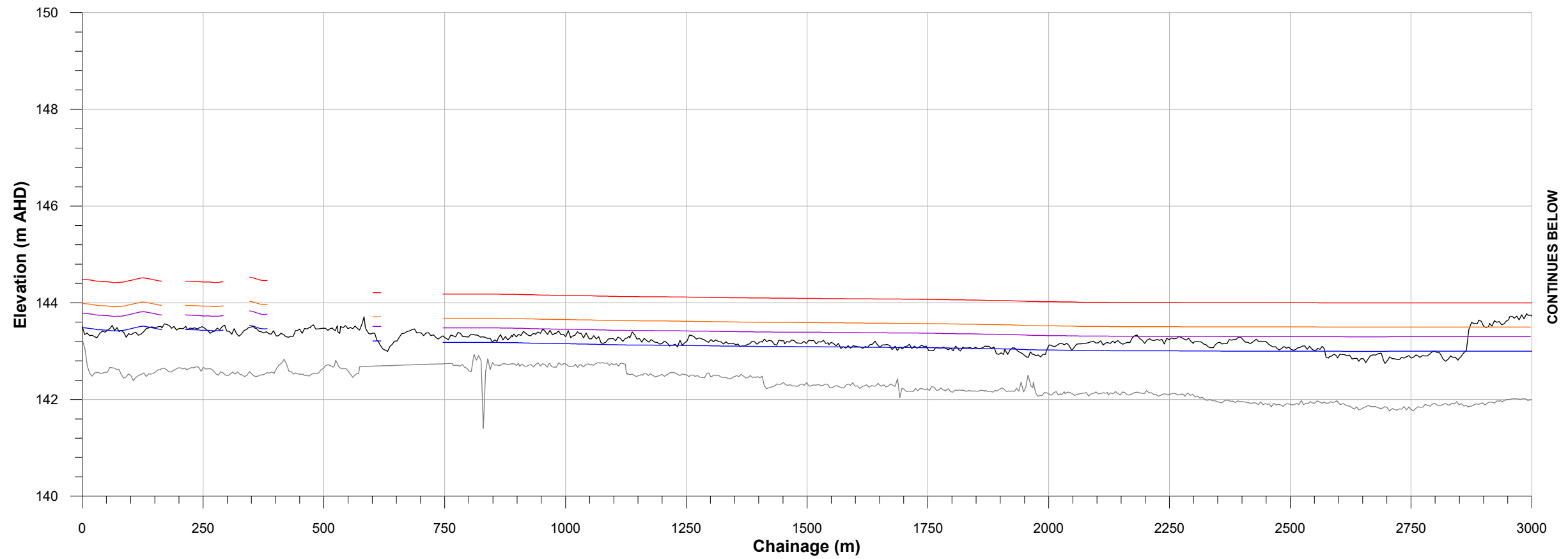


NOTE:
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 Location of homesteads and unnamed residences only shown for potentially flood affected areas.

LEGEND	
--- (Dashed line)	TUFLOW Model Extent
— (Thick grey line)	Major Road
—+—+— (Line with cross-ticks)	Railway
● (Red dot)	Weir Park Homestead
● (Yellow dot)	Unnamed Residence
—+—+— (Pink dashed line)	Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.4



WATER SURFACE PROFILES

- 1% AEP + 1.0m Freeboard
- 1% AEP + 0.5m Freeboard
- 1% AEP + 0.3m Freeboard
- 1% AEP

GROUND PROFILES

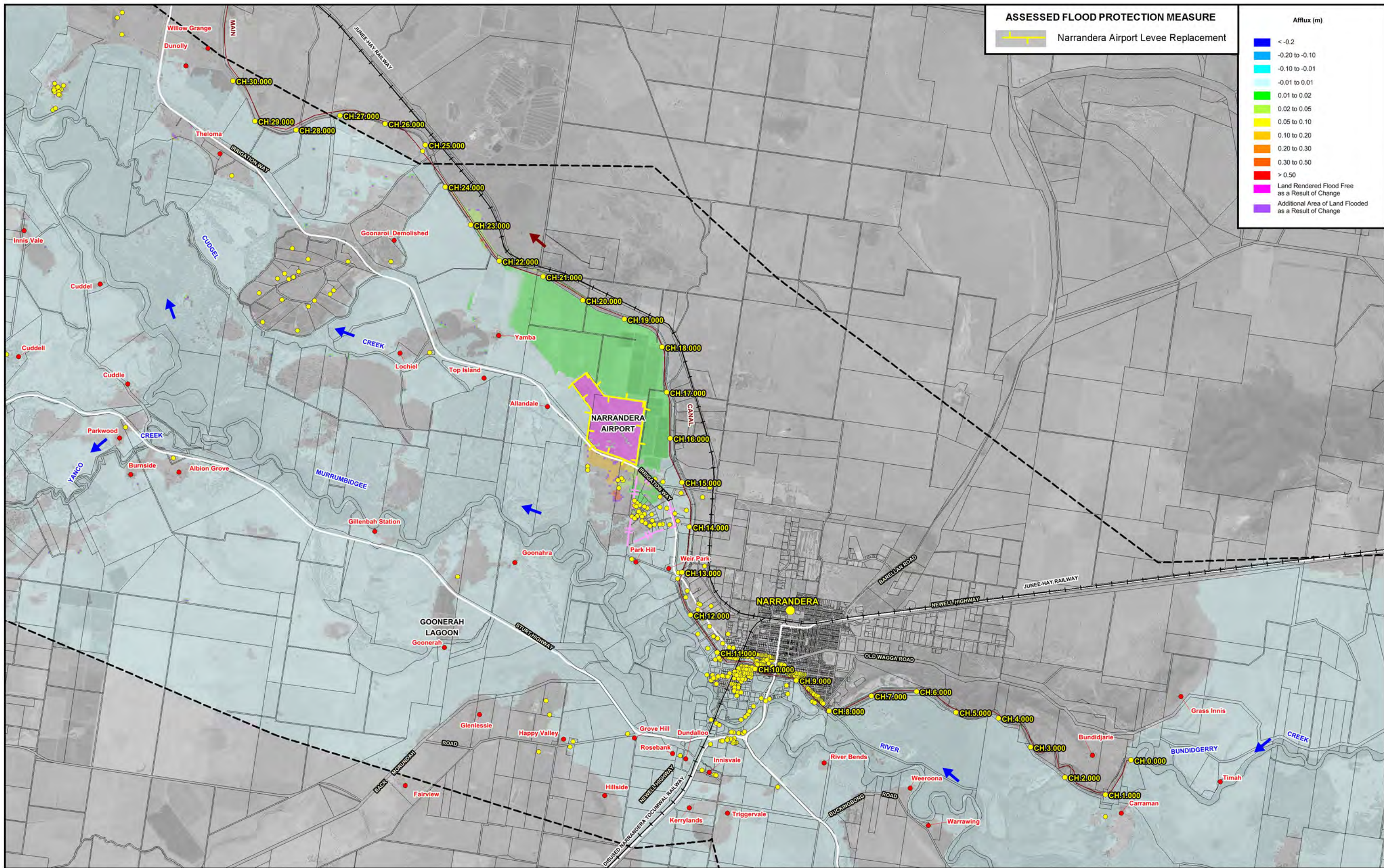
- Crest Level of Narrandera Airport Levee
- Level of Floodplain on River Side of Narrandera Airport Levee

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.5

LONGITUDINAL SECTION ALONG NARRANDERA AIRPORT LEVEE SHOWING SECTIONS TO BE RAISED





ASSESSED FLOOD PROTECTION MEASURE

Narrandera Airport Levee Replacement

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

Scale: 1:75,000

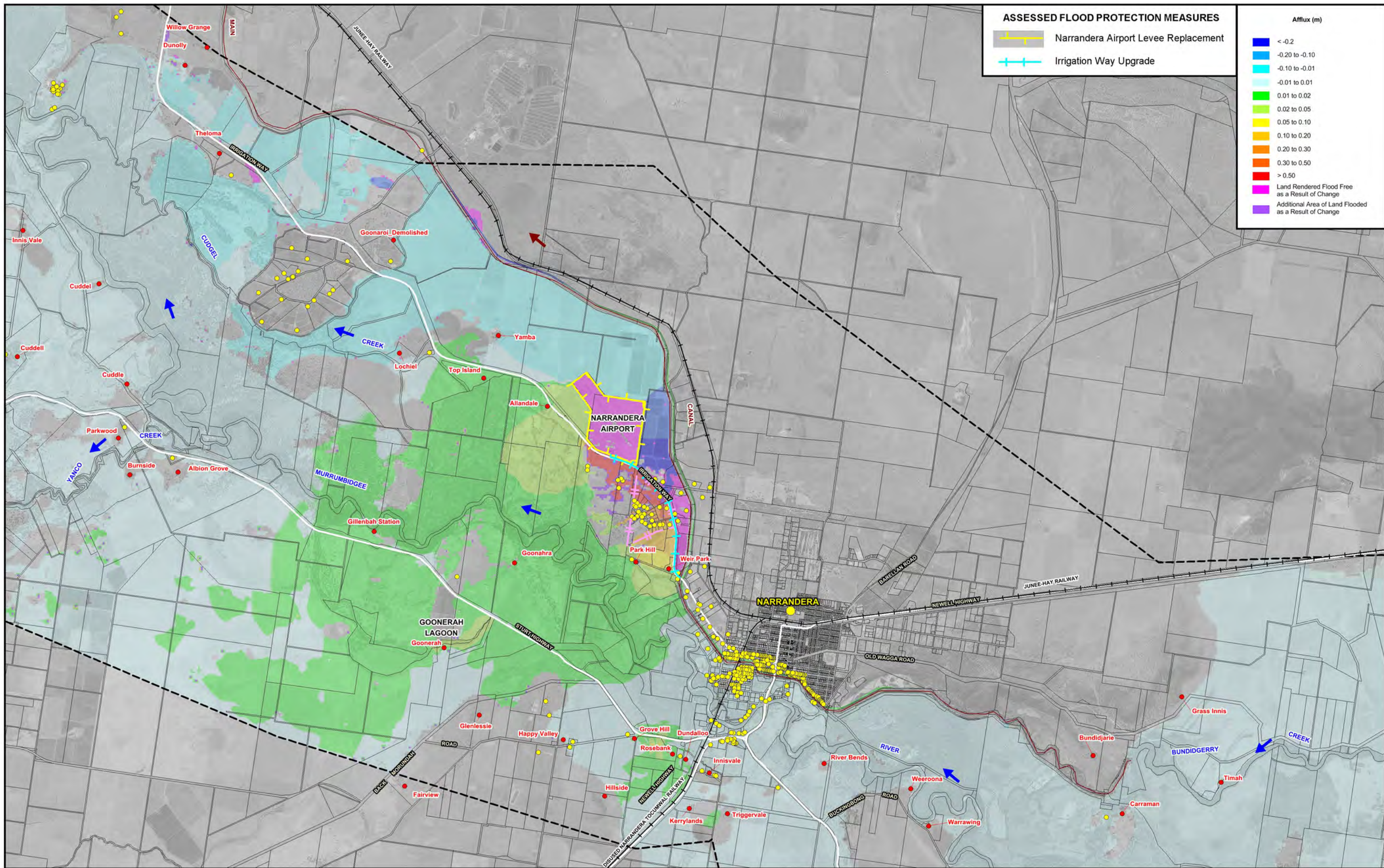
0 750 1500 2250 m

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

LEGEND

- TUFLOW Model Extent
- Major Road
- Railway
- Weir Park Homestead
- Unnamed Residence
- Nallabooma Estate Boundary

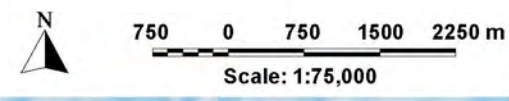
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN



ASSESSED FLOOD PROTECTION MEASURES

- Narrandera Airport Levee Replacement
- Irrigation Way Upgrade

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

LEGEND

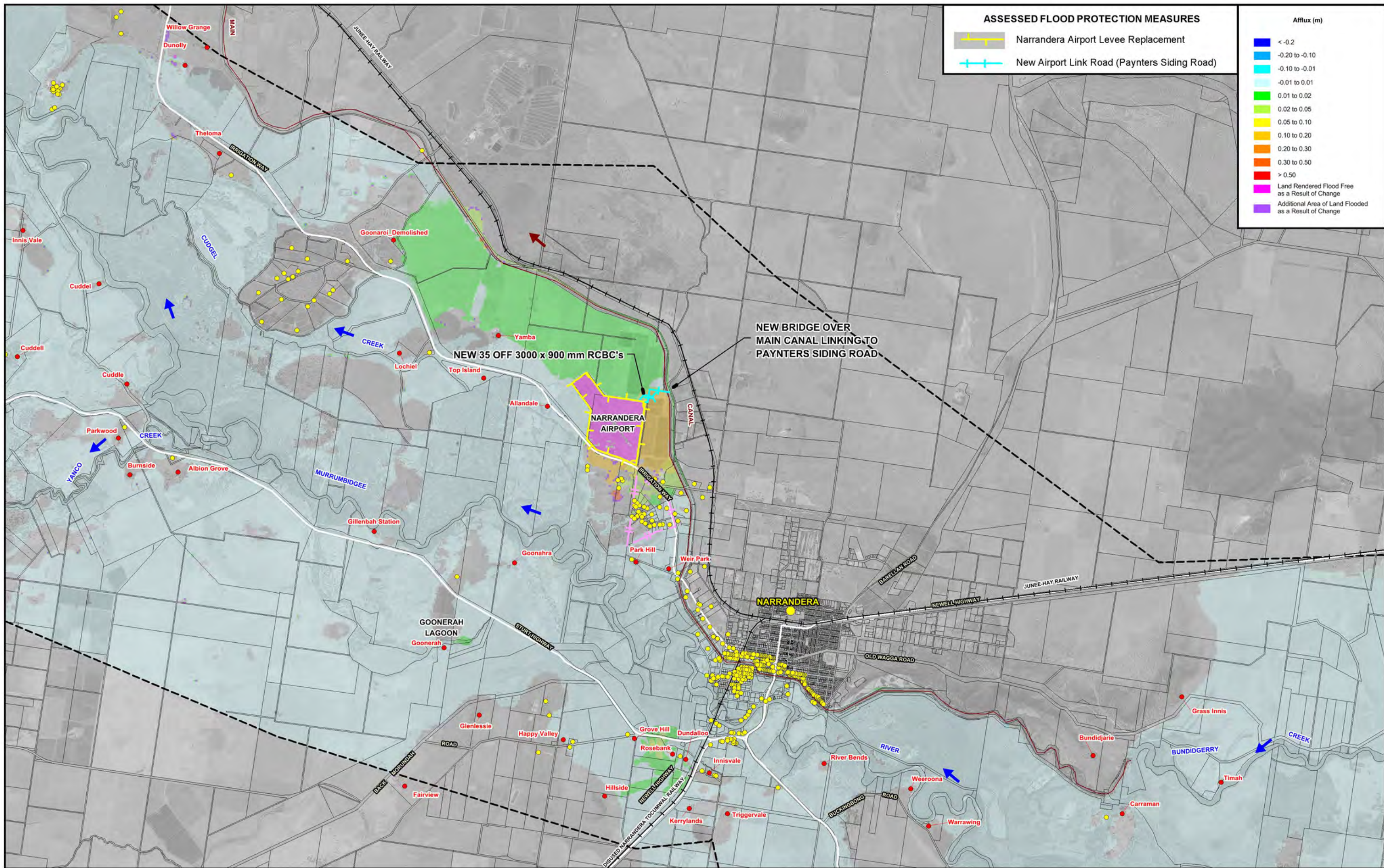
--- TUFLOW Model Extent	● Weir Park Homestead
— Major Road	● Unnamed Residence
— Railway	— Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.7

Lyal & Associates

IMPACT OF NARRANDERA AIRPORT LEVEE REPLACEMENT AND IRRIGATION WAY UPGRADE OPTIONS ON FLOODING BEHAVIOUR - 1% AEP MURRUMBIDGEE RIVER FLOOD



ASSESSED FLOOD PROTECTION MEASURES

- Narrandera Airport Levee Replacement
- New Airport Link Road (Paynters Siding Road)

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

Scale: 1:75,000

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

LEGEND

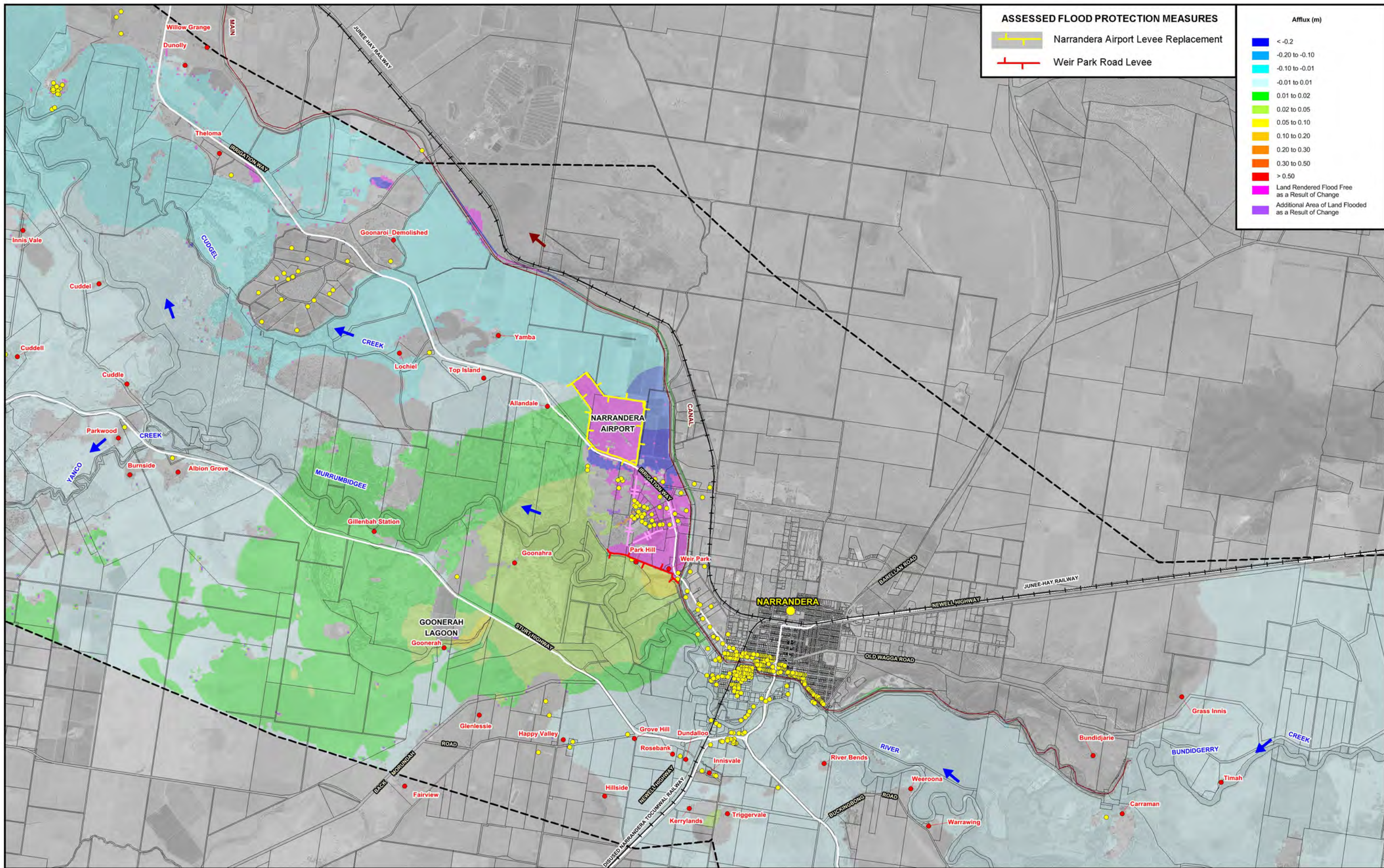
- TUFLOW Model Extent
- Major Road
- Railway
- Weir Park Homestead
- Unnamed Residence
- Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.8



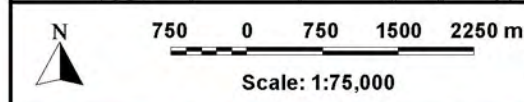
IMPACT OF NARRANDERA AIRPORT LEVEE REPLACEMENT AND NEW AIRPORT LINK ROAD (PAYNTERS SIDING ROAD) OPTIONS ON FLOODING BEHAVIOUR - 1% AEP MURRUMBIDGEE RIVER FLOOD



ASSESSED FLOOD PROTECTION MEASURES

- Narrandera Airport Levee Replacement
- Weir Park Road Levee

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



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

LEGEND

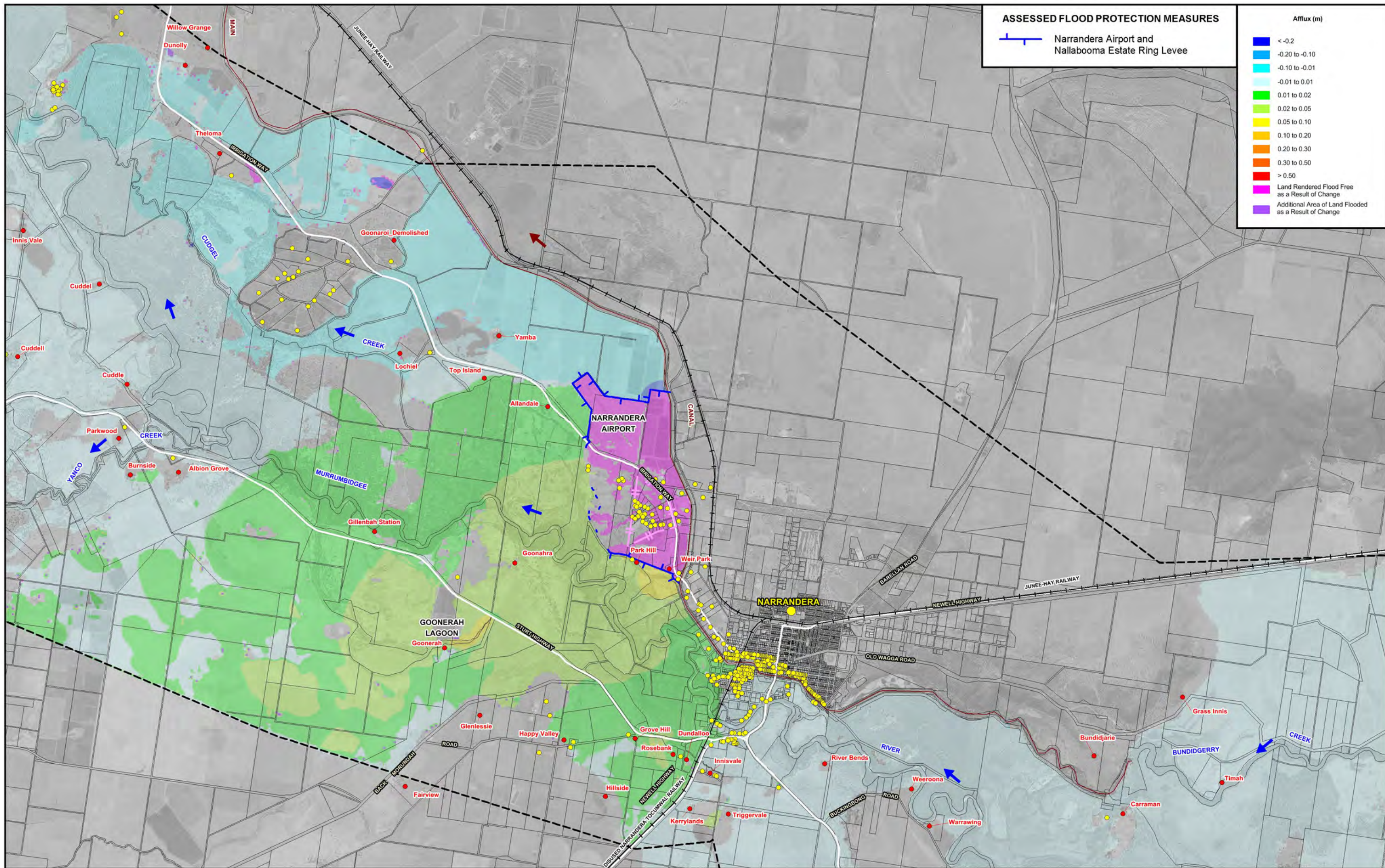
--- TUFLOW Model Extent	● Weir Park Homestead
— Major Road	● Unnamed Residence
--- Railway	--- Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN



IMPACT OF NARRANDERA AIRPORT LEVEE REPLACEMENT AND WEIR PARK ROAD LEVEE OPTIONS ON FLOODING BEHAVIOUR - 1% AEP MURRUMBIDGEE RIVER FLOOD

Figure D1.9

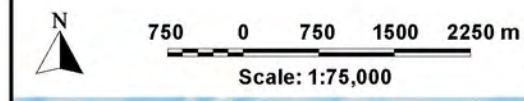


ASSESSED FLOOD PROTECTION MEASURES

Narrandera Airport and Nallabooma Estate Ring Levee

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



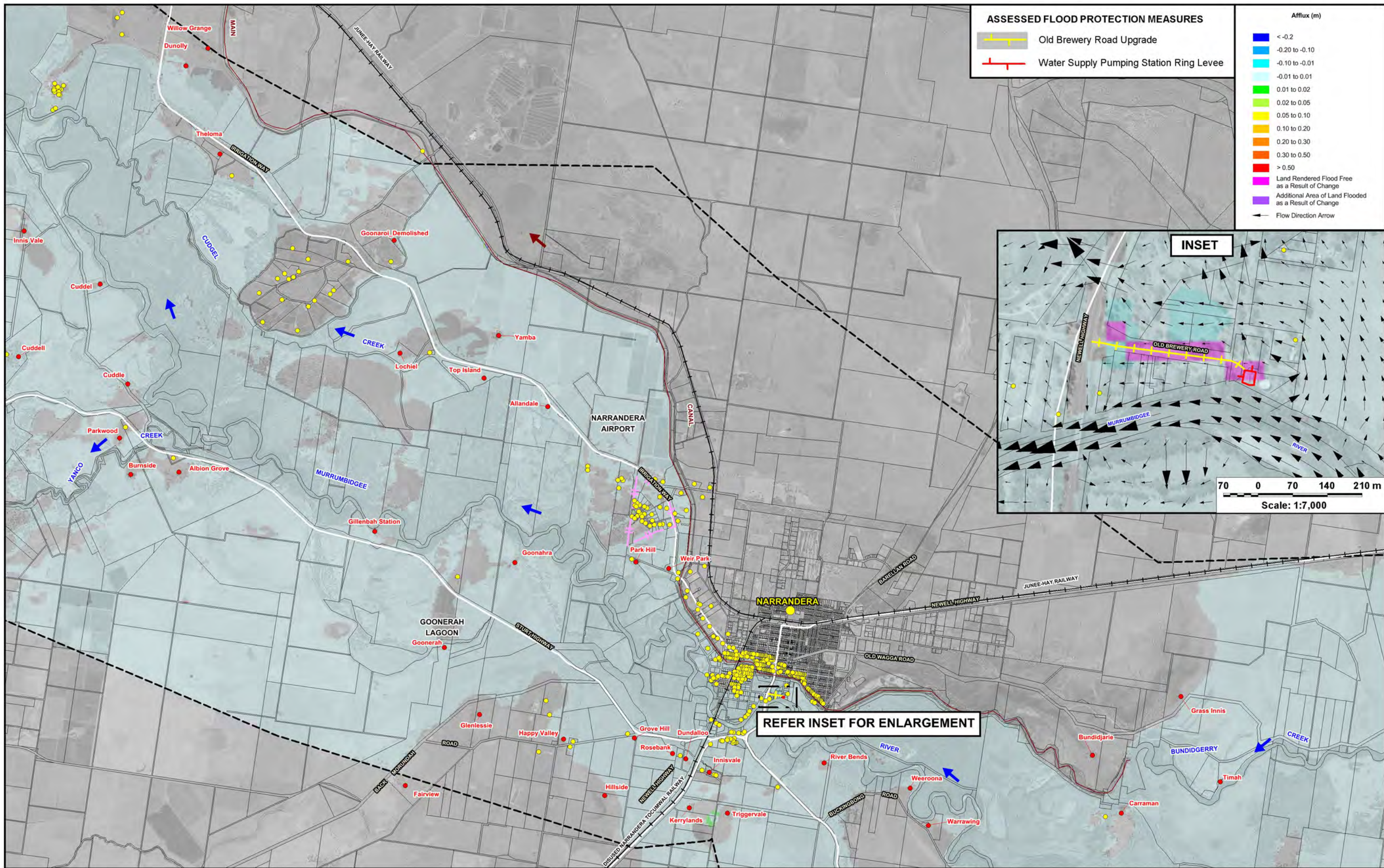
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.
 Location of homesteads and unnamed residences only shown for potentially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

LEGEND

- TUFLOW Model Extent
- == Major Road
- + Railway
- Weir Park Homestead
- Unnamed Residence
- Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.10

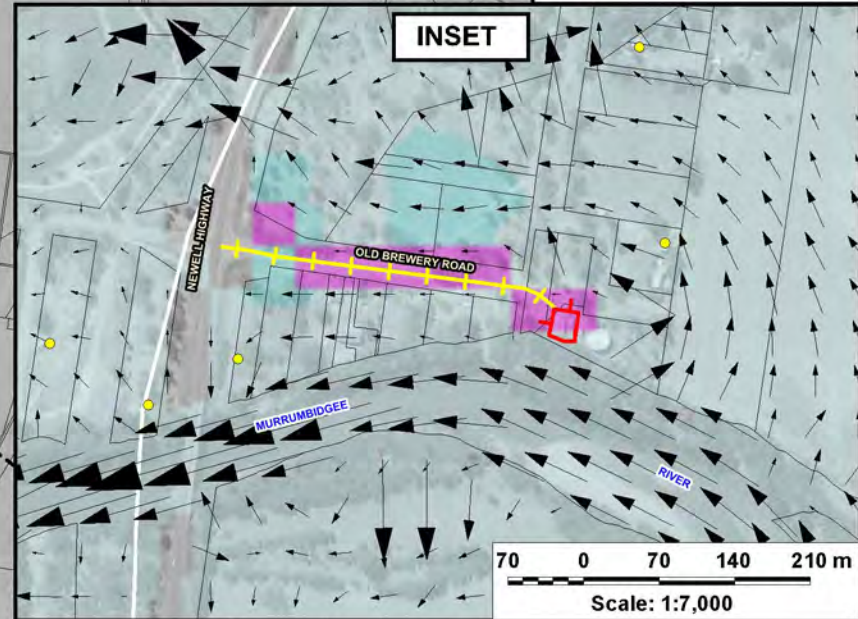


ASSESSED FLOOD PROTECTION MEASURES

- Old Brewery Road Upgrade
- Water Supply Pumping Station Ring Levee

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
- Flow Direction Arrow



REFER INSET FOR ENLARGEMENT

Scale: 1:75,000

750 0 750 1500 2250 m

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

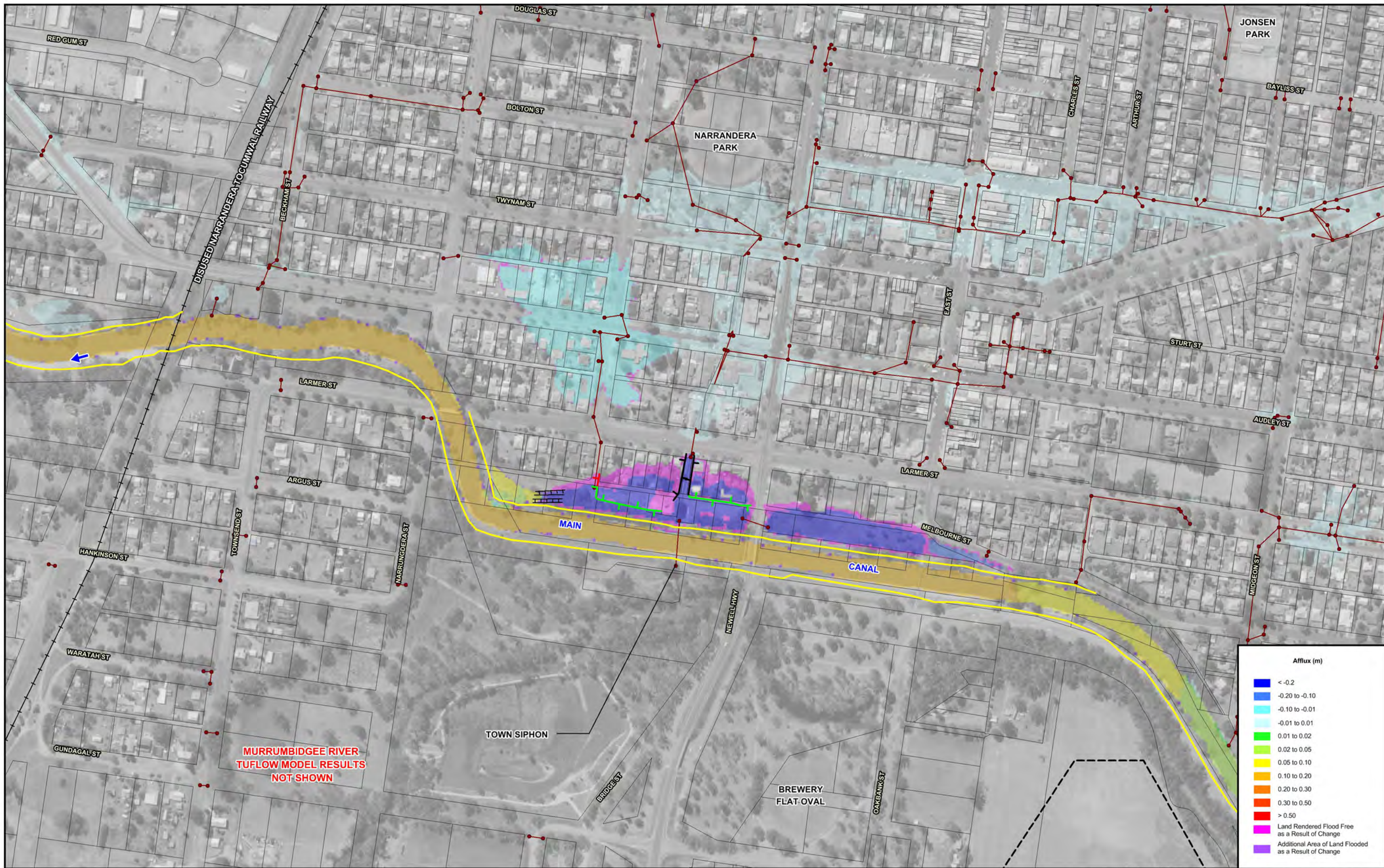
LEGEND


- TUFLOW Model Extent
- Major Road
- Railway
- Weir Park Homestead
- Unnamed Residence
- Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.11


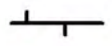




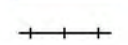
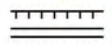
IMPACT OF OLD BREWERY ROAD UPGRADE ON FLOODING BEHAVIOUR
 1% AEP MURRUMBIDGEE RIVER FLOOD



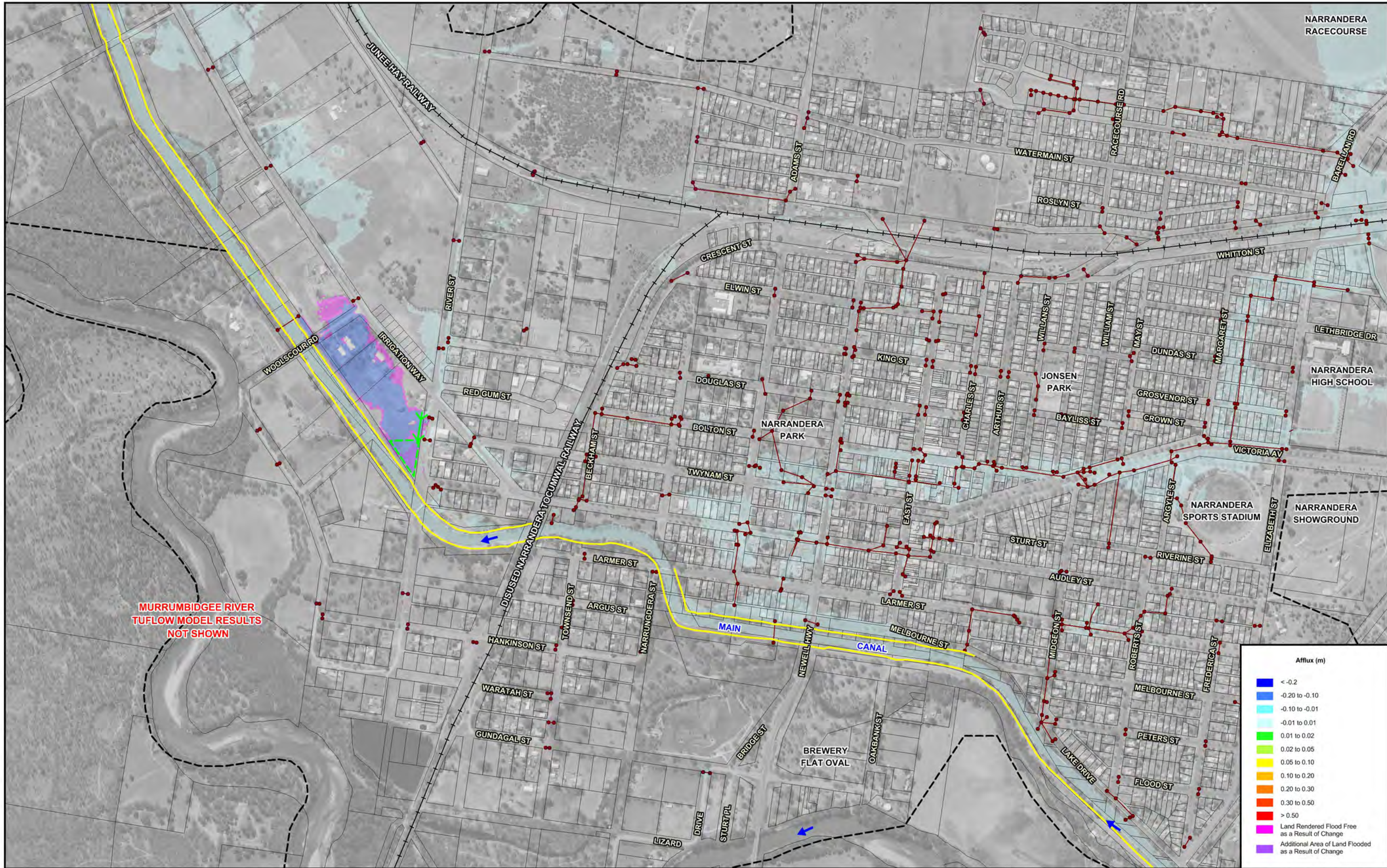

 50 0 50 100 150 m
 Scale: 1:5,000
Lyall & Associates

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

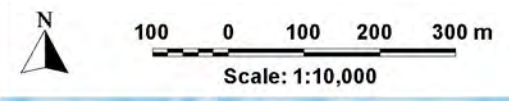
	Existing Stormwater Network		Proposed Brickwall
	Limit of Overland Flow Mapping		Proposed Earth Embankment
	Existing Canal Embankment / Levee		Proposed Raised Section of Road
	Railway		Proposed Extent of Excavation

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure D1.12
IMPACT OF TOWN SIPHON WORKS ON FLOODING BEHAVIOUR
 1% AEP LOCAL CATCHMENT FLOOD



MURRUMBIDGE RIVER
TUFLOW MODEL RESULTS
NOT SHOWN

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



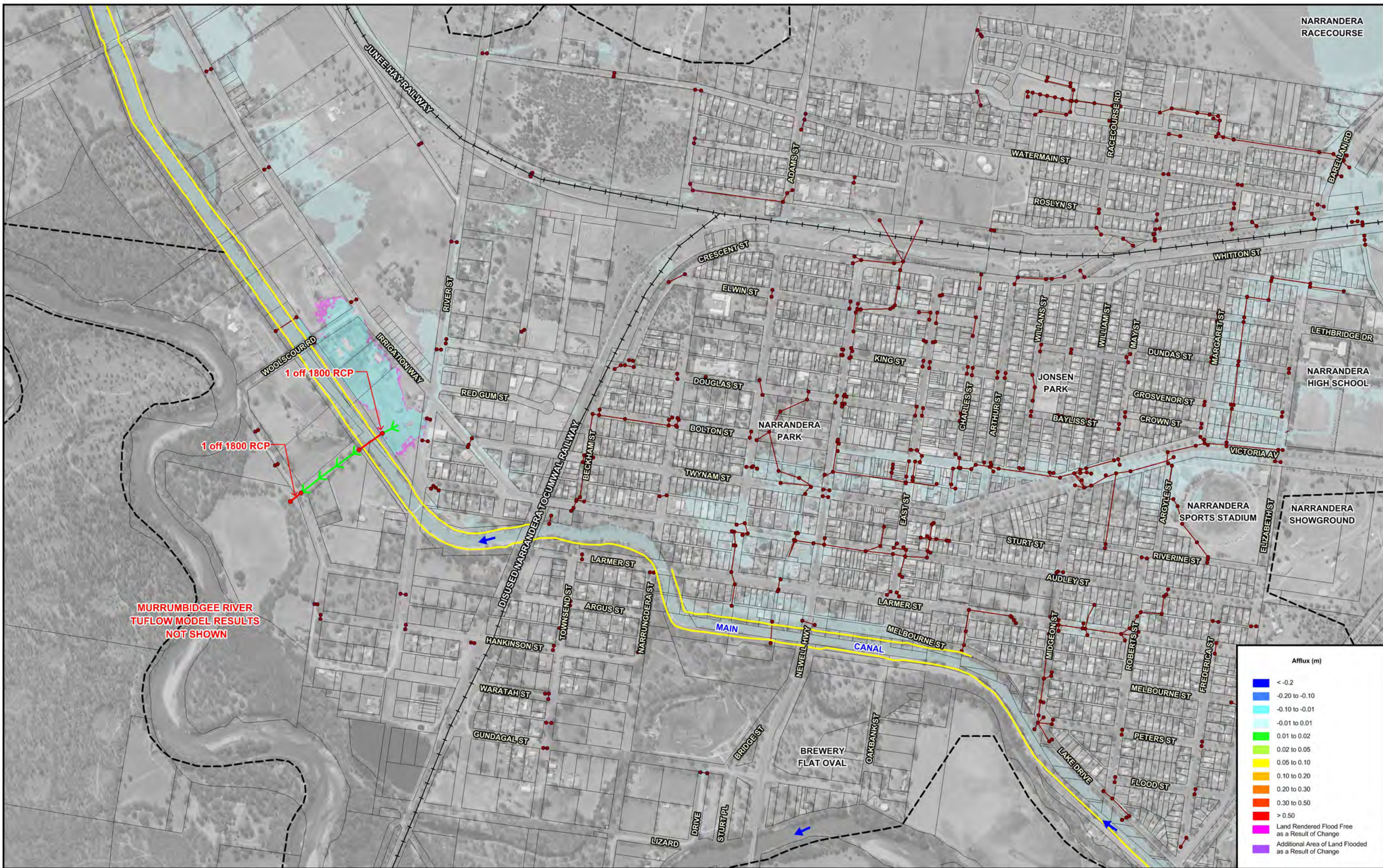
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

- LEGEND**
- Existing Stormwater Network
 - Limit of Overland Flow Mapping
 - Existing Canal Embankment / Levee
 - Railway

- Proposed Channel Works
- Proposed Excavated Storage Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.13



100 0 100 200 300 m

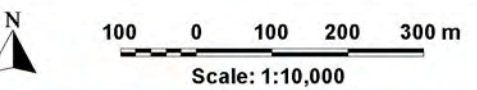
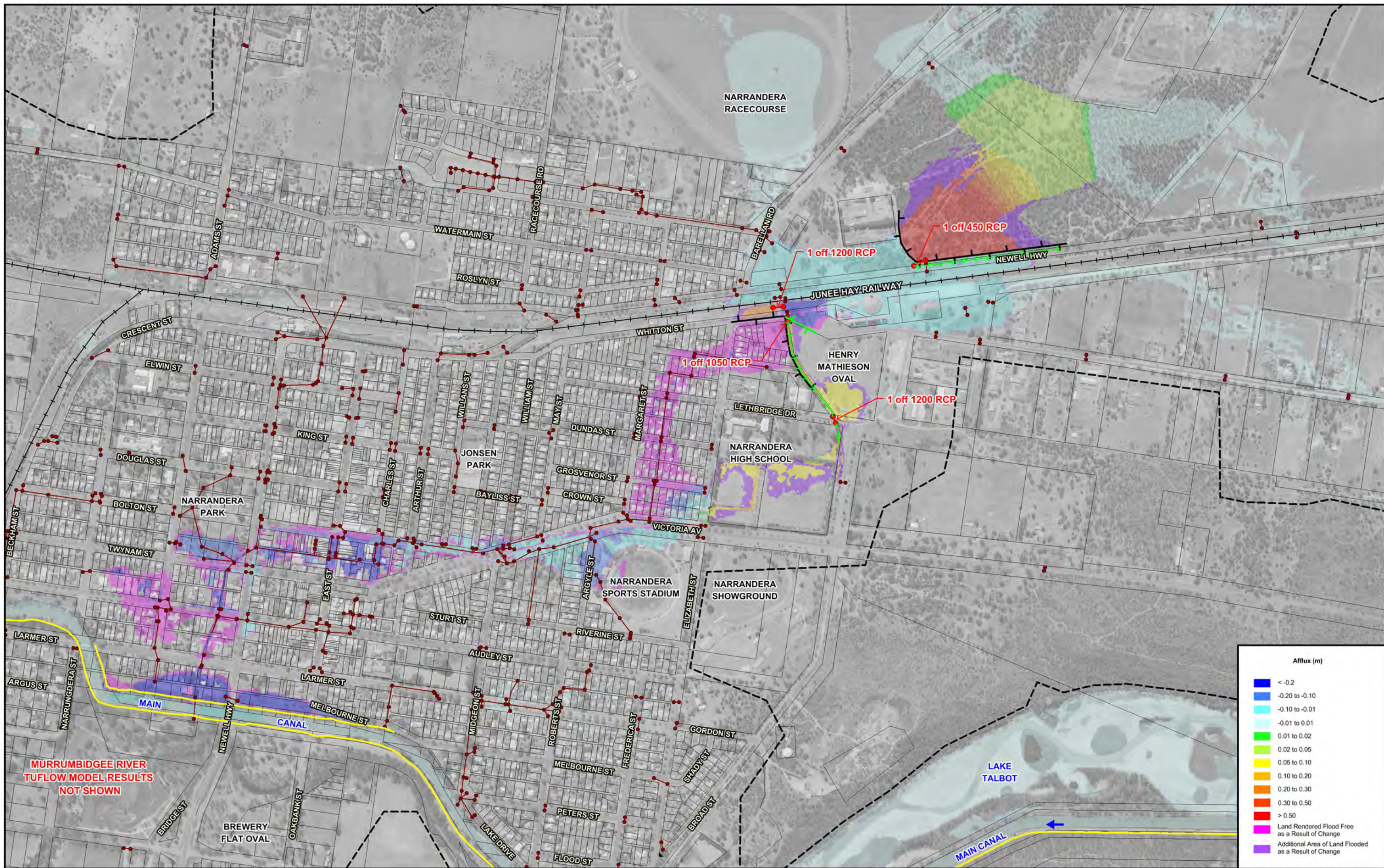
 Scale: 1:10,000

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**
- Existing Stormwater Network
 - Limit of Overland Flow Mapping
 - Existing Canal Embankment / Levee
 - Railway

- Proposed Channel Works
- Proposed Stormwater Network

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure D1.14
IMPACT OF WOOLSCOUR ROAD SIPHON WORKS (OPTION 2) ON FLOODING BEHAVIOUR
 1% AEP LOCAL CATCHMENT FLOOD



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.

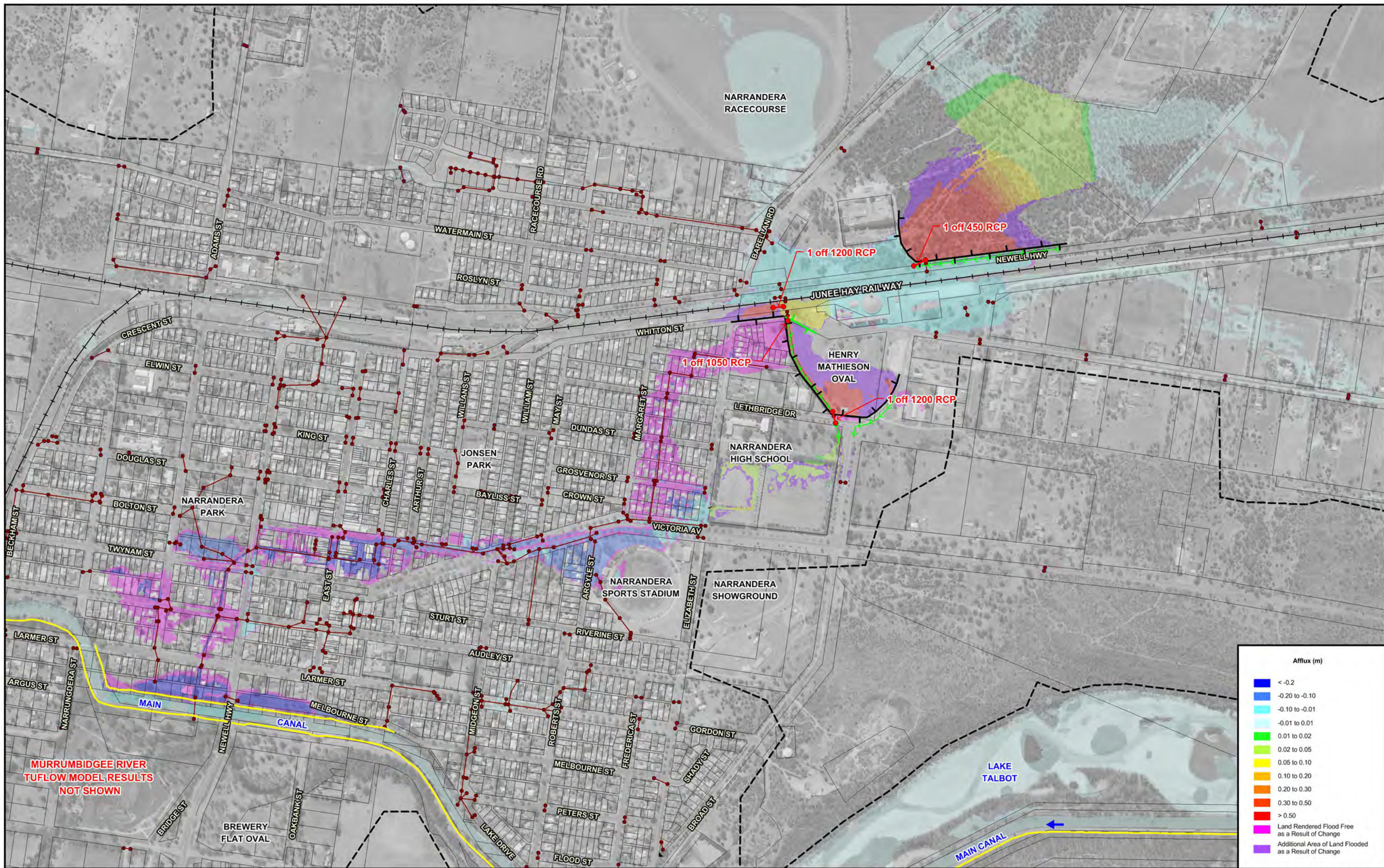
- LEGEND**
- Existing Stormwater Network
 - Limit of Overland Flow Mapping
 - Existing Canal Embankment / Levee
 - Railway

- Proposed Embankment / Raised Section of Road
- Proposed Lowered Section of Road
- Proposed Stormwater Network
- Proposed Channel Works

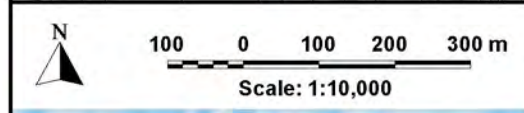
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.15

IMPACT OF DETENTION BASIN STRATEGY (OPTION 1) ON FLOODING BEHAVIOUR - 1% AEP LOCAL CATCHMENT FLOOD



Afflux (m)	
Blue	< -0.2
Light Blue	-0.20 to -0.10
Light Cyan	-0.10 to -0.01
Cyan	-0.01 to 0.01
Green	0.01 to 0.02
Light 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



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.

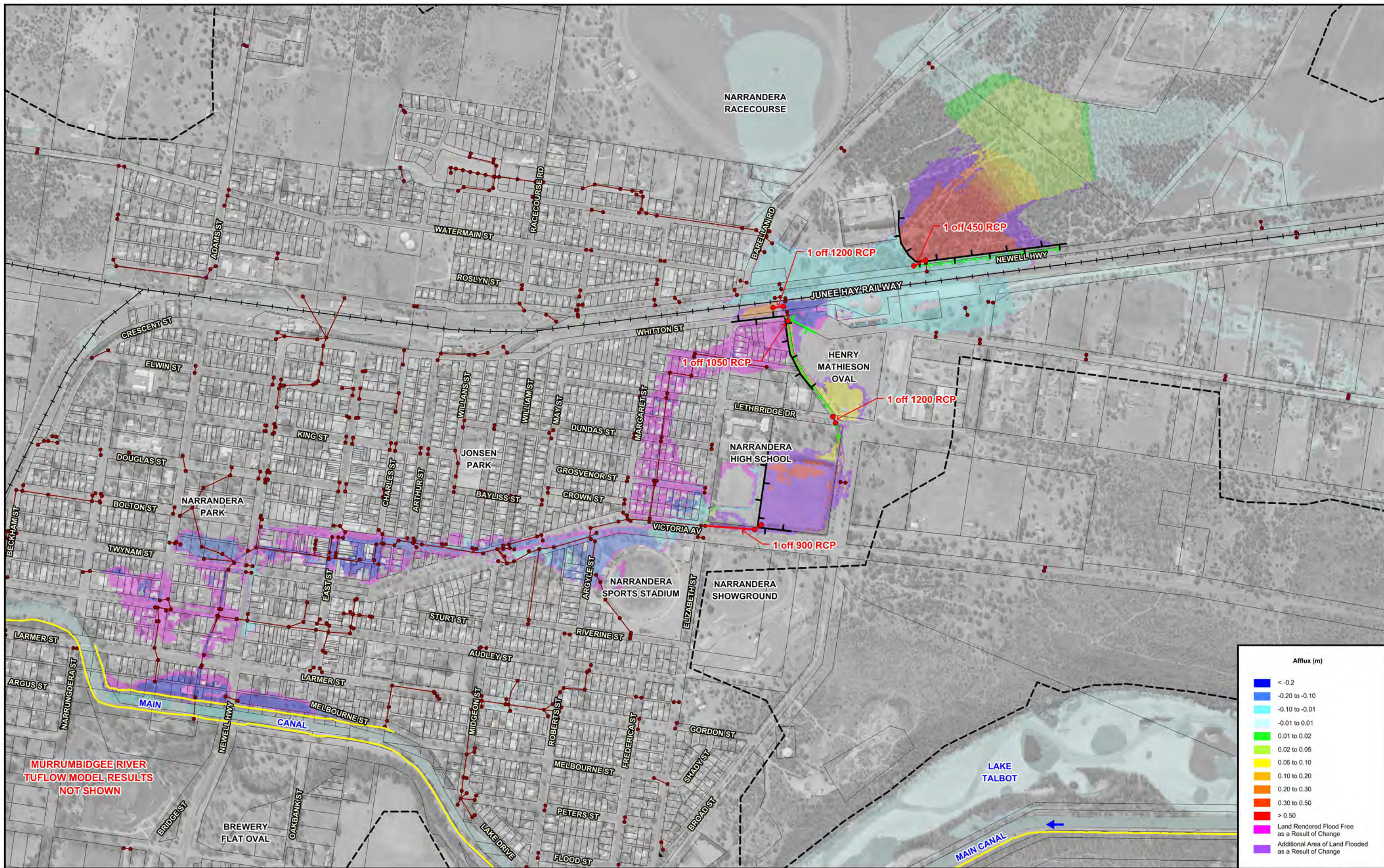
- LEGEND**
- Existing Stormwater Network
 - Limit of Overland Flow Mapping
 - Existing Canal Embankment / Levee
 - Railway


- Proposed Embankment / Raised Section of Road
- Proposed Lowered Section of Road
- Proposed Stormwater Network
- Proposed Channel Works

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

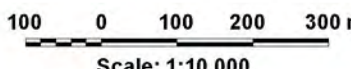
Figure D1.16

IMPACT OF DETENTION BASIN STRATEGY (OPTION 2) ON FLOODING BEHAVIOUR - 1% AEP LOCAL CATCHMENT FLOOD













 Scale: 1:10,000



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.

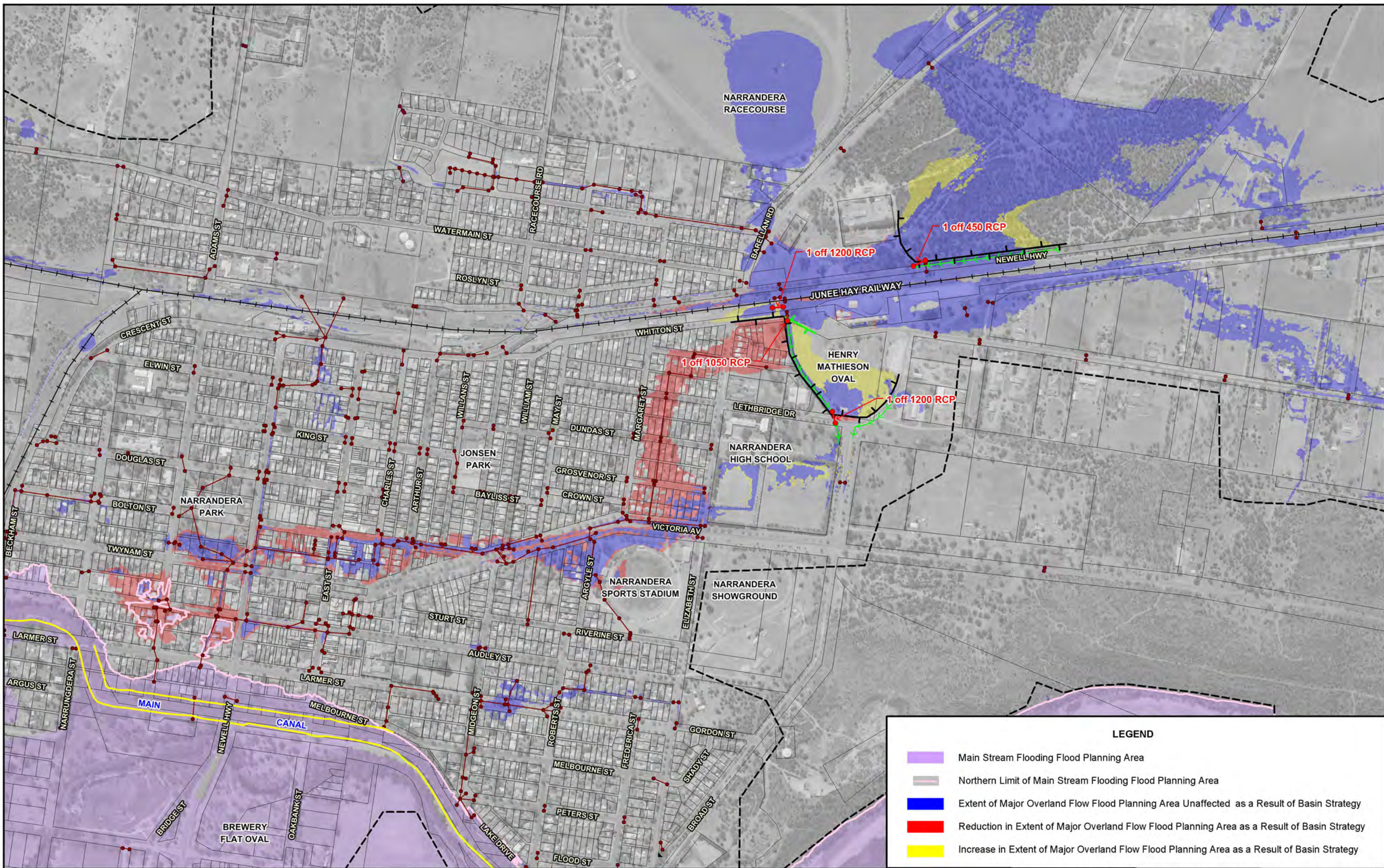
- LEGEND**
-  Existing Stormwater Network
 -  Limit of Overland Flow Mapping
 -  Existing Canal Embankment / Levee
 -  Railway

-  Proposed Embankment / Raised Section of Road
-  Proposed Lowered Section of Road
-  Proposed Stormwater Network
-  Proposed Channel Works

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure D1.17

IMPACT OF DETENTION BASIN STRATEGY (OPTION 3) ON FLOODING BEHAVIOUR - 1% AEP LOCAL CATCHMENT FLOOD



LEGEND

- Main Stream Flooding Flood Planning Area
- Northern Limit of Main Stream Flooding Flood Planning Area
- Extent of Major Overland Flow Flood Planning Area Unaffected as a Result of Basin Strategy
- Reduction in Extent of Major Overland Flow Flood Planning Area as a Result of Basin Strategy
- Increase in Extent of Major Overland Flow Flood Planning Area as a Result of Basin Strategy

Scale: 1:10,000

0 100 200 300 m

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

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

- Proposed Embankment / Raised Section of Road
- Proposed Lowered Section of Road
- Proposed Stormwater Network
- Proposed Channel Works

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

Figure D1.18

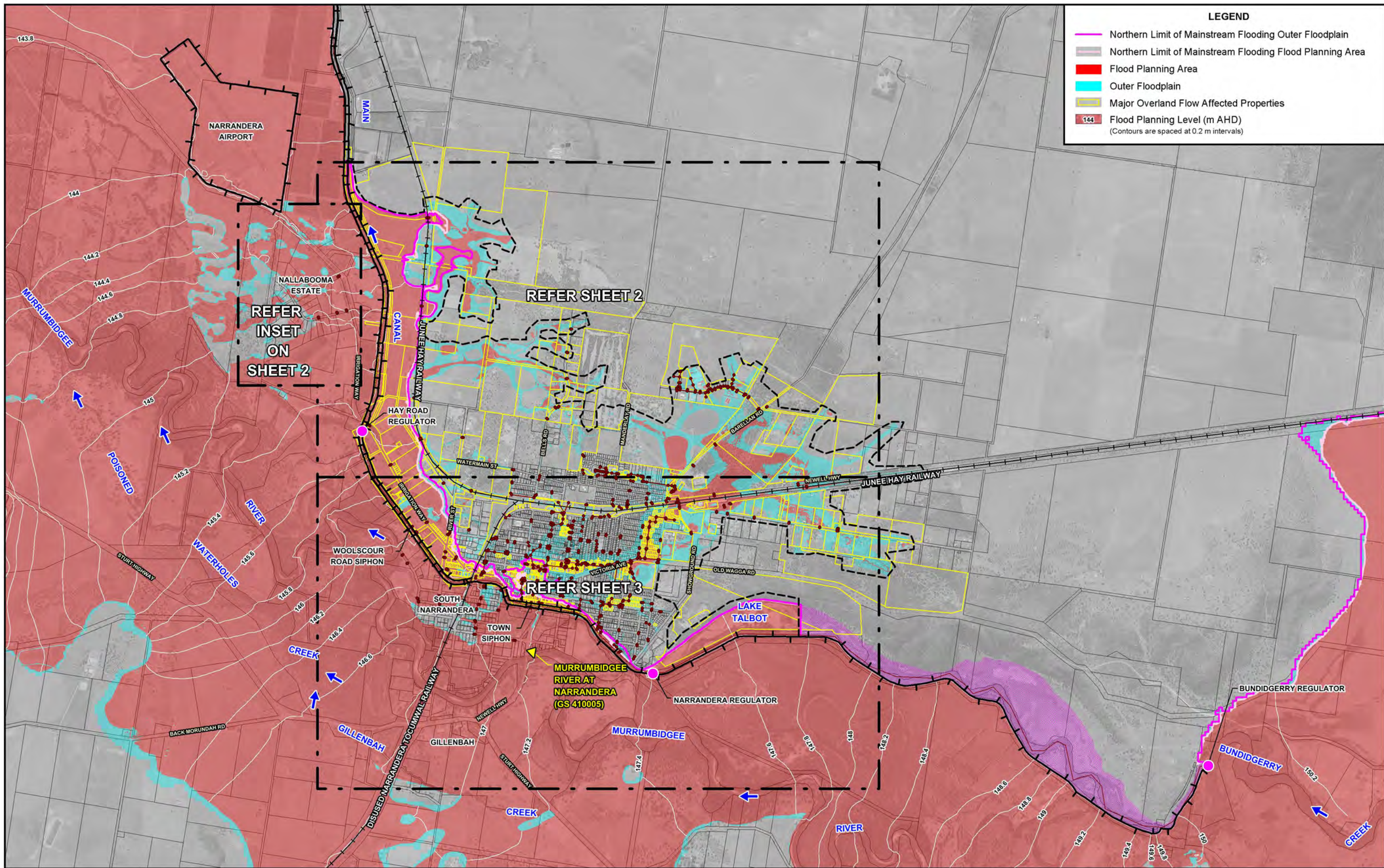
**EXTENT OF FLOOD PLANNING AREA
 PRE- AND POST- DETENTION BASIN STRATEGY (OPTION 2) CONDITIONS**

APPENDIX E

DRAFT FLOOD POLICY

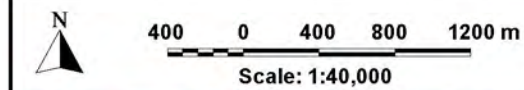
LIST OF FIGURES (APPENDIX E)

- E1.1 Extract of Flood Planning Map at Narrandera (3 Sheets)
- E1.2 Narrandera Development Controls Matrix Map (3 Sheets)
- E1.3 Narrandera Flood Hazard Map (3 Sheets)



LEGEND

- Northern Limit of Mainstream Flooding Outer Floodplain
- Northern Limit of Mainstream Flooding Flood Planning Area
- Flood Planning Area
- Outer Floodplain
- Major Overland Flow Affected Properties
- 144 Flood Planning Level (m AHD)
(Contours are spaced at 0.2 m intervals)



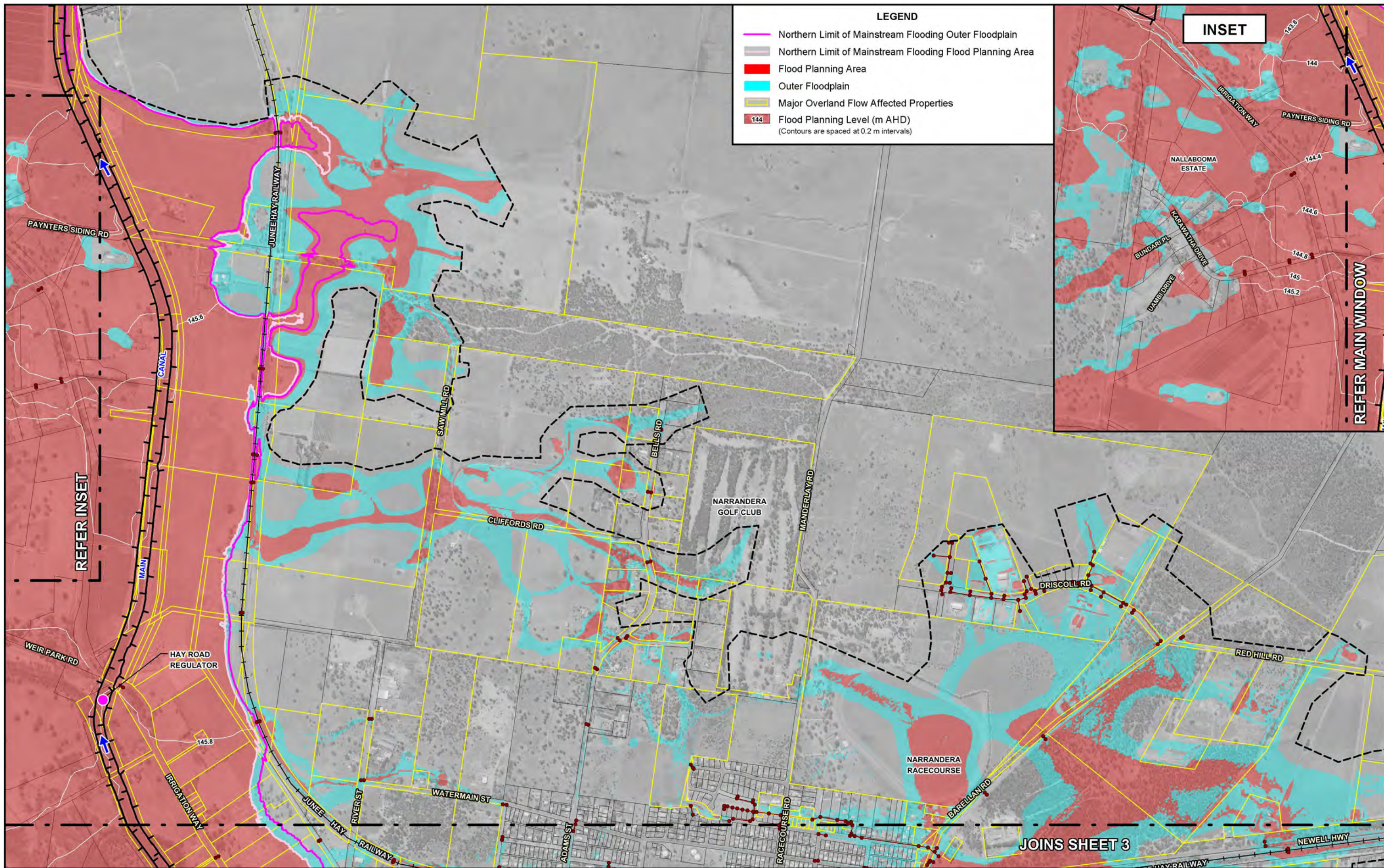
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

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

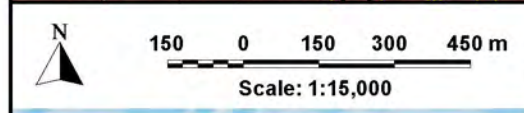
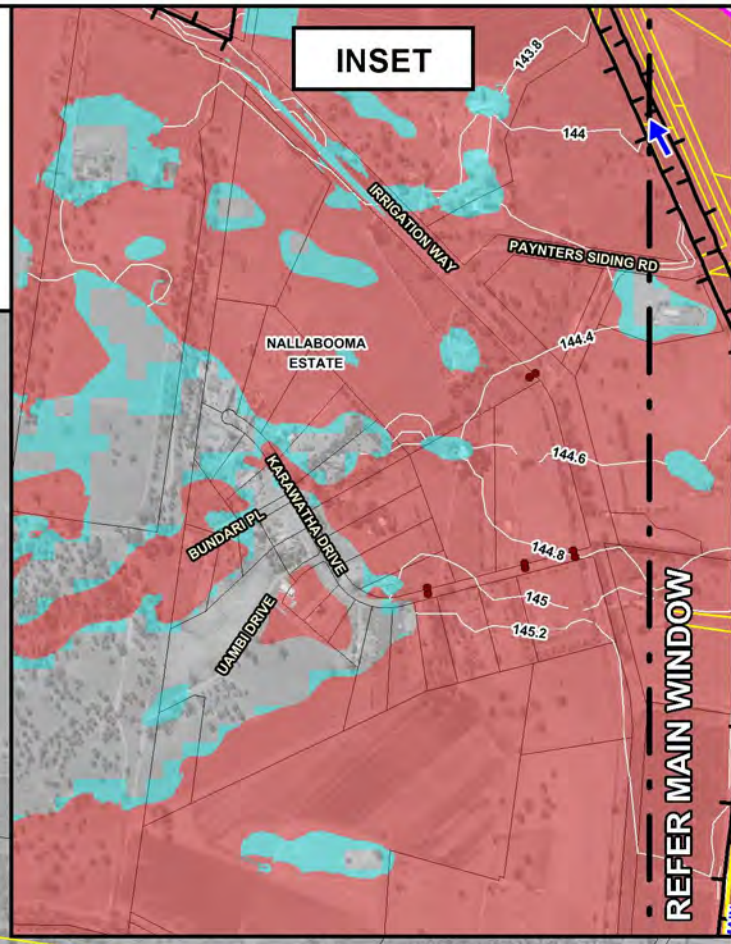
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure E1.1
(Sheet 1 of 3)



LEGEND

- Northern Limit of Mainstream Flooding Outer Floodplain
- Northern Limit of Mainstream Flooding Flood Planning Area
- Flood Planning Area
- Outer Floodplain
- Major Overland Flow Affected Properties
- Flood Planning Level (m AHD)
(Contours are spaced at 0.2 m intervals)



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

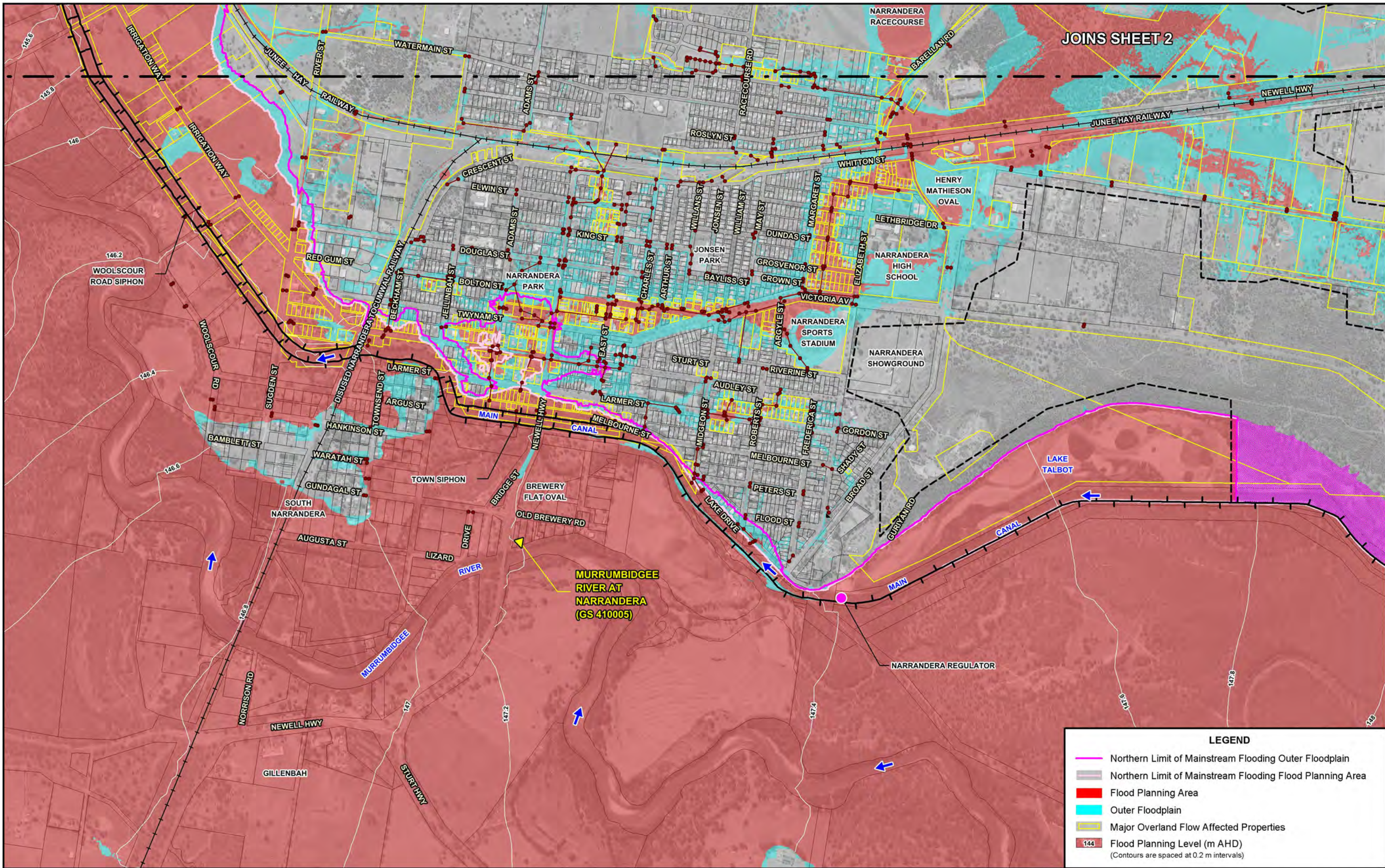
- Modelled Stormwater Network
- Murrumbidgee Irrigation Operated Regulator
- Existing Canal Embankment / Levee
- Railway
- Limit of Overland Flow Mapping

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure E1.1
(Sheet 2 of 3)

Lyal & Associates

EXTRACT OF FLOOD PLANNING MAP AT NARRANDERA

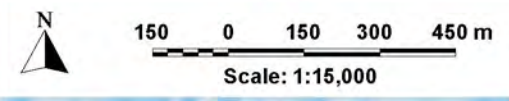


JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

LEGEND

- Northern Limit of Mainstream Flooding Outer Floodplain
- Northern Limit of Mainstream Flooding Flood Planning Area
- Flood Planning Area
- Outer Floodplain
- Major Overland Flow Affected Properties
- 144 Flood Planning Level (m AHD)
(Contours are spaced at 0.2 m intervals)

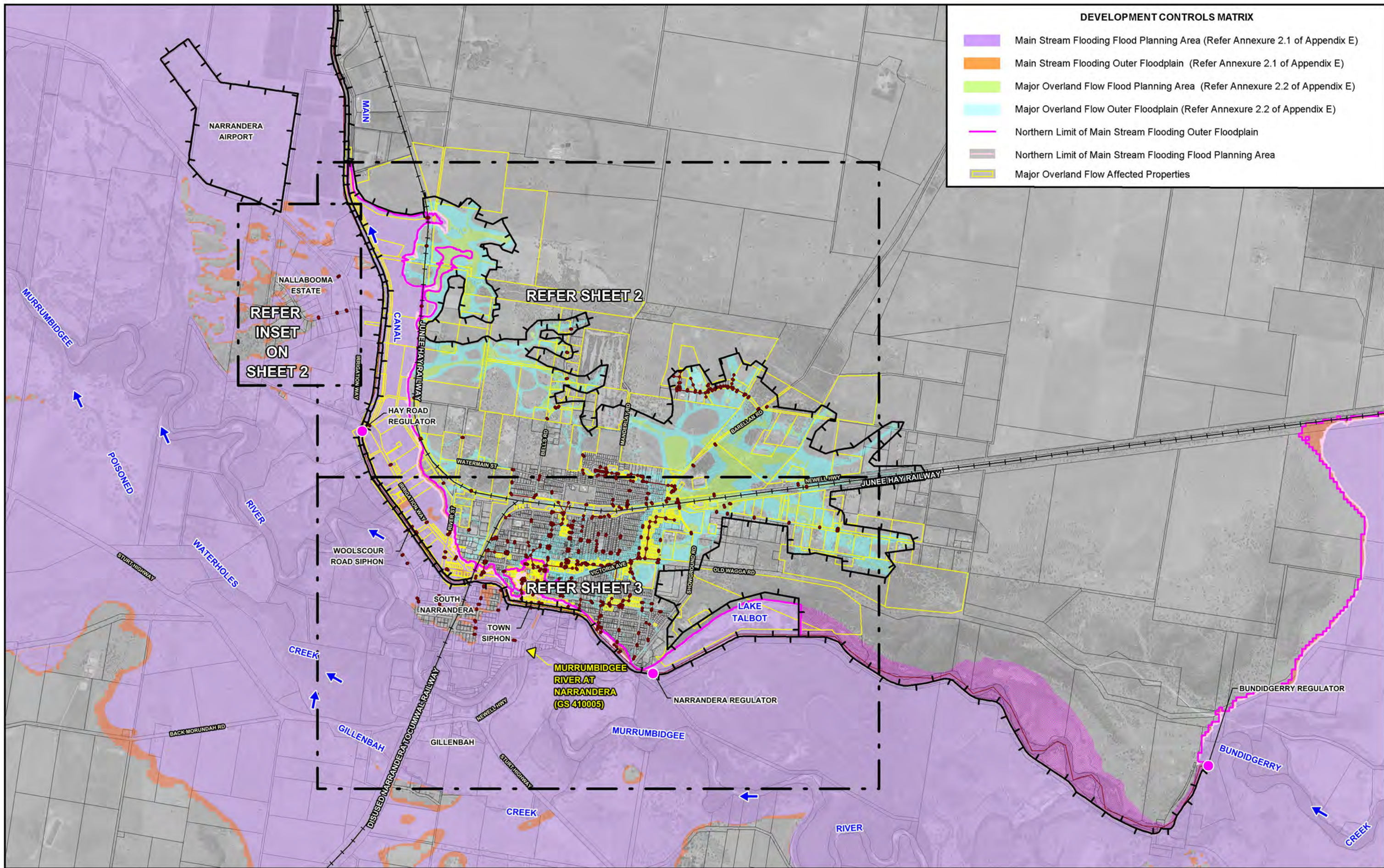


NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

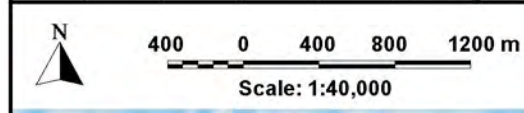
LEGEND

- 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 E1.1 (Sheet 3 of 3)
EXTRACT OF FLOOD PLANNING MAP AT NARRANDERA



DEVELOPMENT CONTROLS MATRIX	
	Main Stream Flooding Flood Planning Area (Refer Annexure 2.1 of Appendix E)
	Main Stream Flooding Outer Floodplain (Refer Annexure 2.1 of Appendix E)
	Major Overland Flow Flood Planning Area (Refer Annexure 2.2 of Appendix E)
	Major Overland Flow Outer Floodplain (Refer Annexure 2.2 of Appendix E)
	Northern Limit of Main Stream Flooding Outer Floodplain
	Northern Limit of Main Stream Flooding Flood Planning Area
	Major Overland Flow Affected Properties

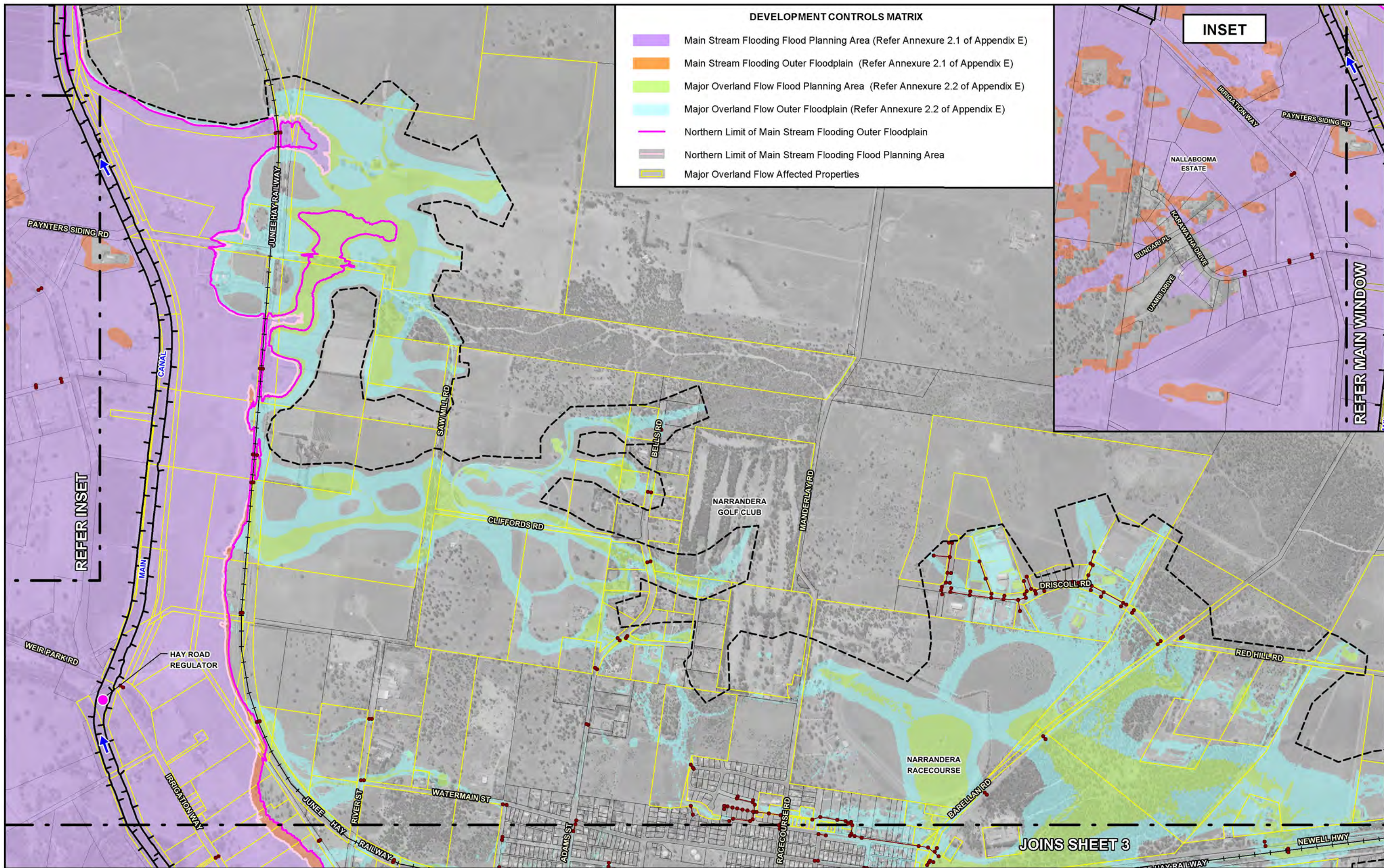


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

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

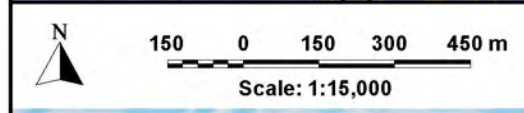
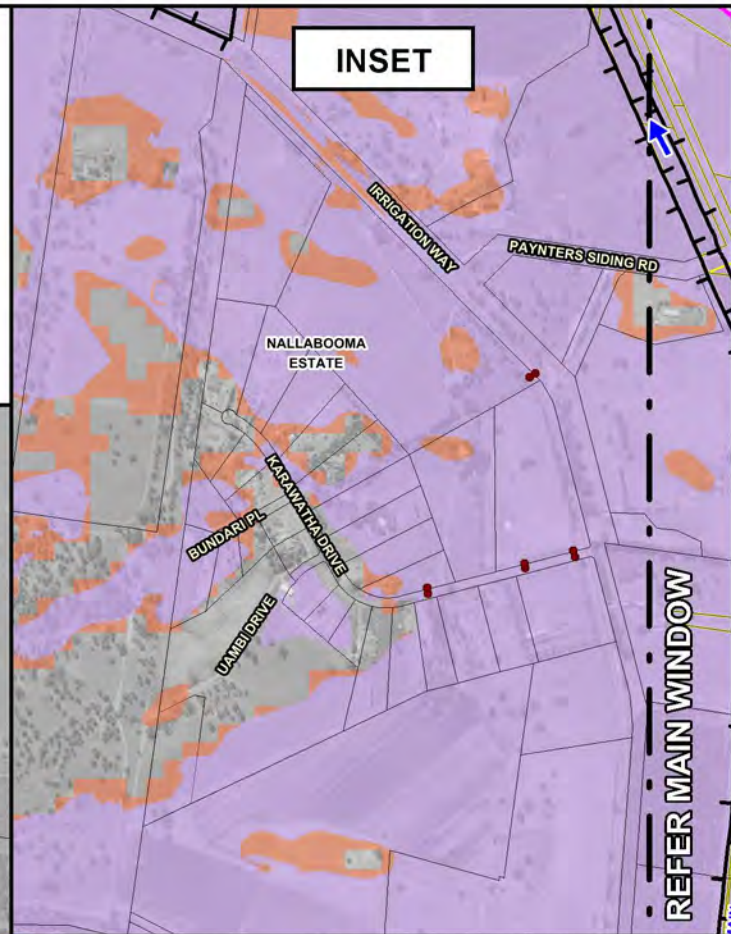
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure E1.2
 (Sheet 1 of 3)



DEVELOPMENT CONTROLS MATRIX

- Main Stream Flooding Flood Planning Area (Refer Annexure 2.1 of Appendix E)
- Main Stream Flooding Outer Floodplain (Refer Annexure 2.1 of Appendix E)
- Major Overland Flow Flood Planning Area (Refer Annexure 2.2 of Appendix E)
- Major Overland Flow Outer Floodplain (Refer Annexure 2.2 of Appendix E)
- Northern Limit of Main Stream Flooding Outer Floodplain
- Northern Limit of Main Stream Flooding Flood Planning Area
- Major Overland Flow Affected Properties



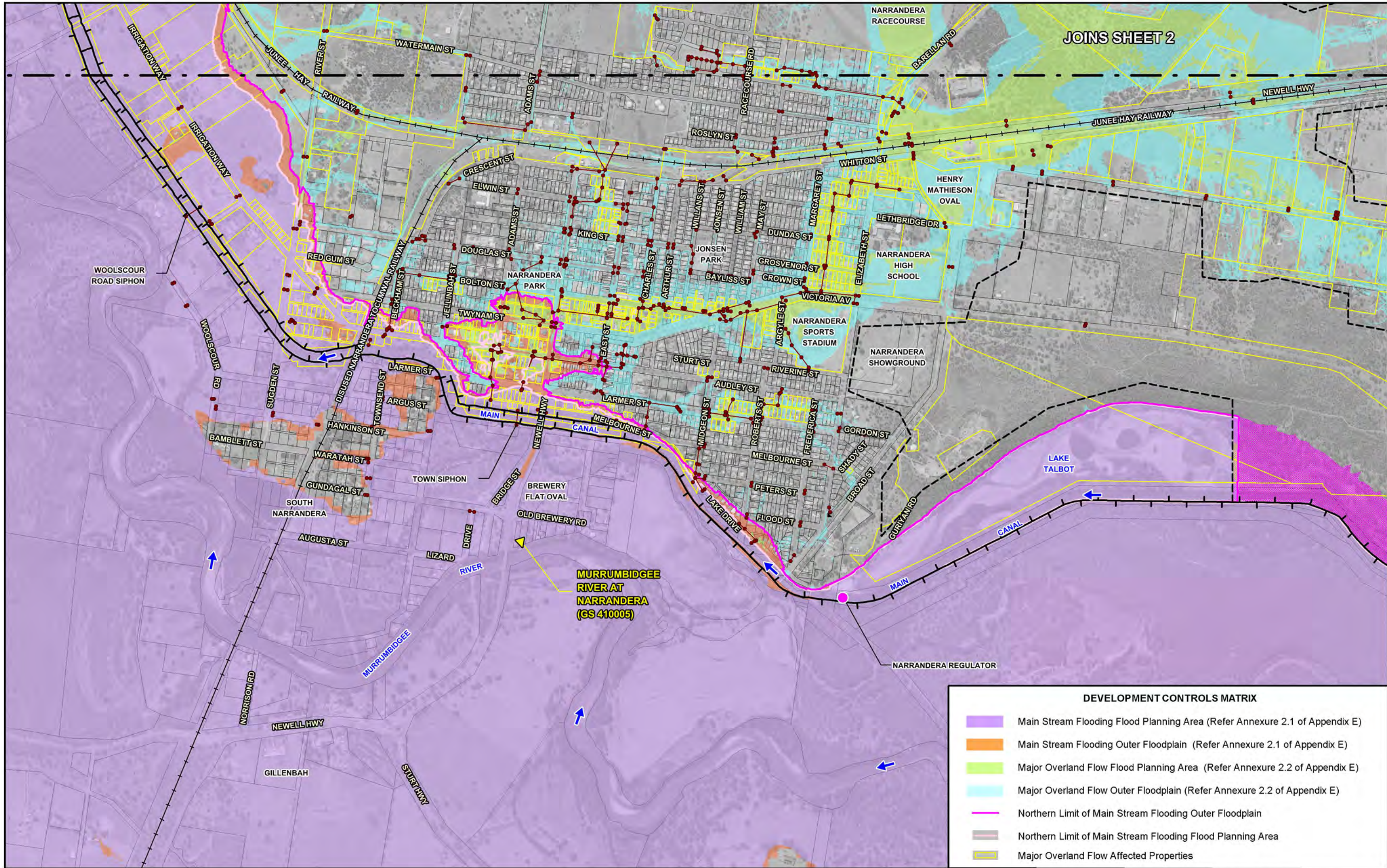
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

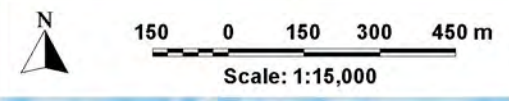
- Modelled Stormwater Network
- Existing Canal Embankment / Levee
- Railway
- Limit of Overland Flow Mapping
- Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure E1.2 (Sheet 2 of 3)



DEVELOPMENT CONTROLS MATRIX	
	Main Stream Flooding Flood Planning Area (Refer Annexure 2.1 of Appendix E)
	Main Stream Flooding Outer Floodplain (Refer Annexure 2.1 of Appendix E)
	Major Overland Flow Flood Planning Area (Refer Annexure 2.2 of Appendix E)
	Major Overland Flow Outer Floodplain (Refer Annexure 2.2 of Appendix E)
	Northern Limit of Main Stream Flooding Outer Floodplain
	Northern Limit of Main Stream Flooding Flood Planning Area
	Major Overland Flow Affected Properties

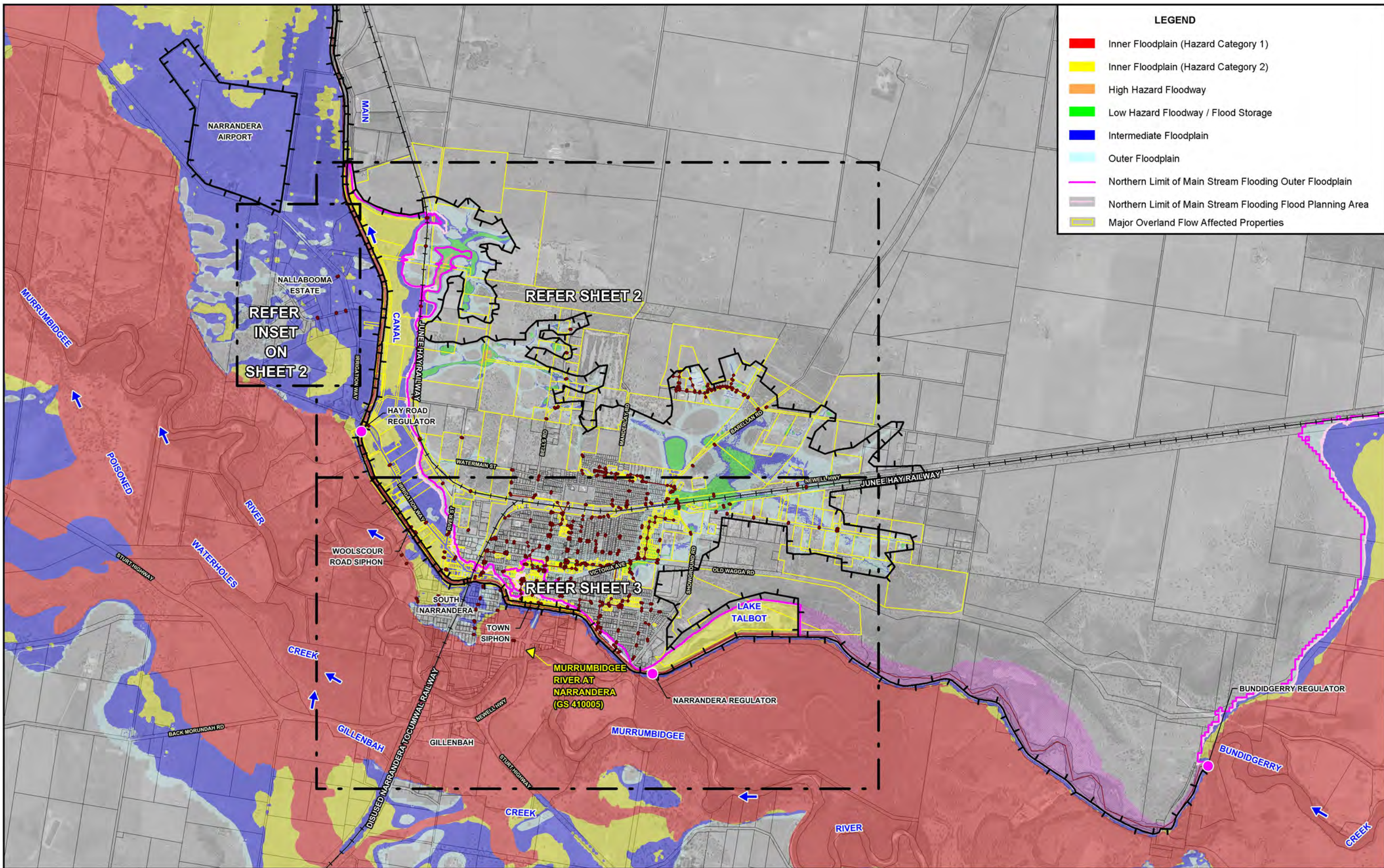


NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

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

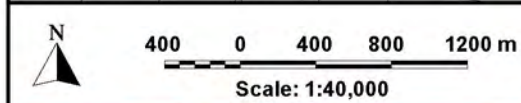
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure E1.2 (Sheet 3 of 3)



LEGEND

- Inner Floodplain (Hazard Category 1)
- Inner Floodplain (Hazard Category 2)
- High Hazard Floodway
- Low Hazard Floodway / Flood Storage
- Intermediate Floodplain
- Outer Floodplain
- Northern Limit of Main Stream Flooding Outer Floodplain
- Northern Limit of Main Stream Flooding Flood Planning Area
- Major Overland Flow Affected Properties



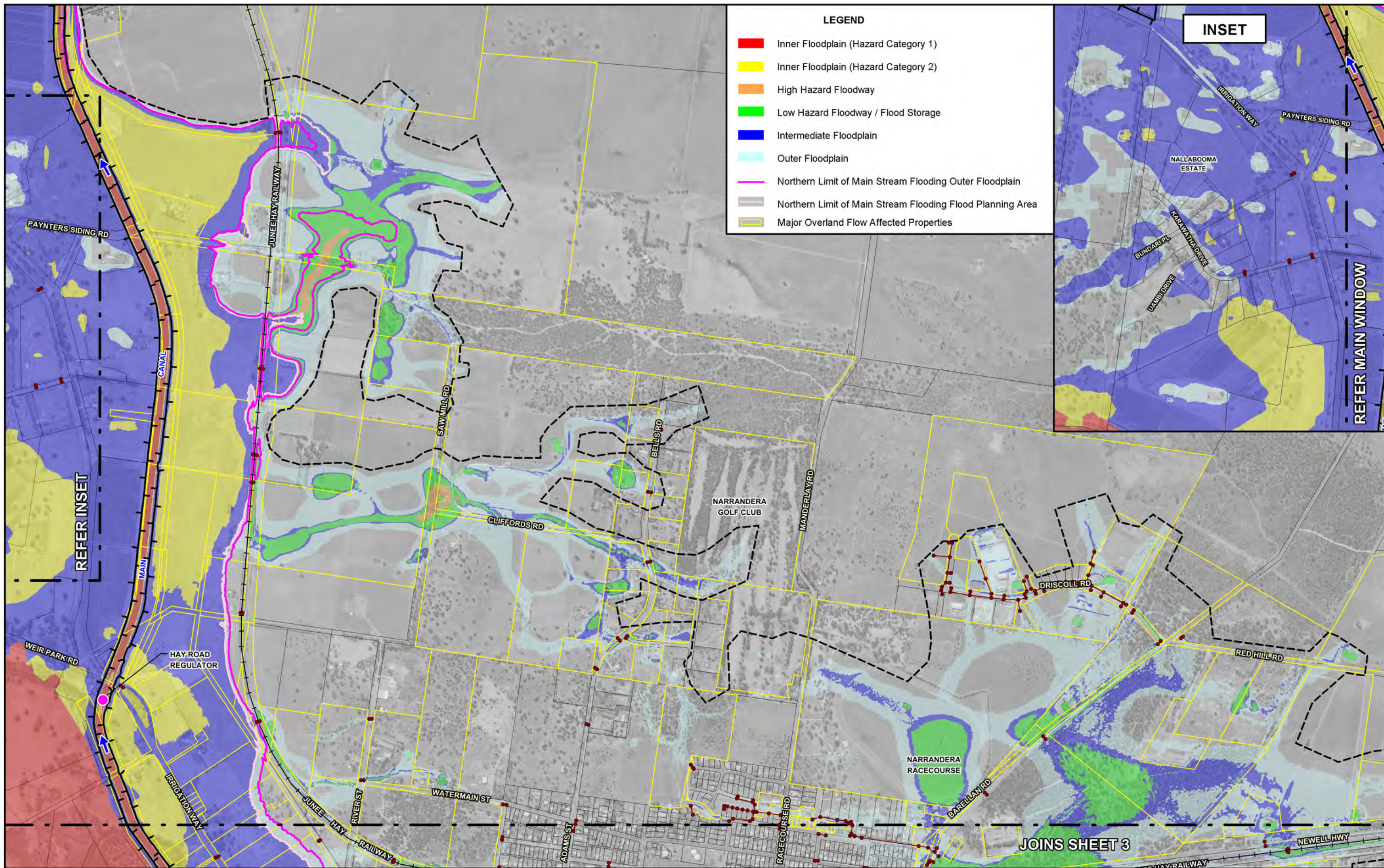
NOTE:
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 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

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

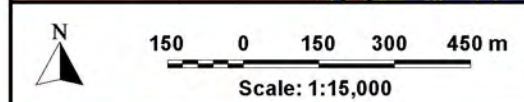
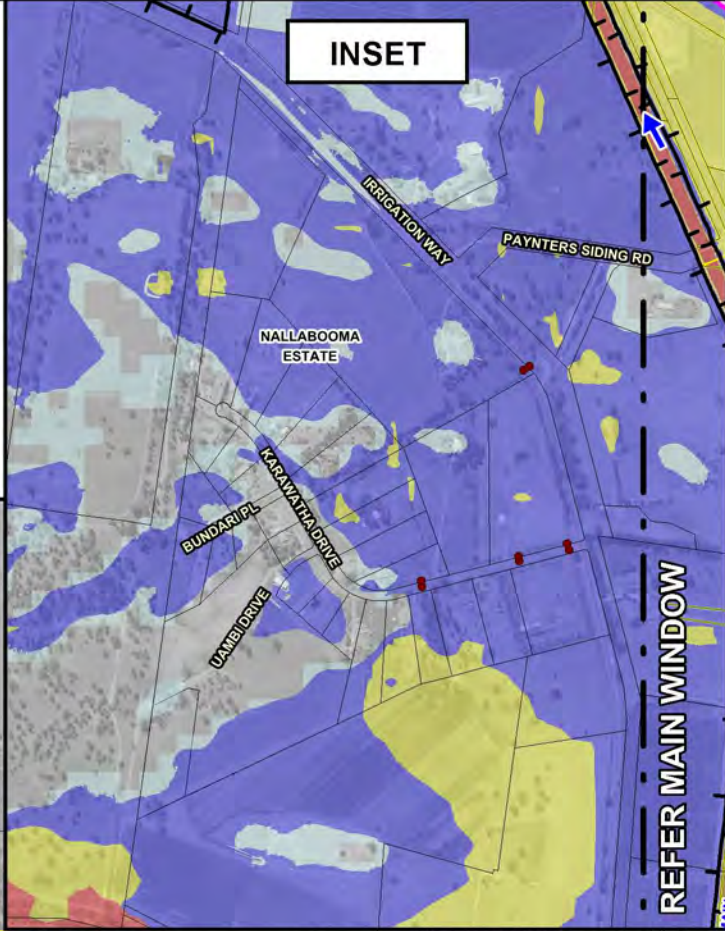
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure E1.3
(Sheet 1 of 3)



LEGEND

- Inner Floodplain (Hazard Category 1)
- Inner Floodplain (Hazard Category 2)
- High Hazard Floodway
- Low Hazard Floodway / Flood Storage
- Intermediate Floodplain
- Outer Floodplain
- Northern Limit of Main Stream Flooding Outer Floodplain
- Northern Limit of Main Stream Flooding Flood Planning Area
- Major Overland Flow Affected Properties



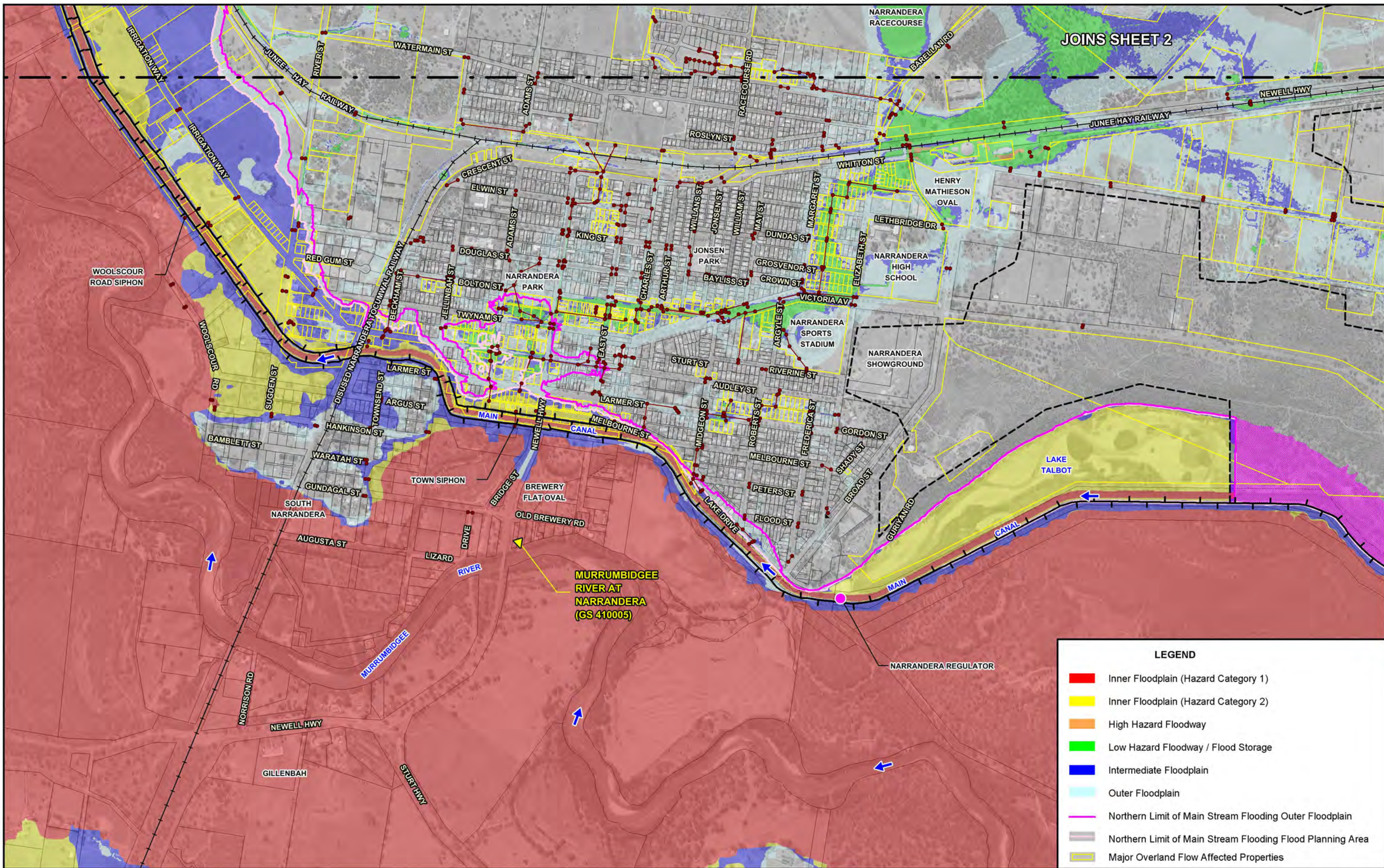
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND

- Modelled Stormwater Network
- Murrumbidgee Irrigation Operated Regulator
- Existing Canal Embankment / Levee
- Railway
- Limit of Overland Flow Mapping

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

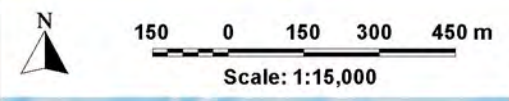
Figure E1.3
 (Sheet 2 of 3)



JOINS SHEET 2

LEGEND

- Inner Floodplain (Hazard Category 1)
- Inner Floodplain (Hazard Category 2)
- High Hazard Floodway
- Low Hazard Floodway / Flood Storage
- Intermediate Floodplain
- Outer Floodplain
- Northern Limit of Main Stream Flooding Outer Floodplain
- Northern Limit of Main Stream Flooding Flood Planning Area
- Major Overland Flow Affected Properties



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 E1.3
(Sheet 3 of 3)

Lyall & Associates

NARRANDERA FLOOD HAZARD MAP