

NARRANDERA SHIRE COUNCIL

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

MARCH 2019

VOLUME 2 – FIGURES

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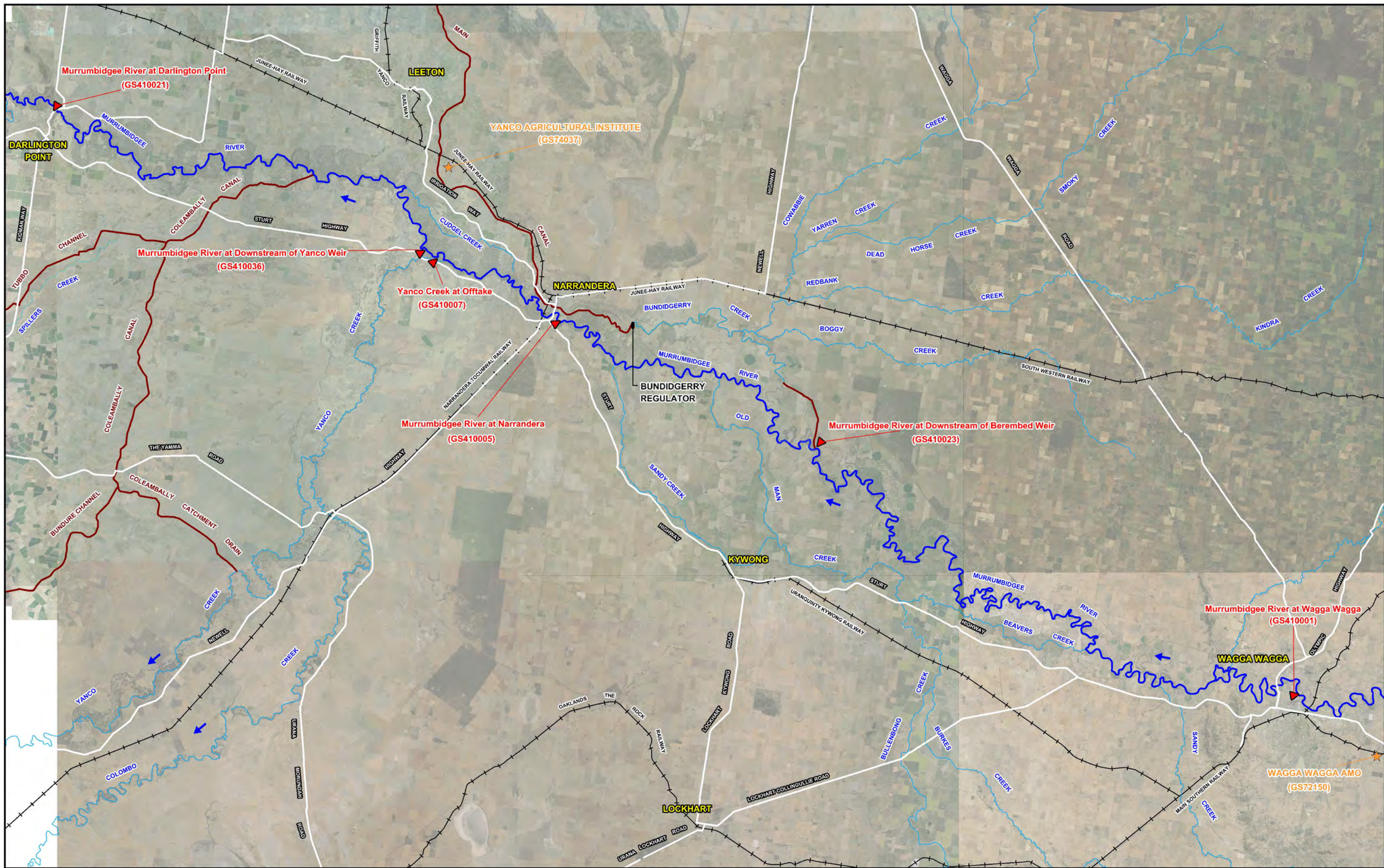
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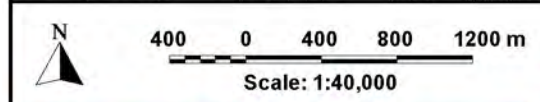
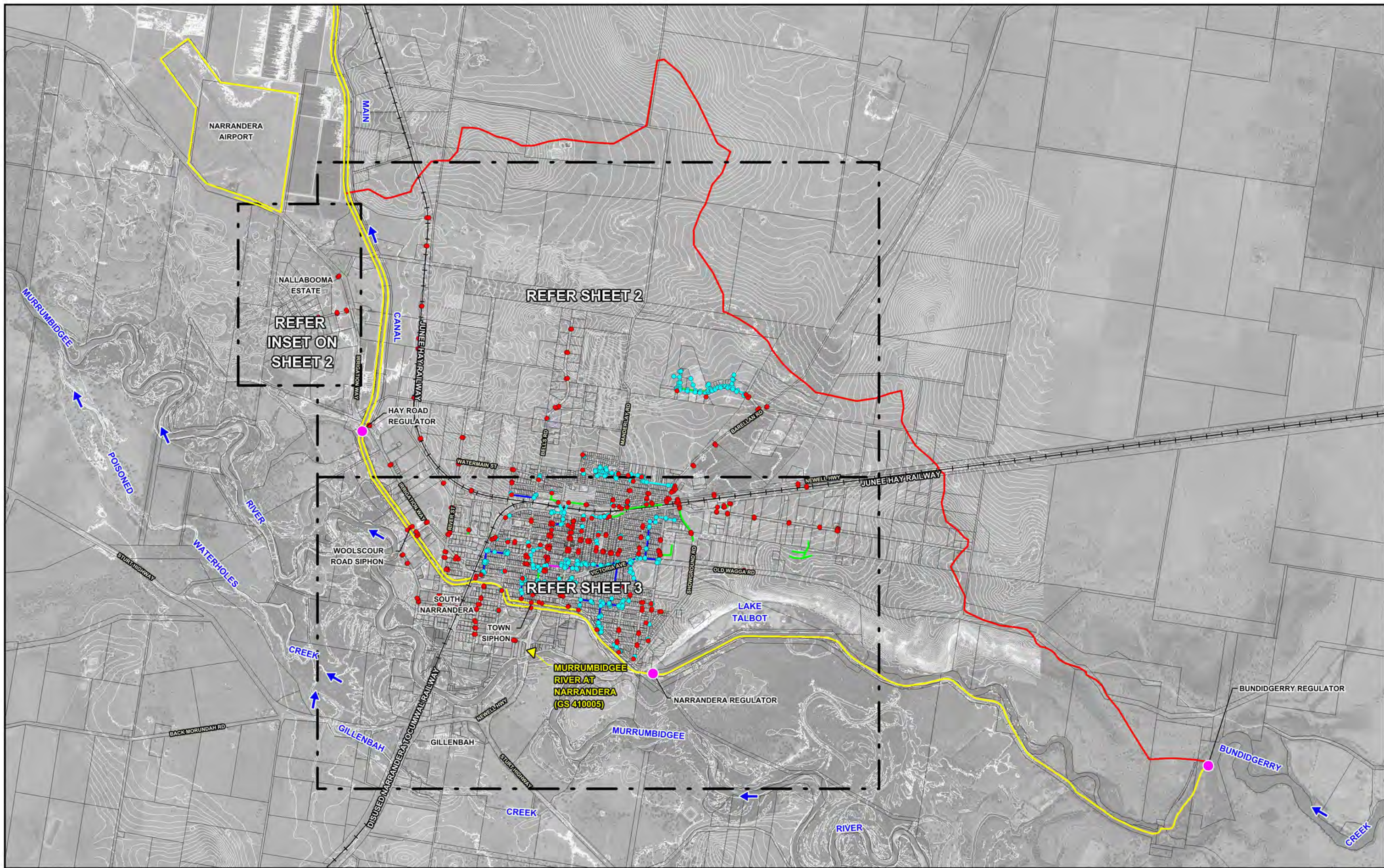


- LEGEND**
- ▼ Stream Gauge and Identifier
 - ★ Pluviometer Rain Gauge and Identifier

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 1.1

LOCATION PLAN



LEGEND	
	Pipe (Diameter < 450 mm)
	Pipe (Diameter ≥ 450 mm)
	Box Culvert
	Channel
	WaterNSW Stream Gauge
	Inlet Pit
	Headwall
	Existing Canal Embankment / Levee
	Railway
	Local Catchment Boundary
	Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.1
(Sheet 1 of 3)



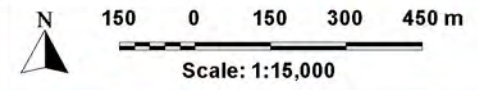



INSET

REFER INSET

REFER MAIN WINDOW

JOINS SHEET 3

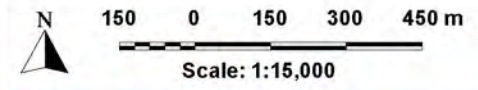
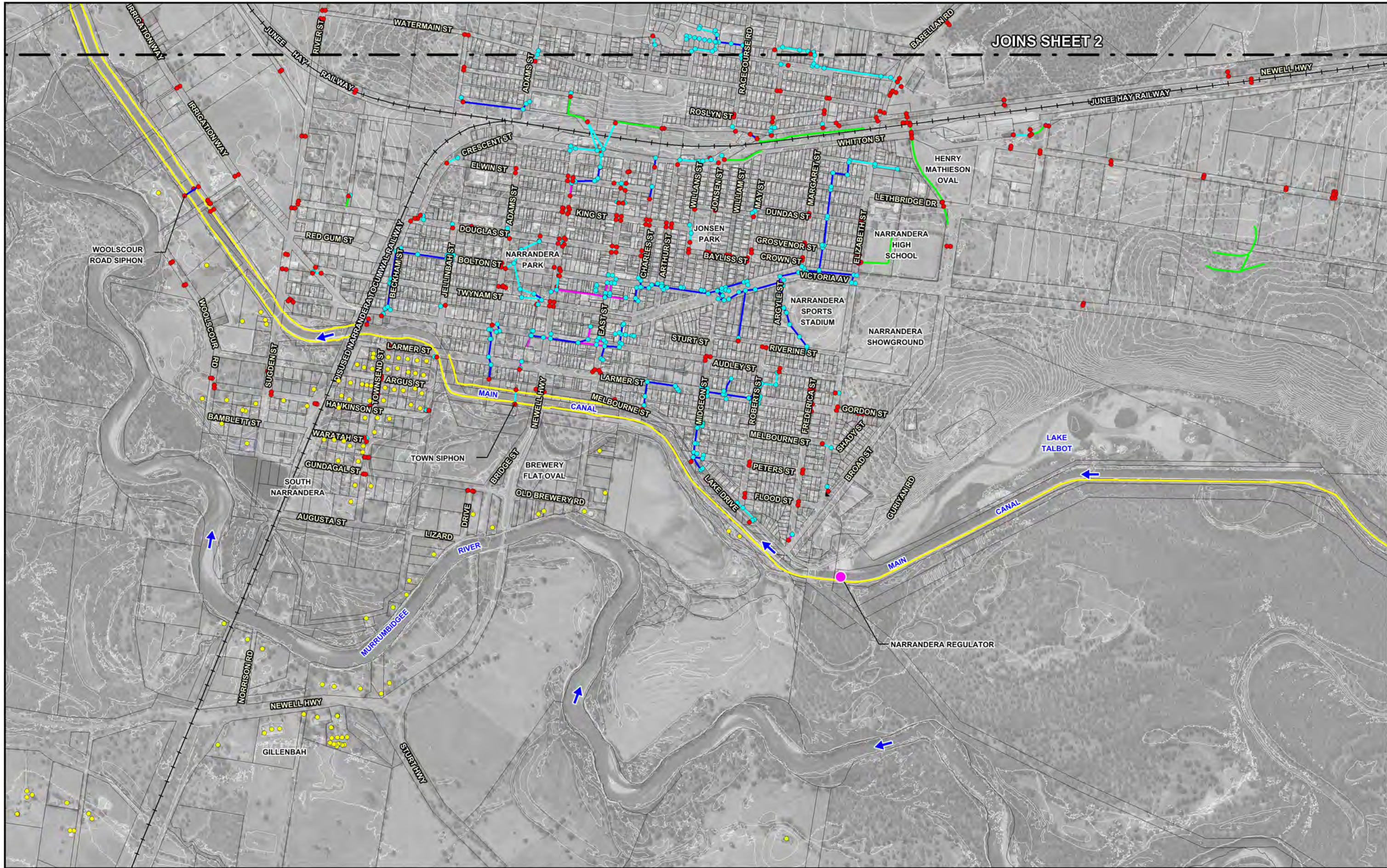


LEGEND					
	Pipe (Diameter < 450 mm)		Inlet Pit		Murrumbidgee Irrigation Operated Regulator
	Pipe (Diameter ≥ 450 mm)		Headwall		Dwelling Located on Murumbidgee Side of Main Canal
	Box Culvert		Existing Canal Embankment / Levee		
	Channel		Railway		
			Local Catchment Boundary		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.1
(Sheet 2 of 3)



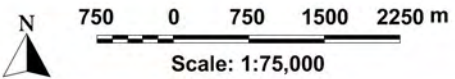
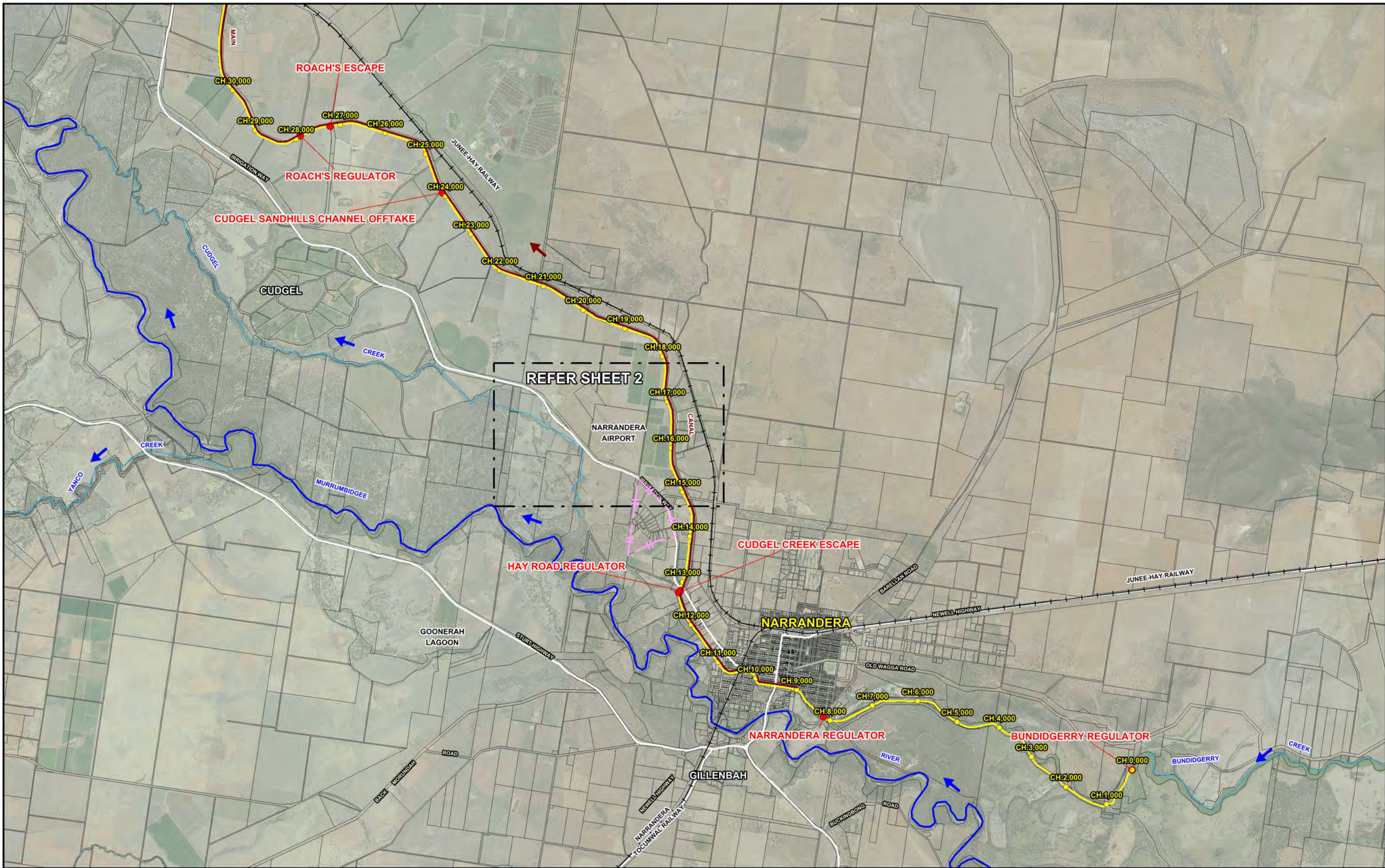


LEGEND	
—	Pipe (Diameter < 450 mm)
—	Pipe (Diameter ≥ 450 mm)
—	Box Culvert
—	Channel
●	Inlet Pit
●	Headwall
—	Existing Canal Embankment / Levee
+++++	Railway
●	Murrumbidgee Irrigation Operated Regulator
●	Dwelling Located on Murumbidgee Side of Main Canal

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.1
(Sheet 3 of 3)



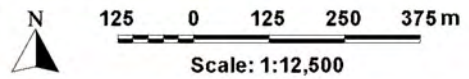
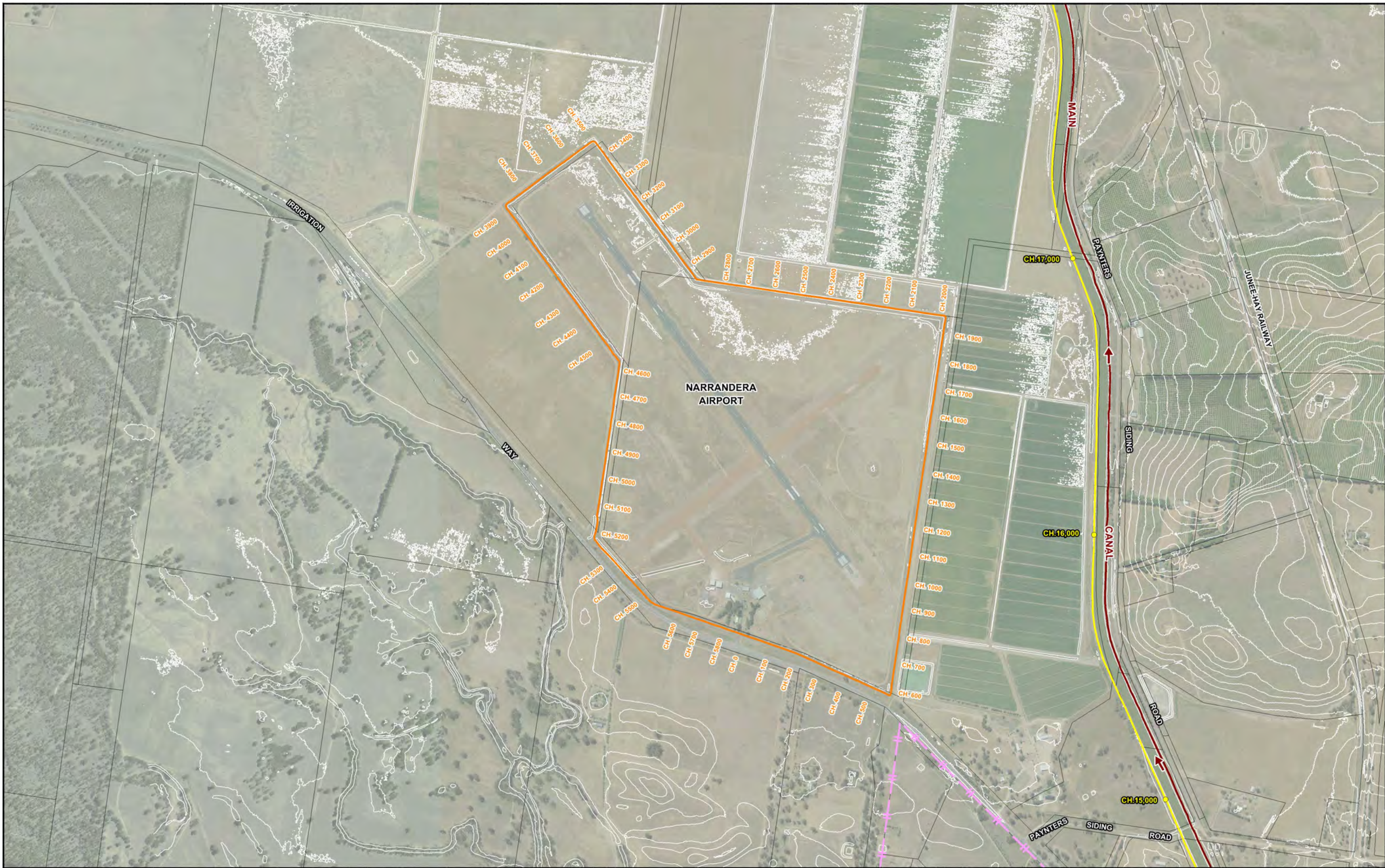


- LEGEND**
- Southern Main Canal Embankment
 - Northern Main Canal Embankment
 - Narrandera Airport Levee
 - Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.2
(Sheet 1 of 2)

ALIGNMENT OF MAIN CANAL EMBANKMENTS AND NARRANDERA AIRPORT LEVEE

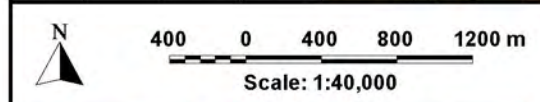
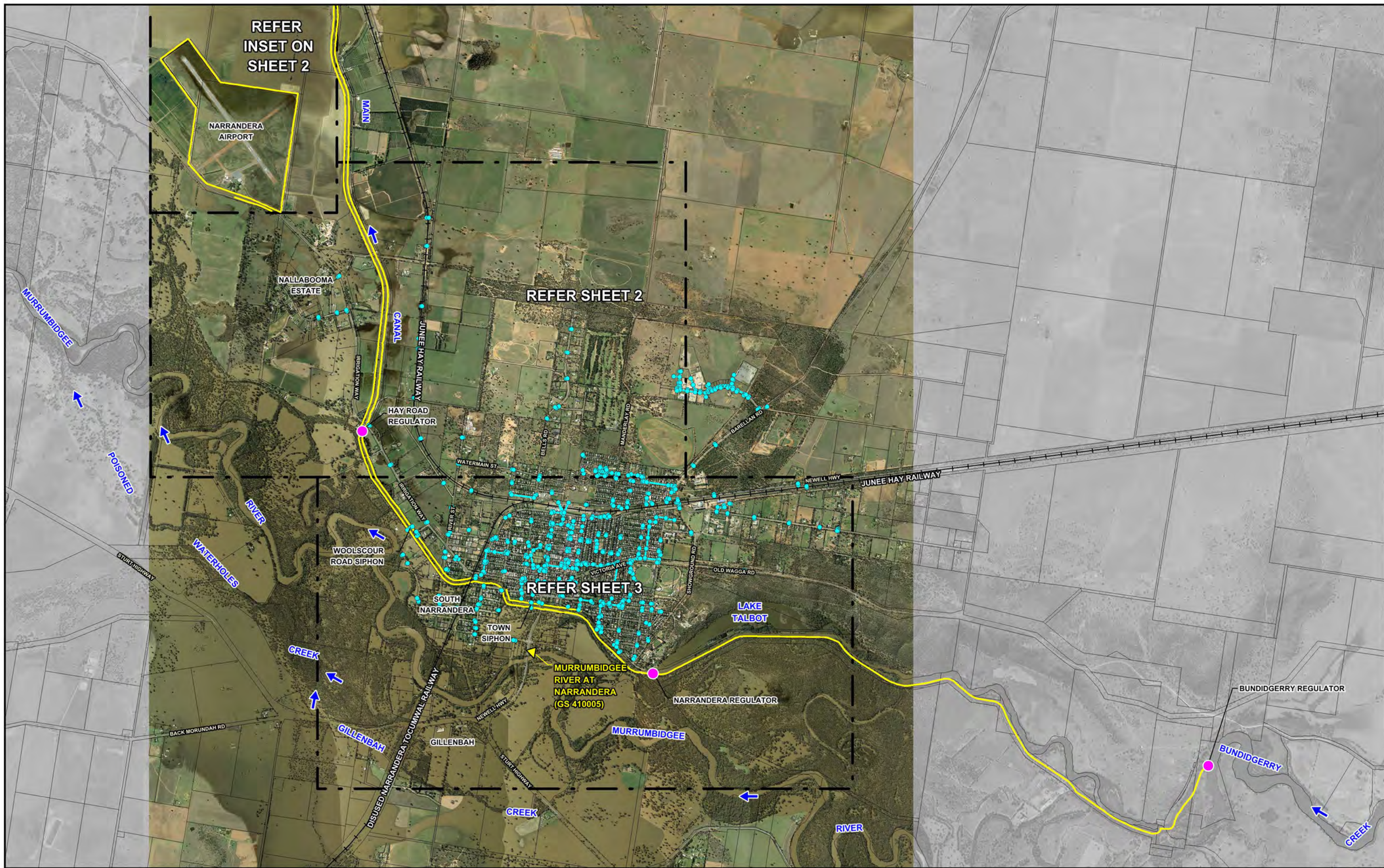


- LEGEND**
- Southern Main Canal Embankment
 - Northern Main Canal Embankment
 - Narrandera Airport Levee
 - Nallabooma Estate Boundary

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.2
(Sheet 2 of 2)

ALIGNMENT OF MAIN CANAL EMBANKMENTS AND NARRANDERA AIRPORT LEVEE

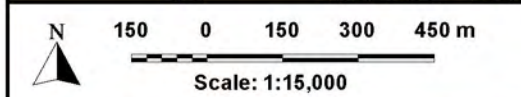
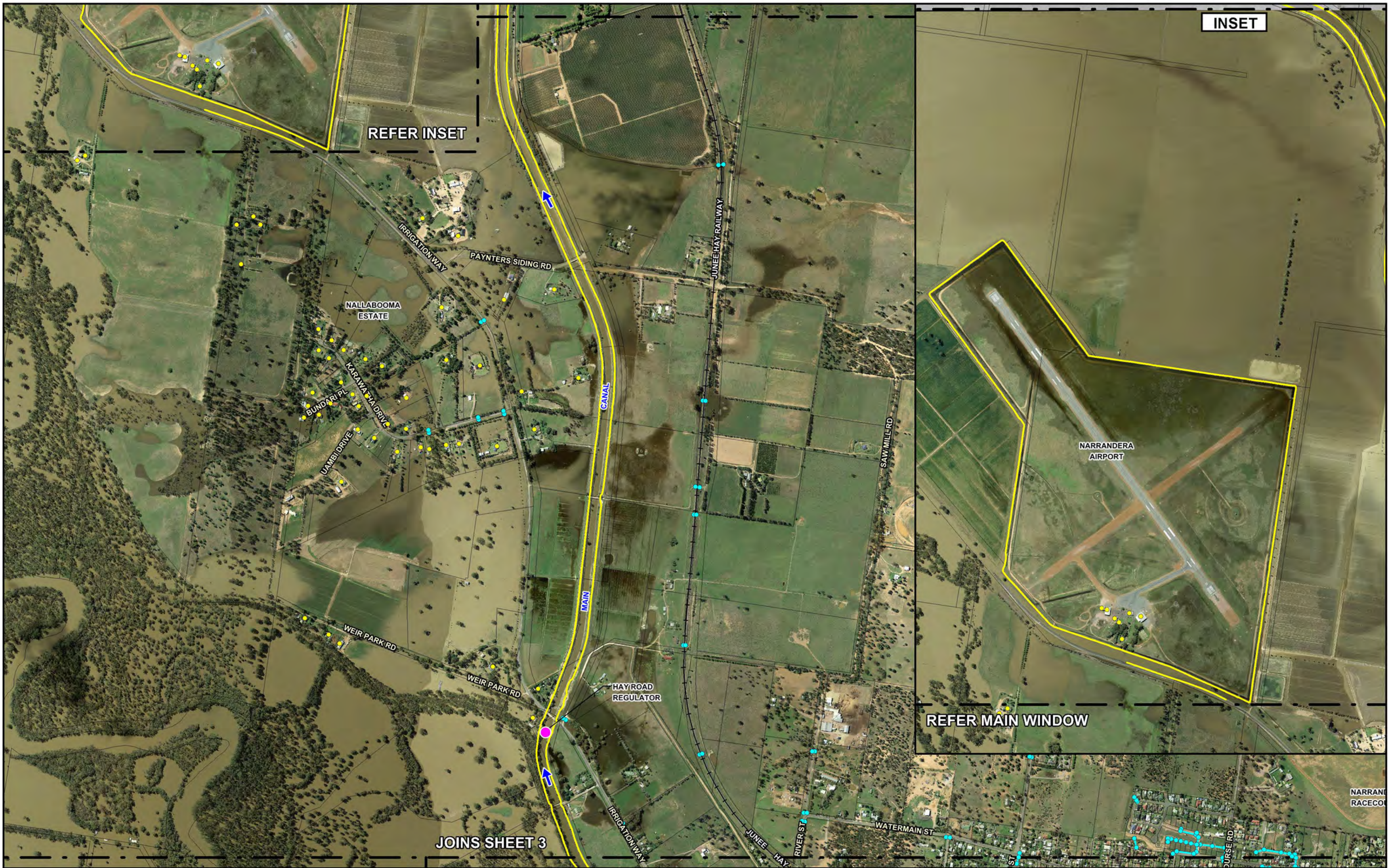


LEGEND	
	Existing Piped Stormwater Drainage System
	Existing Canal Embankment / Levee
	Railway
	Murrumbidgee Irrigation Operated Regulator
	WaterNSW Stream Gauge

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.3
(Sheet 1 of 3)

AERIAL PHOTOGRAPH SHOWING HISTORIC FLOODING AT NARRANDERA MARCH 2012 FLOOD



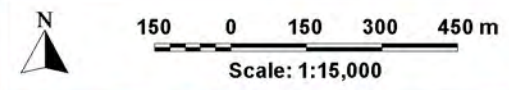
LEGEND

	Existing Piped Stormwater Drainage System		Murrumbidgee Irrigation Operated Regulator
	Existing Canal Embankment / Levee		WaterNSW Stream Gauge
	Railway		Dwelling Located on Murumbidgee Side of Main Canal

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

Figure 2.3
(Sheet 2 of 3)

AERIAL PHOTOGRAPH SHOWING HISTORIC FLOODING AT NARRANDERA
MARCH 2012 FLOOD



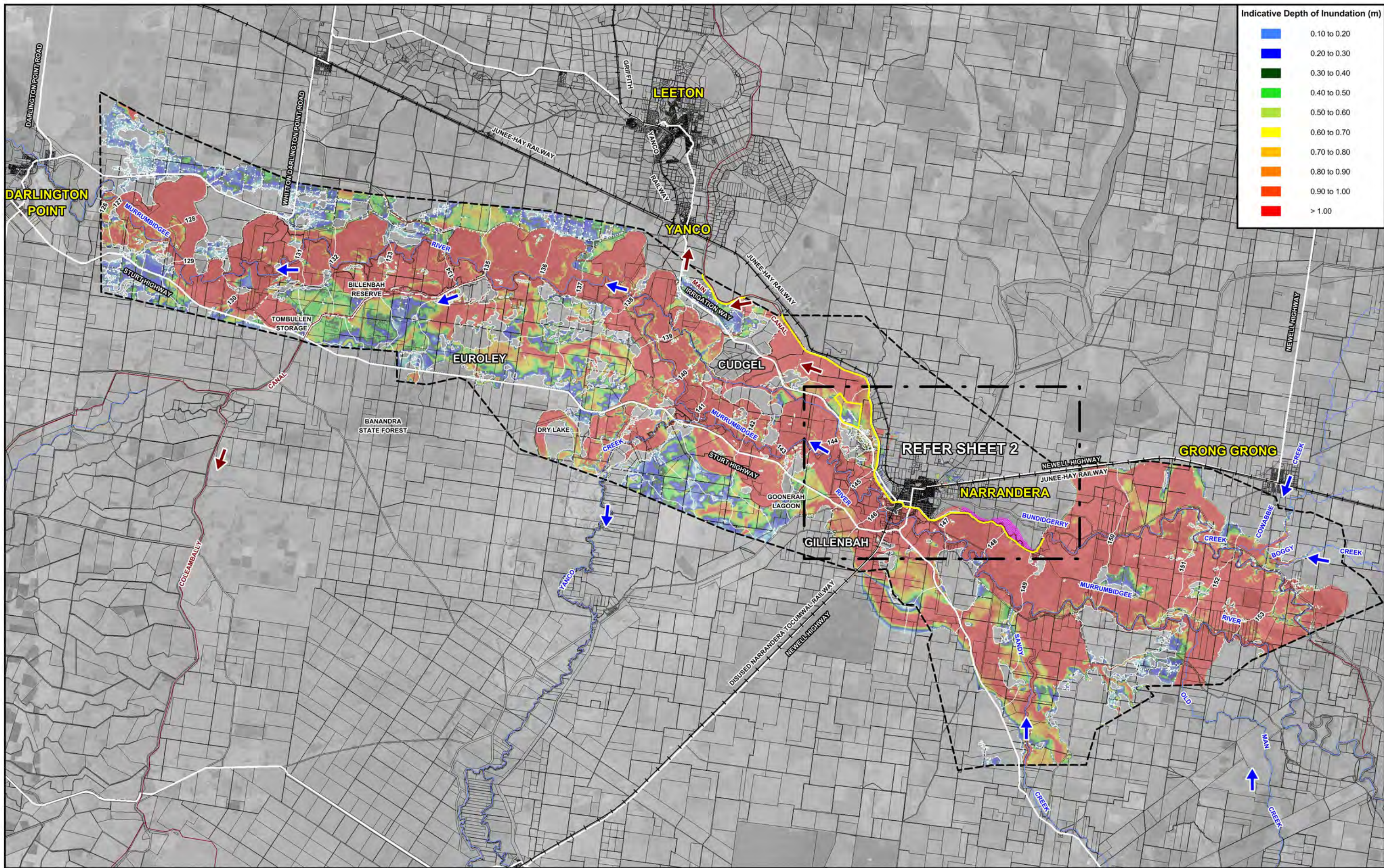
LEGEND

- Existing Piped Stormwater Drainage System
- Existing Canal Embankment / Levee
- +—+— Railway
- Murrumbidgee Irrigation Operated Regulator
- ▲ WaterNSW Stream Gauge
- Dwelling Located on Murrumbidgee River Side of Main Canal

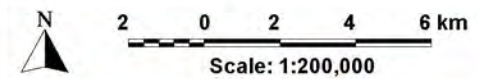
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.3
(Sheet 3 of 3)

AERIAL PHOTOGRAPH SHOWING HISTORIC FLOODING AT NARRANDERA MARCH 2012 FLOOD



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



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.
 (1) Alignment of Southern Main Canal Embankment only shown within TUFLOW Model Extent.

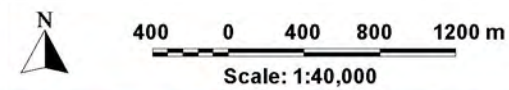
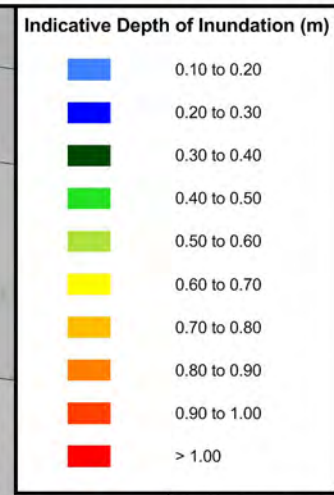
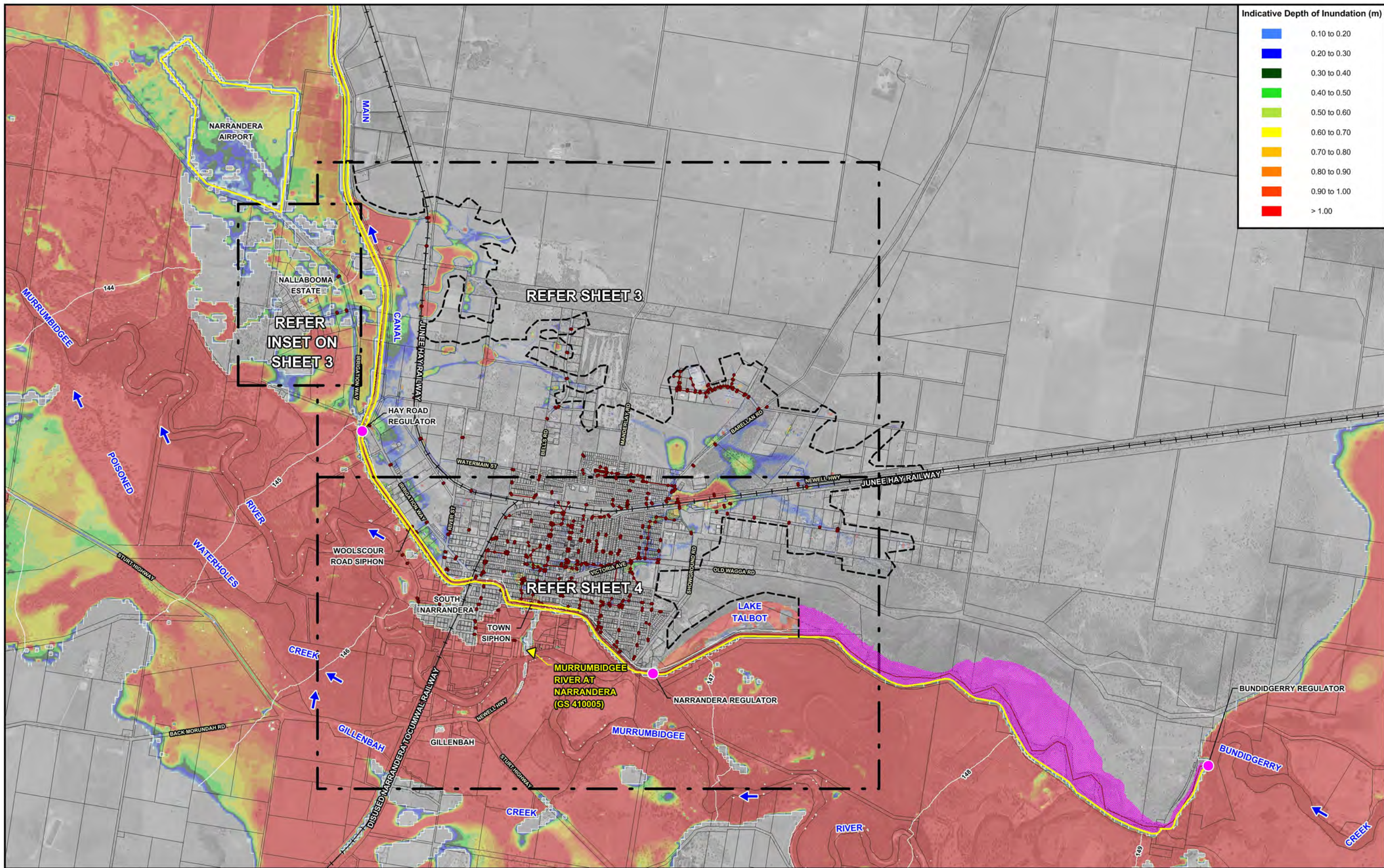
LEGEND	
--- (Dashed line)	TUFLOW Model Extent
— (Thick grey line)	Major Road
—+—+— (Thin grey line with cross-ticks)	Railway
— (Yellow line)	Existing Canal Embankment / Levee

Red box with '148'	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
Pink box	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.4 (Sheet 1 of 4)

INDICATIVE EXTENT AND DEPTHS OF INUNDATION
 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.

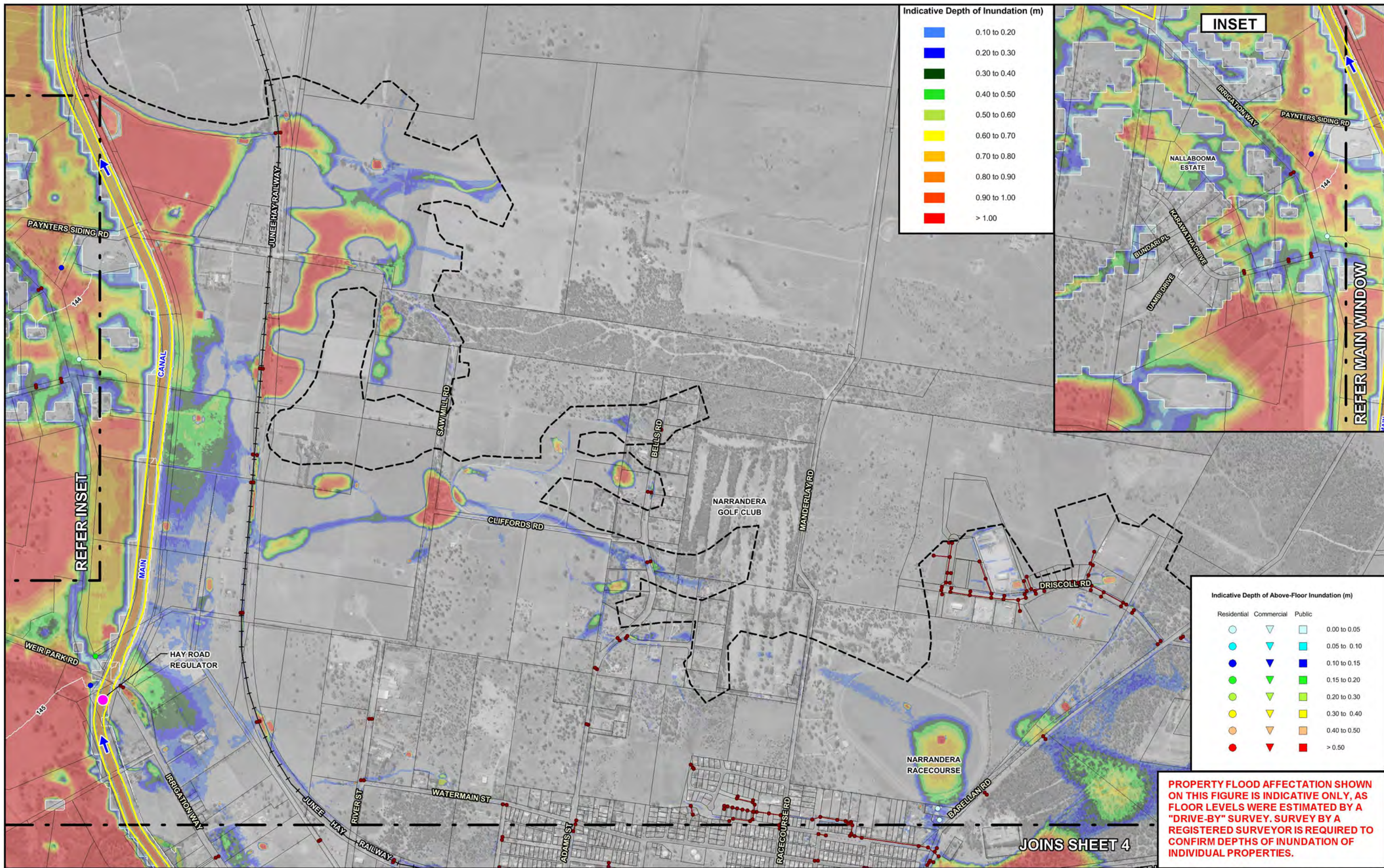
Lyal & Associates

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 2.4
 (Sheet 2 of 4)
INDICATIVE EXTENT AND DEPTHS OF INUNDATION
 1% AEP

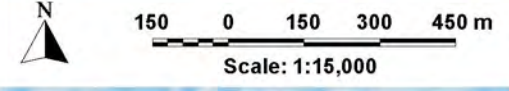


Indicative Depth of Inundation (m)

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

Indicative Depth of Above-Floor Inundation (m)

Residential	Commercial	Public	Depth (m)
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.00 to 0.05
Blue Circle	Blue Triangle	Blue Square	0.05 to 0.10
Dark Blue Circle	Dark Blue Triangle	Dark Blue Square	0.10 to 0.15
Green Circle	Green Triangle	Green Square	0.15 to 0.20
Light Green Circle	Light Green Triangle	Light Green Square	0.20 to 0.30
Yellow Circle	Yellow Triangle	Yellow Square	0.30 to 0.40
Orange Circle	Orange Triangle	Orange Square	0.40 to 0.50
Red Circle	Red Triangle	Red Square	> 0.50



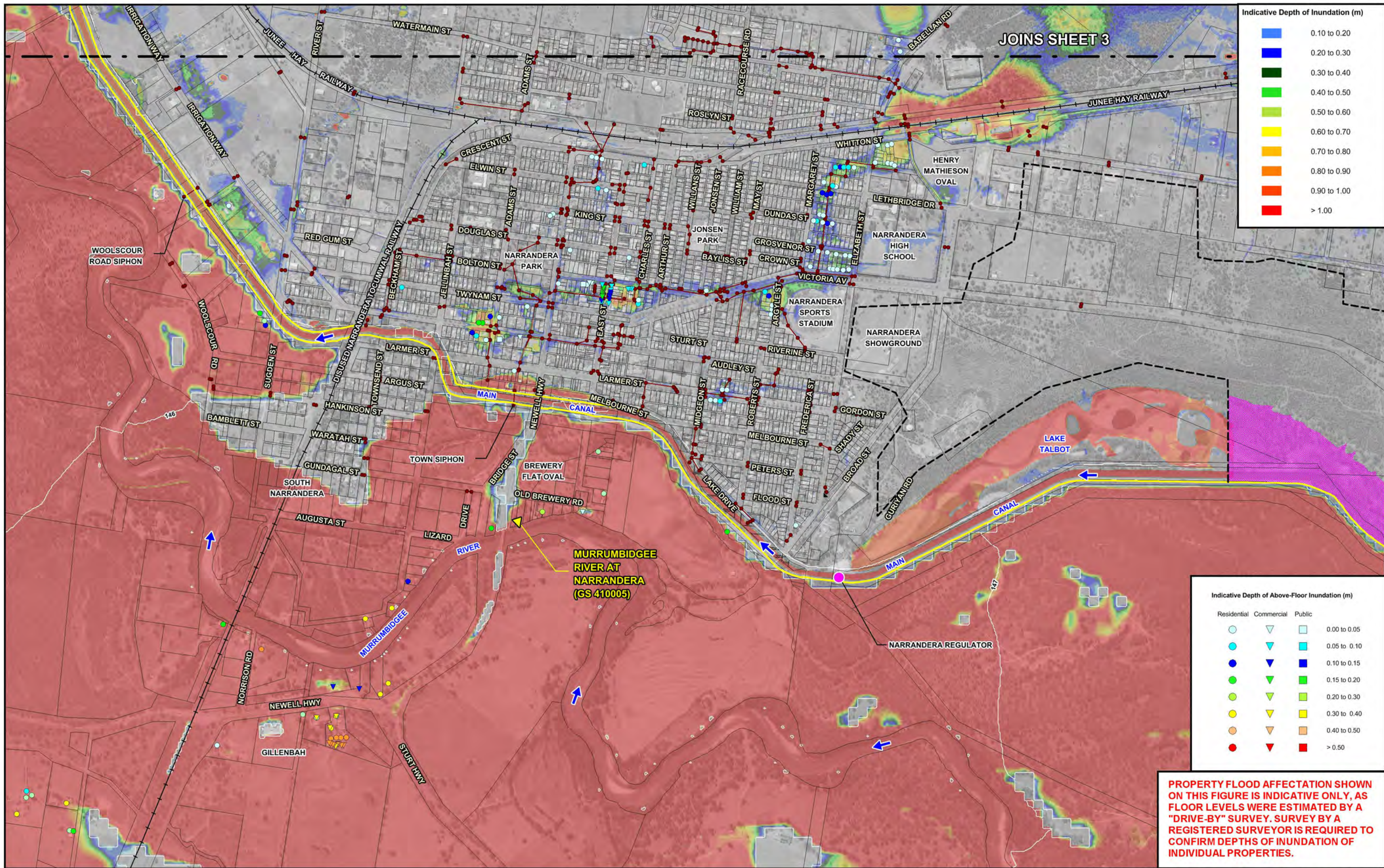
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

- LEGEND**
- Modelled Stormwater Network
 - Existing Canal Embankment / Levee
 - Railway
 - Limit of Overland Flow Mapping
 - Murrumbidgee Irrigation Operated Regulator
 - 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 2.4 (Sheet 3 of 4)

INDICATIVE EXTENT AND DEPTHS OF INUNDATION
 1% AEP



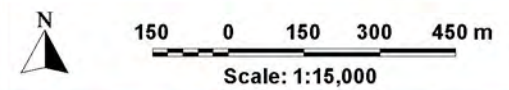
Indicative Depth of Inundation (m)

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-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

Indicative Depth of Above-Floor Inundation (m)

Residential	Commercial	Public	Depth (m)
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.00 to 0.05
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.05 to 0.10
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.10 to 0.15
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.15 to 0.20
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.20 to 0.30
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.30 to 0.40
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.40 to 0.50
Light Blue Circle	Light Blue Triangle	Light Blue Square	> 0.50

PROPERTY FLOOD AFFECTATION SHOWN ON THIS FIGURE IS INDICATIVE ONLY, AS FLOOR LEVELS WERE ESTIMATED BY A "DRIVE-BY" SURVEY. SURVEY BY A REGISTERED SURVEYOR IS REQUIRED TO CONFIRM DEPTHS OF INUNDATION OF INDIVIDUAL 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.

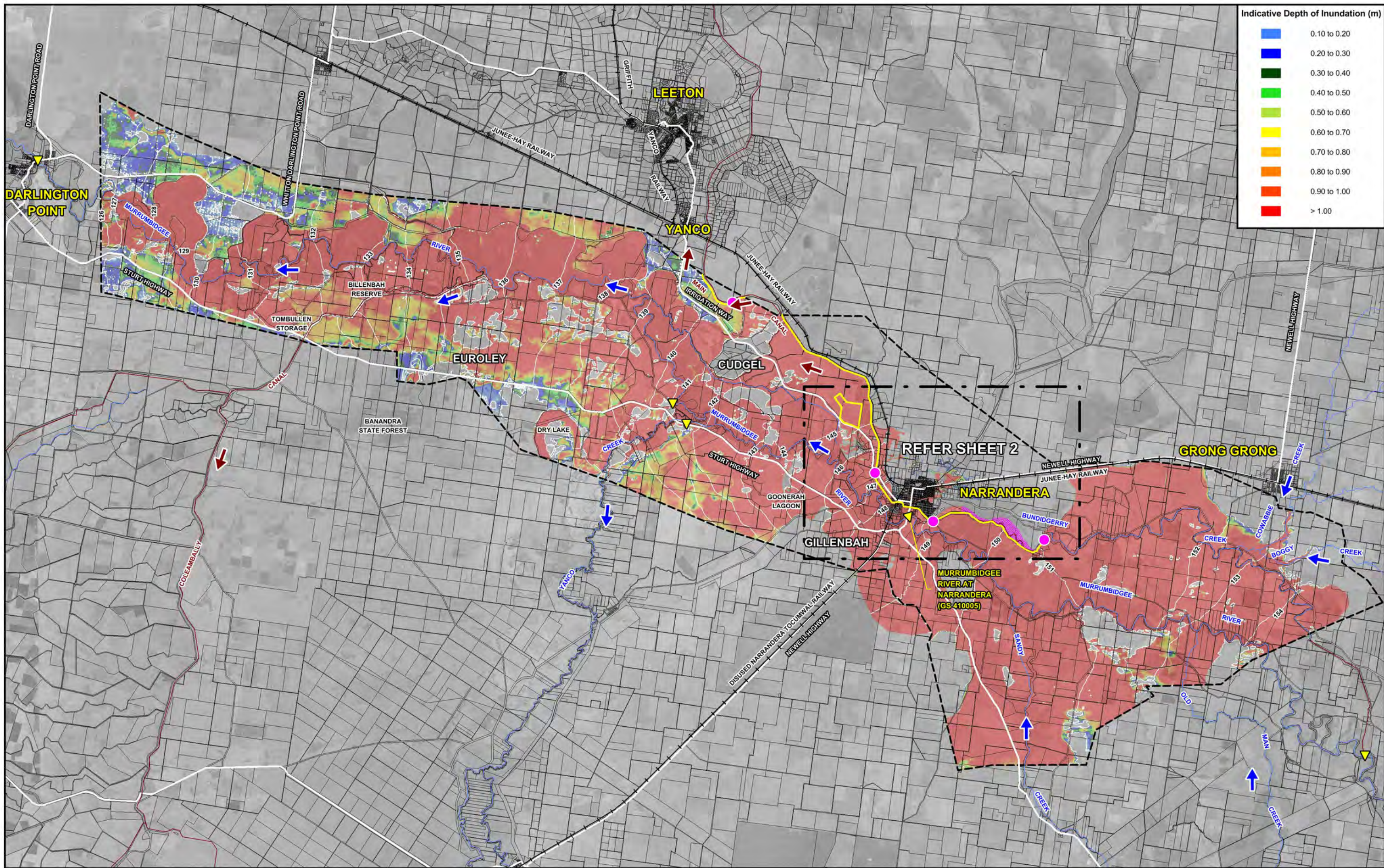
LEGEND

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

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

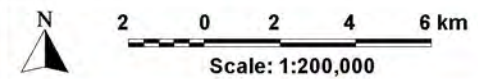
Figure 2.4 (Sheet 4 of 4)

INDICATIVE EXTENT AND DEPTHS OF INUNDATION
1% 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



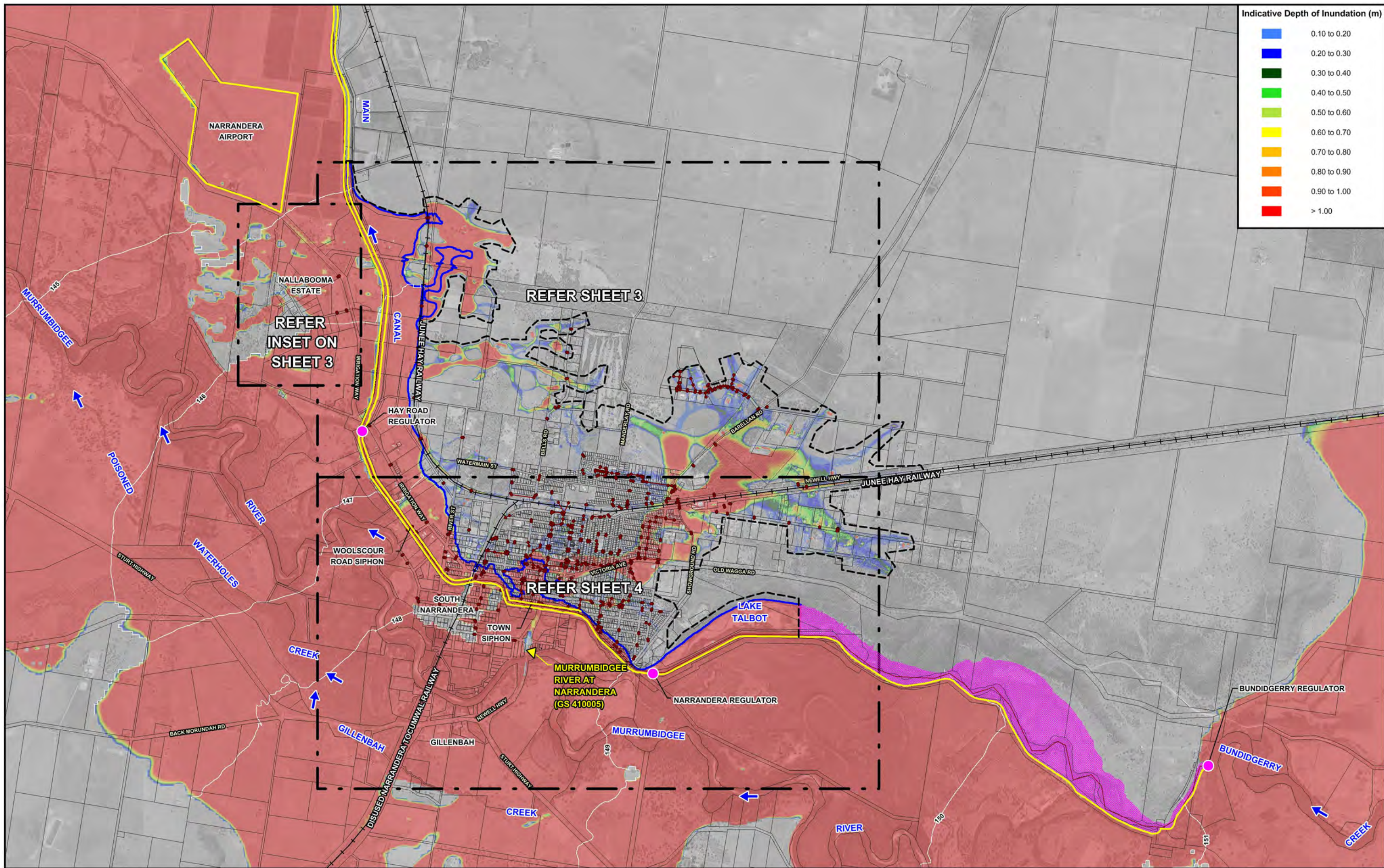
NOTE:
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 (1) Alignment of Southern Main Canal Embankment only shown within TUFLOW Model Extent.

LEGEND

--- (Dashed line)	TUFLOW Model Extent
— (Solid grey line)	Major Road
—+—+— (Line with cross-ticks)	Railway
— (Yellow line)	Existing Canal Embankment / Levee

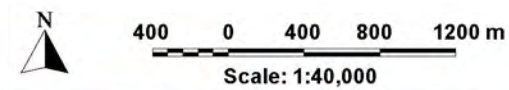
▼ (Yellow triangle)	WaterNSW Stream Gauge
● (Pink circle)	Murrumbidgee Irrigation Operated Regulator
148 (Red box)	Water Surface Elevation Contours (m AHD) (Murrumbidgee River Flood Only)
■ (Pink square)	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN
 Figure 2.5 (Sheet 1 of 4)
 INDICATIVE EXTENT AND DEPTHS OF INUNDATION EXTREME FLOOD



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



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.

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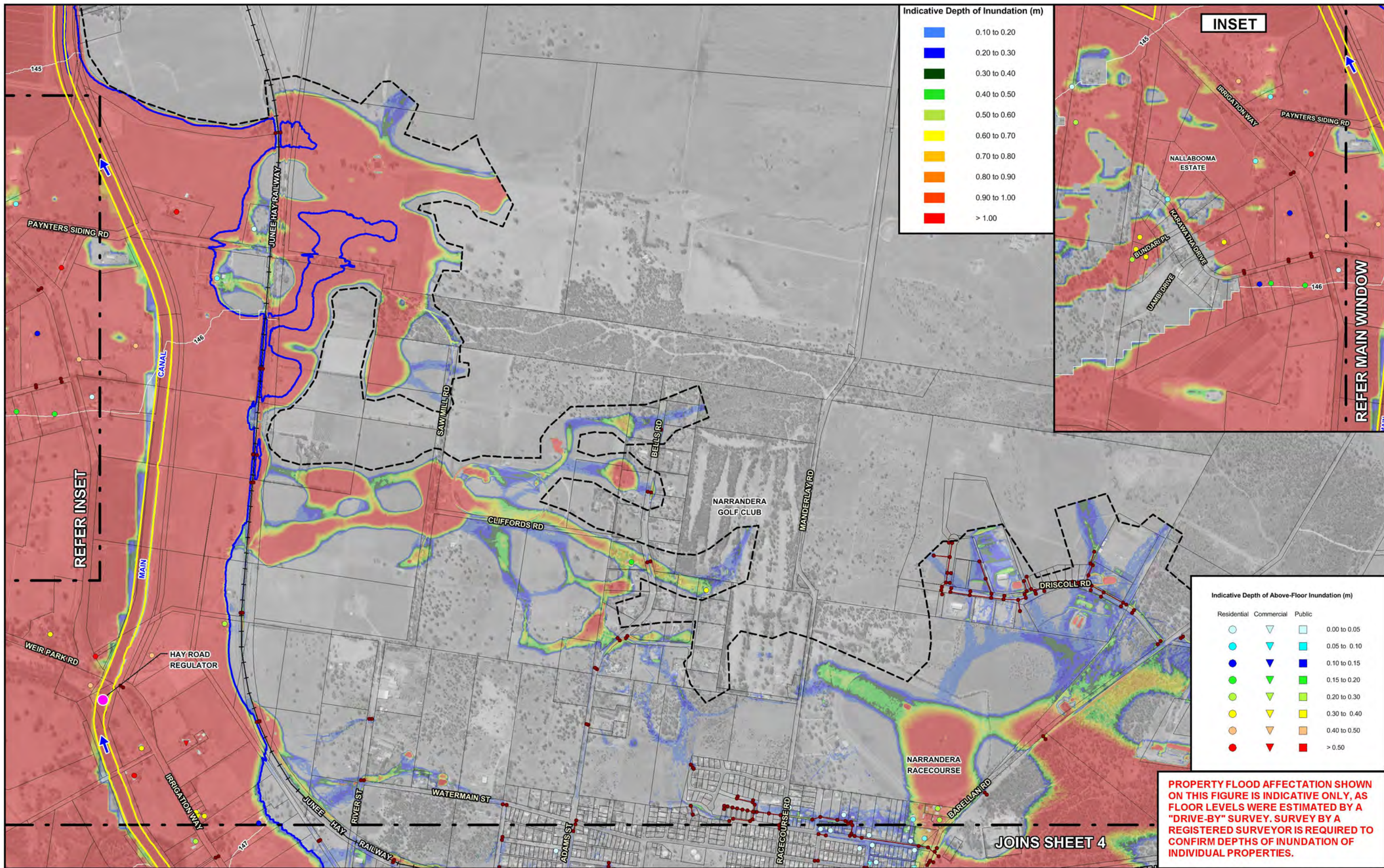
LEGEND

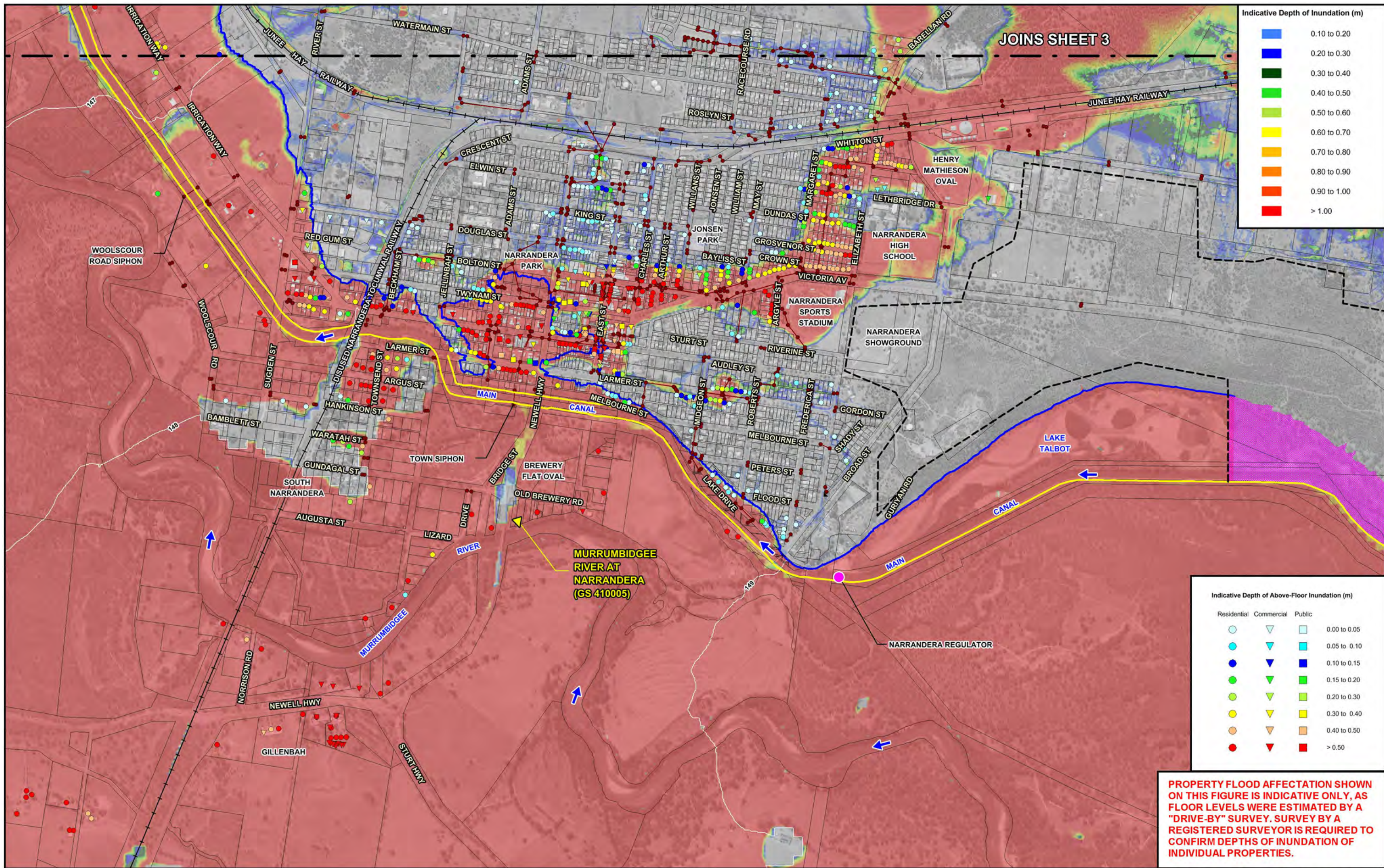
- Modelled Stormwater Network
- Existing Canal Embankment / Levee
- Railway
- Limit of Overland Flow Mapping
- Indicative Extent of Murrumbidgee River Flood Within Limit of Overland Flow Mapping
- WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator
- Water Surface Elevation Contours (m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

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.5 (Sheet 2 of 4)

INDICATIVE EXTENT AND DEPTHS OF INUNDATION EXTREME FLOOD





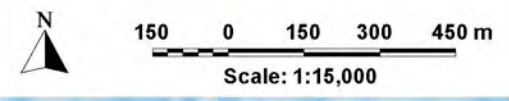
Indicative Depth of Inundation (m)

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
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Indicative Depth of Above-Floor Inundation (m)

Residential	Commercial	Public	Depth (m)
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.00 to 0.05
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.05 to 0.10
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.10 to 0.15
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.15 to 0.20
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.20 to 0.30
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.30 to 0.40
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.40 to 0.50
Light Blue Circle	Light Blue Triangle	Light Blue Square	> 0.50

PROPERTY FLOOD AFFECTATION SHOWN ON THIS FIGURE IS INDICATIVE ONLY, AS FLOOR LEVELS WERE ESTIMATED BY A "DRIVE-BY" SURVEY. SURVEY BY A REGISTERED SURVEYOR IS REQUIRED TO CONFIRM DEPTHS OF INUNDATION OF INDIVIDUAL PROPERTIES.



NOTE:
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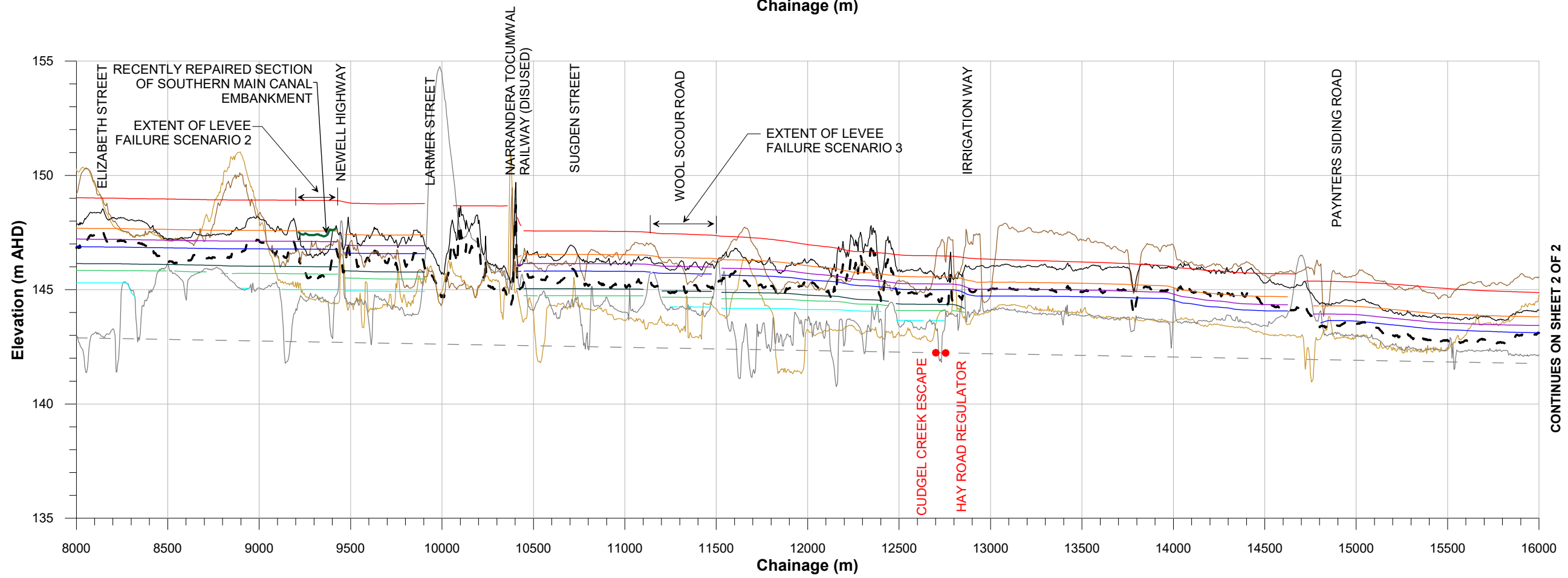
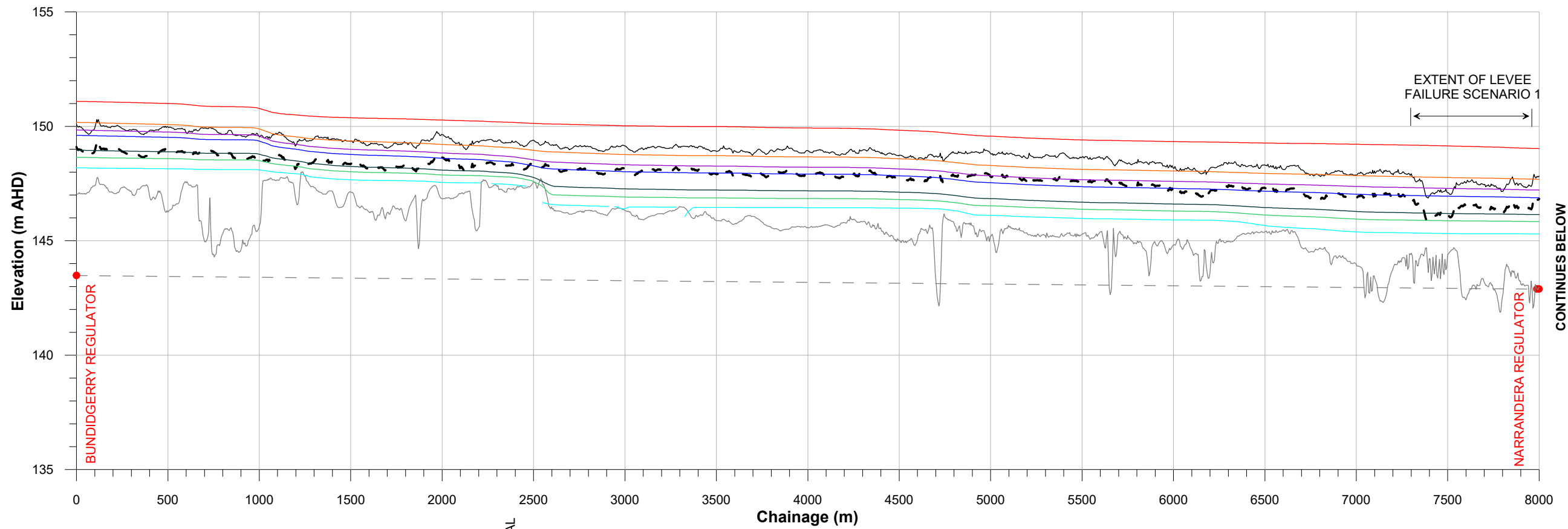
LEGEND

Red line with dots	Modelled Stormwater Network	Yellow triangle	WaterNSW Stream Gauge
Grey line	Existing Canal Embankment / Levee	Pink circle	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 area	Flood Behaviour Not Defined Over This Area
Blue line	Indicative Extent of Murrumbidgee River Flood Within Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.5 (Sheet 4 of 4)

INDICATIVE EXTENT AND DEPTHS OF INUNDATION EXTREME FLOOD



WATER SURFACE PROFILES

- Extreme Flood
- 0.2% AEP
- 0.5% AEP
- 1% AEP
- 5% AEP
- 10% AEP
- 20% AEP

GROUND PROFILES

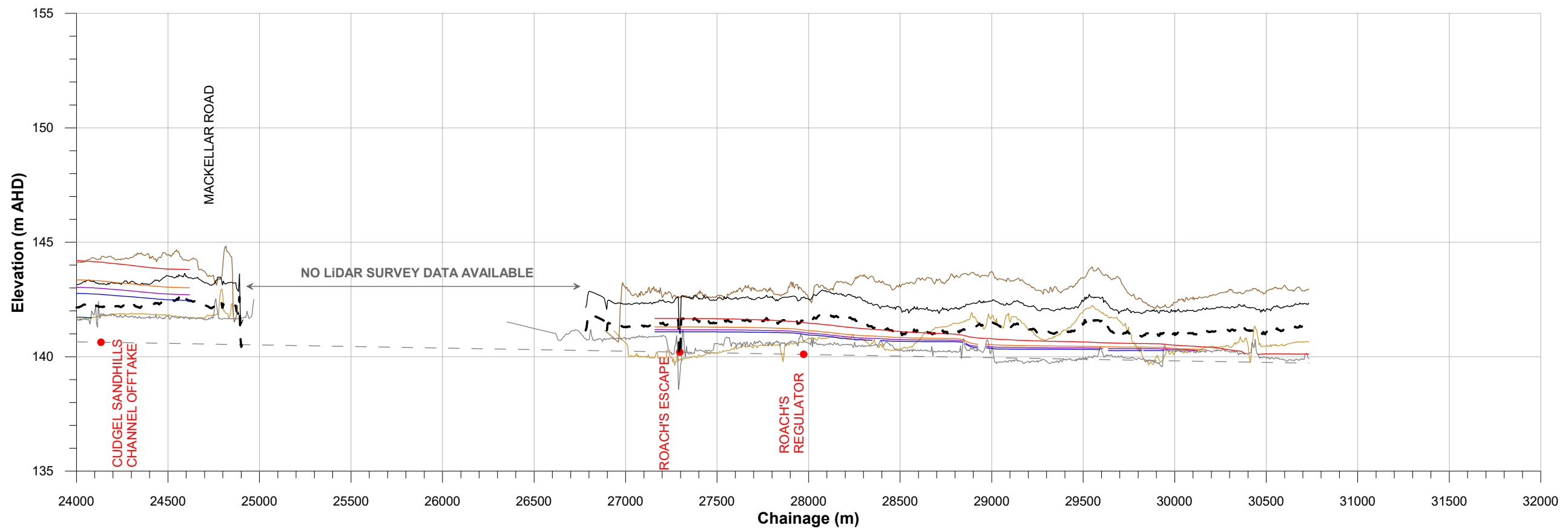
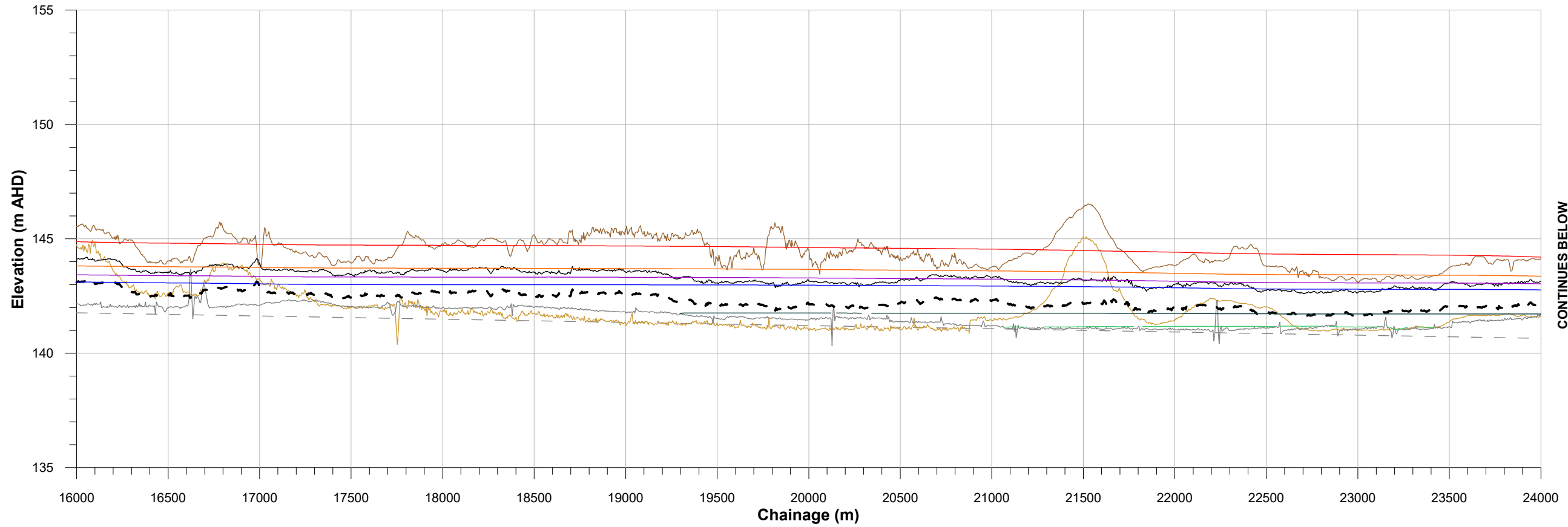
- Crest Level of Northern Main Canal Embankment
- Crest Level of Southern Main Canal Embankment
- - - 1.0 m Freeboard to Crest of Southern Main Canal Embankment
- Level of Floodplain on Town Side of Northern Main Canal Embankment
- Level of Floodplain on River Side of Southern Main Canal Embankment
- - - Invert Level of Main Canal (approx)

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.6
(Sheet 1 of 2)

LONGITUDINAL SECTION ALONG CREST OF MAIN CANAL EMBANKMENTS





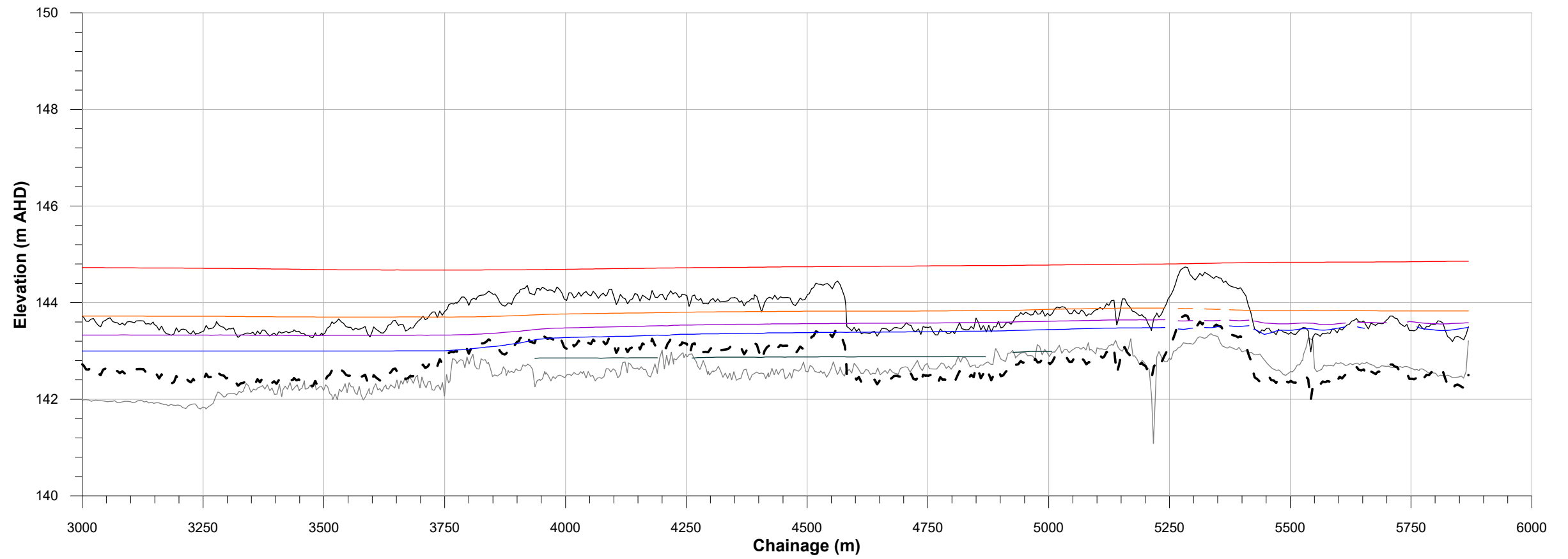
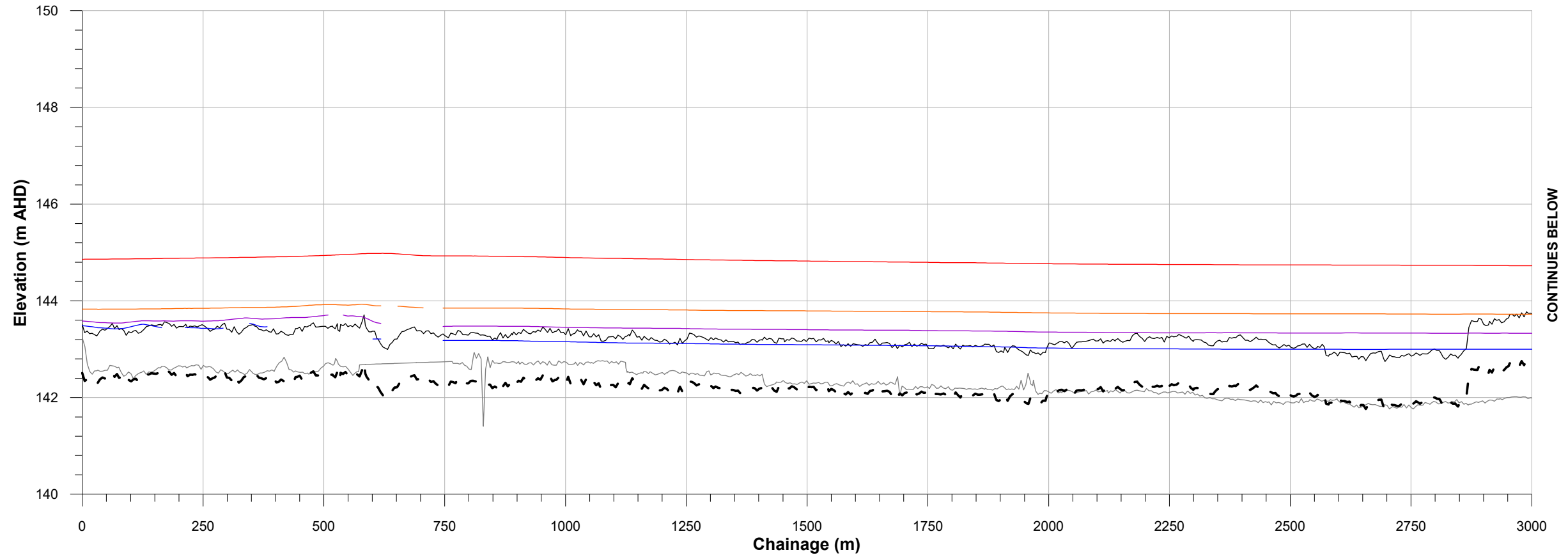
- | WATER SURFACE PROFILES | | GROUND PROFILES | |
|------------------------|---------------|-----------------|---|
| | Extreme Flood | | Crest Level of Northern Main Canal Embankment |
| | 0.2% AEP | | Crest Level of Southern Main Canal Embankment |
| | 0.5% AEP | | 1.0 m Freeboard to Crest of Southern Main Canal Embankment |
| | 1% AEP | | Level of Floodplain on Town Side of Northern Main Canal Embankment |
| | 5% AEP | | Level of Floodplain on River Side of Southern Main Canal Embankment |
| | 10% AEP | | Invert Level of Main Canal (approx) |
| | 20% AEP | | |

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

Figure 2.6
(Sheet 2 of 2)

**LONGITUDINAL SECTION ALONG CREST OF
MAIN CANAL EMBANKMENTS**





WATER SURFACE PROFILES

- Extreme Flood
- 0.2% AEP
- 0.5% AEP
- 1% AEP
- 5% AEP

GROUND PROFILES

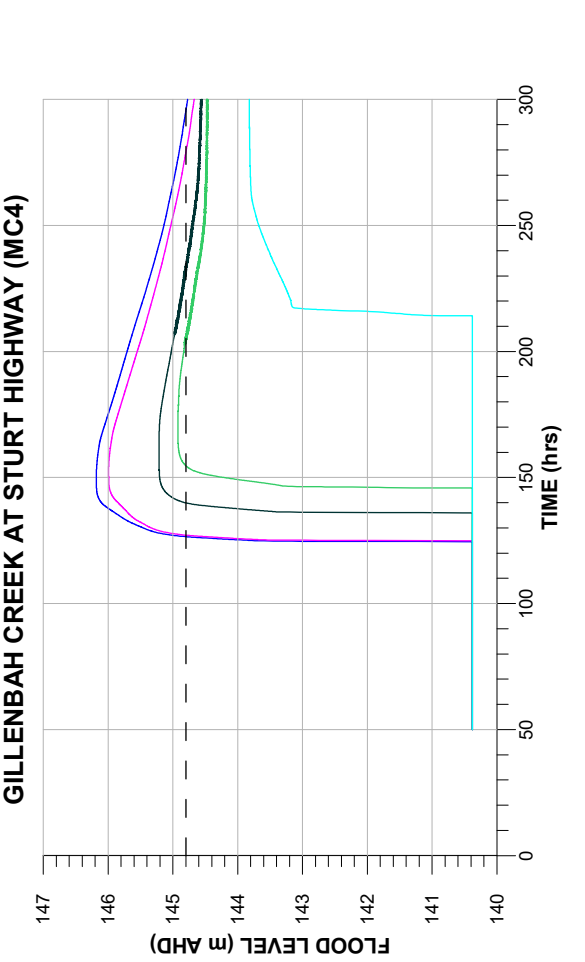
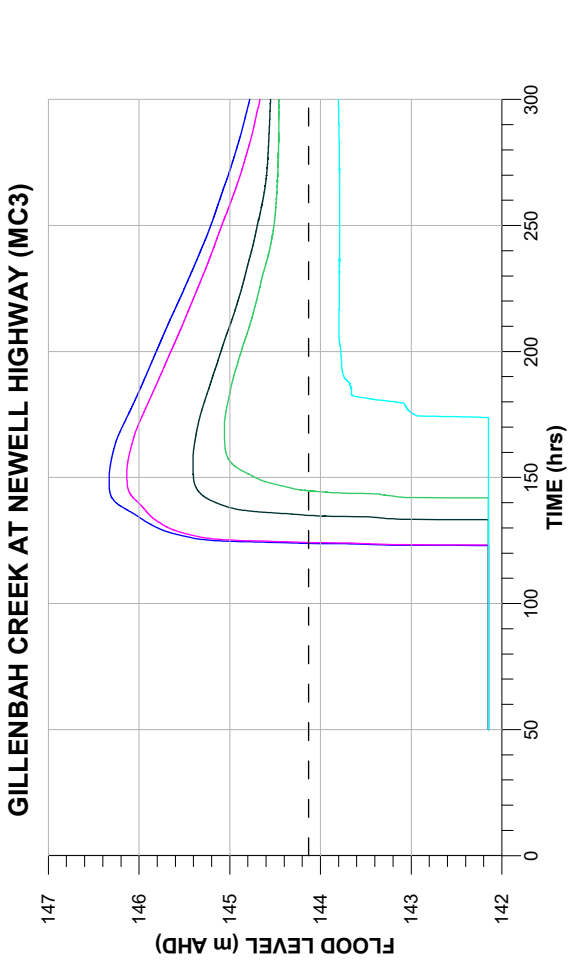
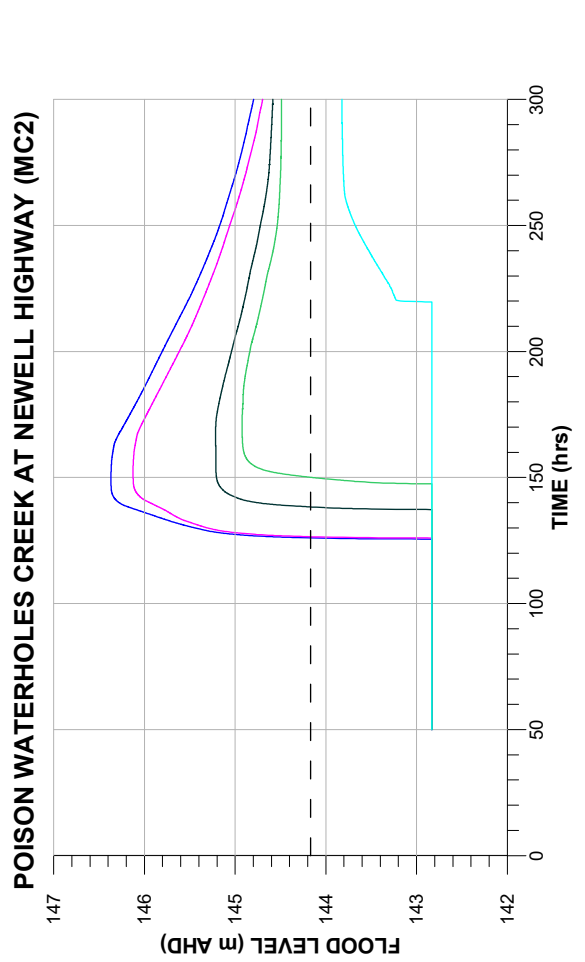
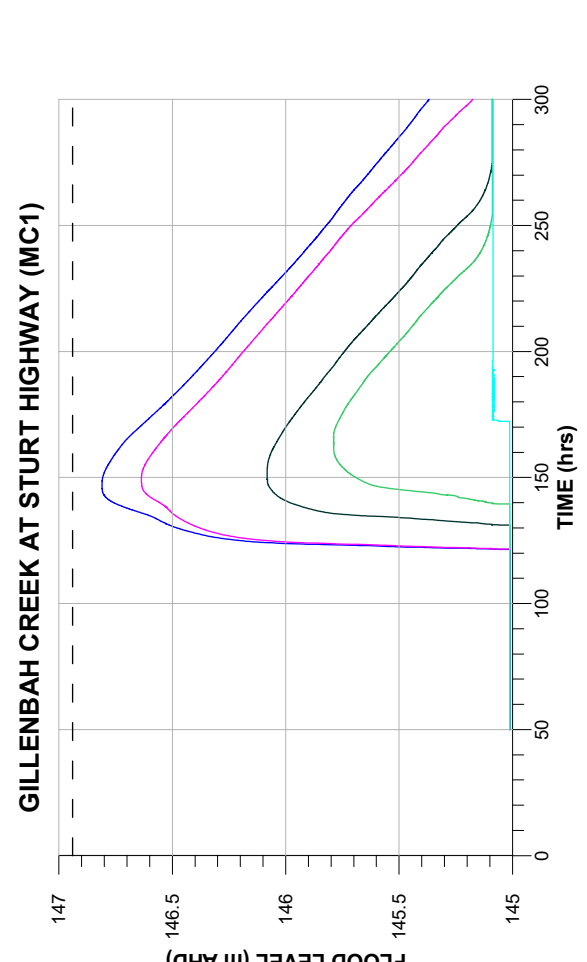
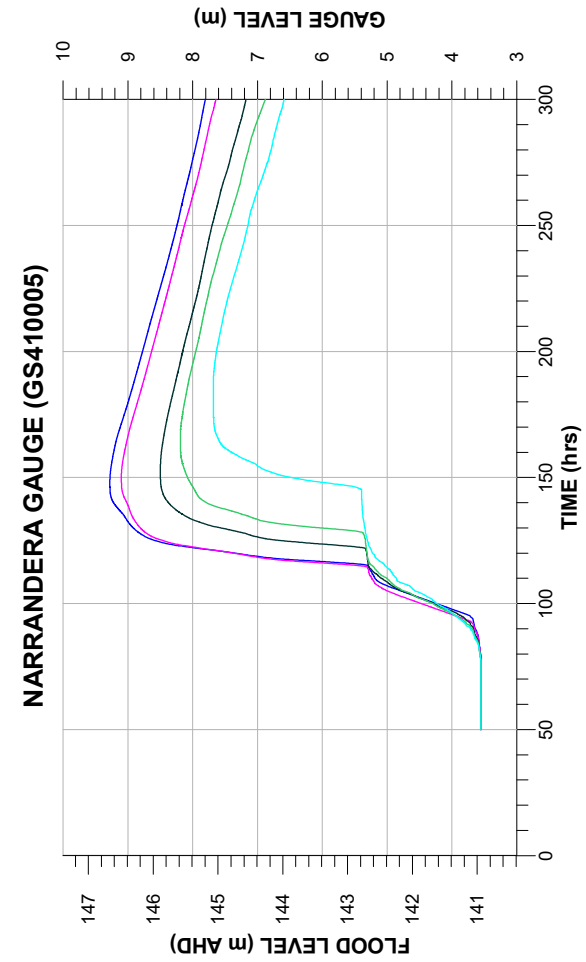
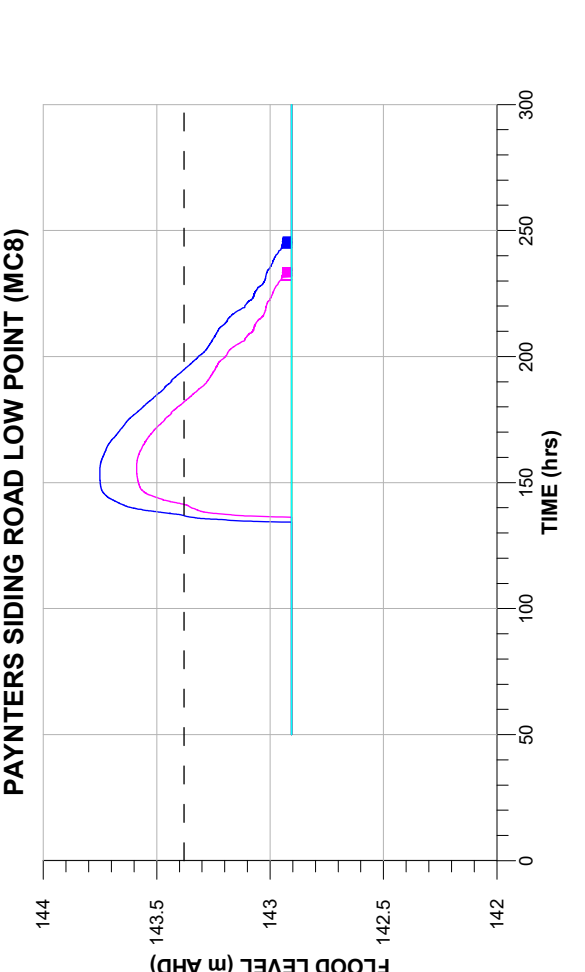
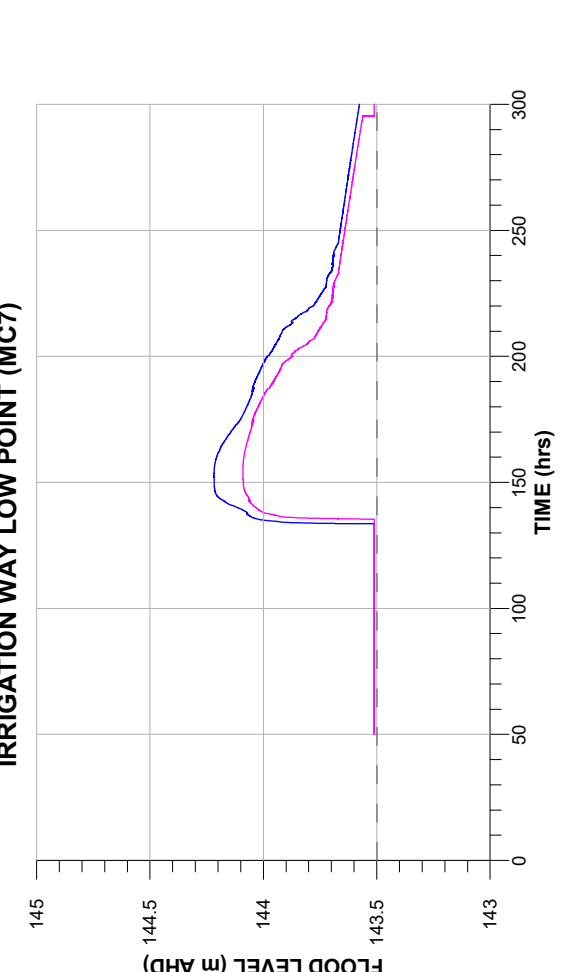
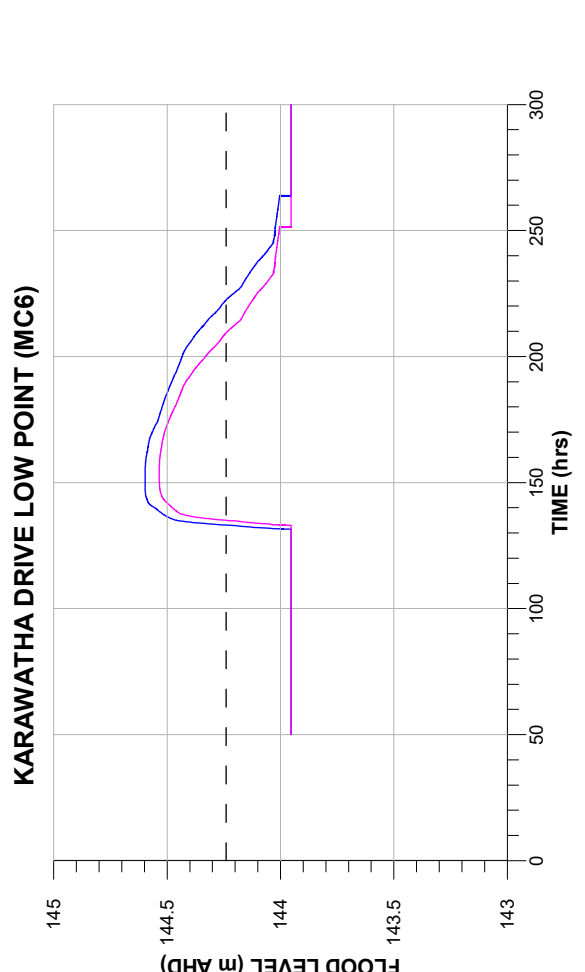
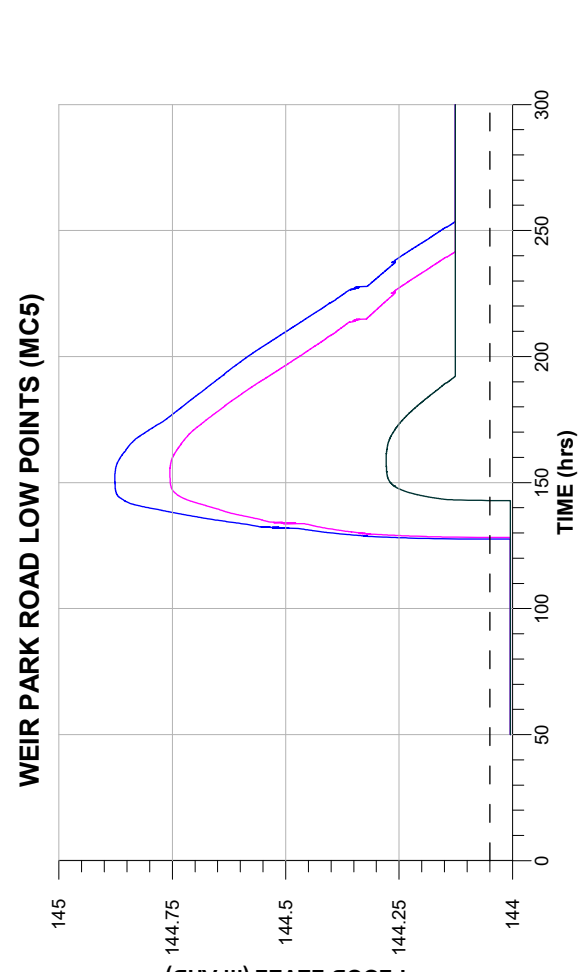
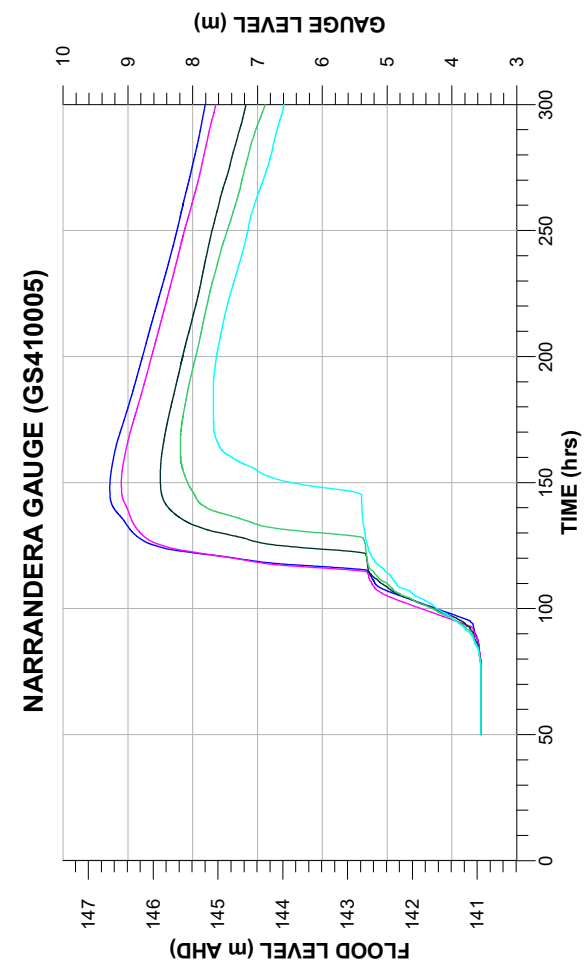
- Crest Level of Narrandera Airport Levee
- - - 1.0 m Freeboard to Crest of Narrandera Airport Levee
- Level of Floodplain on River Side of Narrandera Airport Levee

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

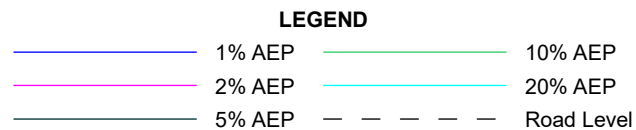
Figure 2.7

LONGITUDINAL SECTION ALONG CREST OF NARRANDERA AIRPORT LEVEE





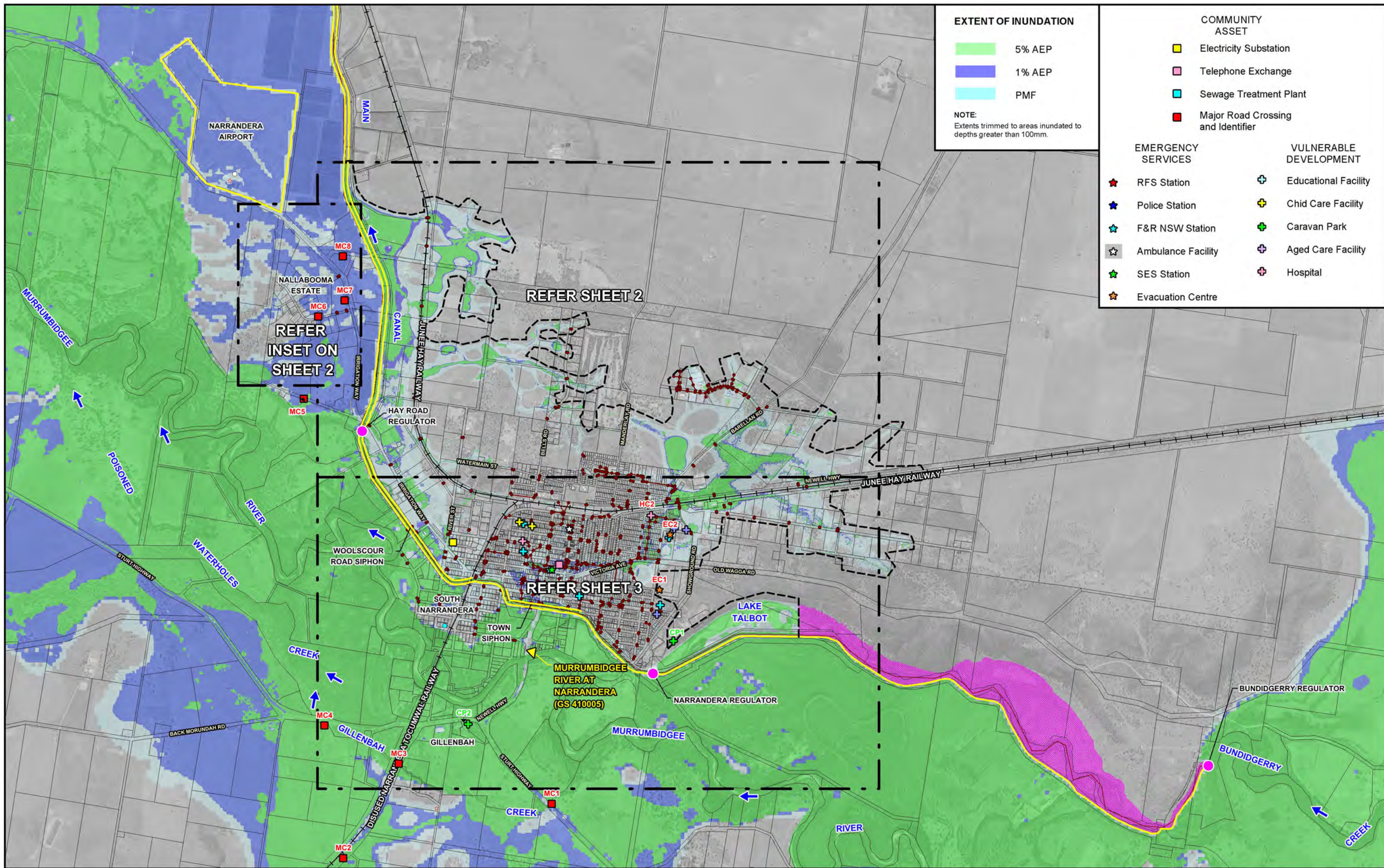
NOTE:
 1. Gauge Zero = 137.391 m AHD
 2. Refer Figure 2.9 for location of stage hydrographs.



REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.8

TIME OF RISE OF FLOODWATERS



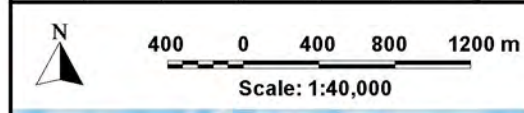
EXTENT OF INUNDATION

- 5% AEP
- 1% AEP
- PMF

NOTE:
Extents trimmed to areas inundated to depths greater than 100mm.

COMMUNITY ASSET	
	Electricity Substation
	Telephone Exchange
	Sewage Treatment Plant
	Major Road Crossing and Identifier

EMERGENCY SERVICES	VULNERABLE DEVELOPMENT
	 Educational Facility
	 Child Care Facility
	 Caravan Park
	 Aged Care Facility
	 Hospital
	



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.

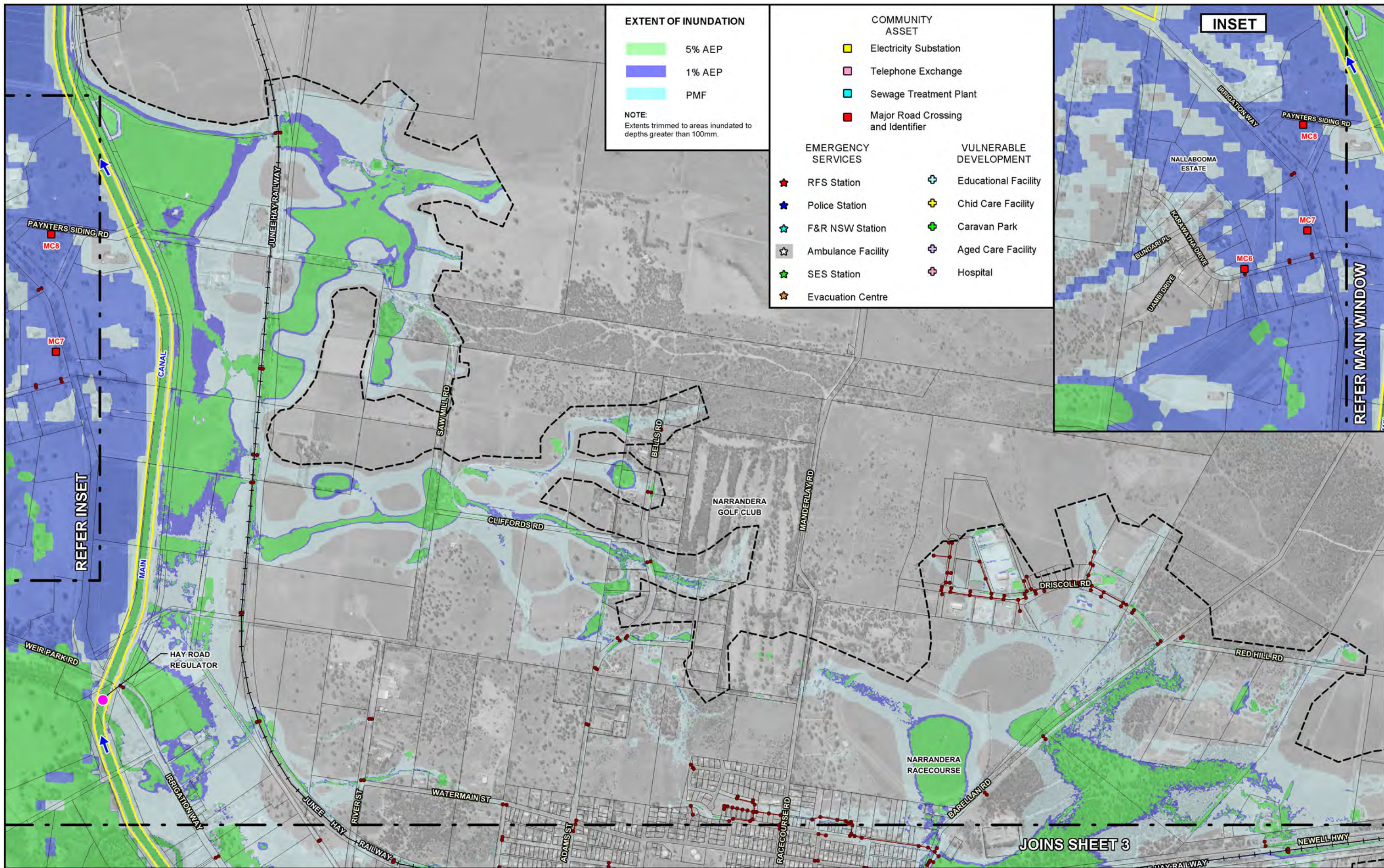
LEGEND

- 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 2.9 (Sheet 1 of 3)

INDICATIVE EXTENT OF INUNDATION AND LOCATION OF VULNERABLE DEVELOPMENT AND CRITICAL INFRASTRUCTURE

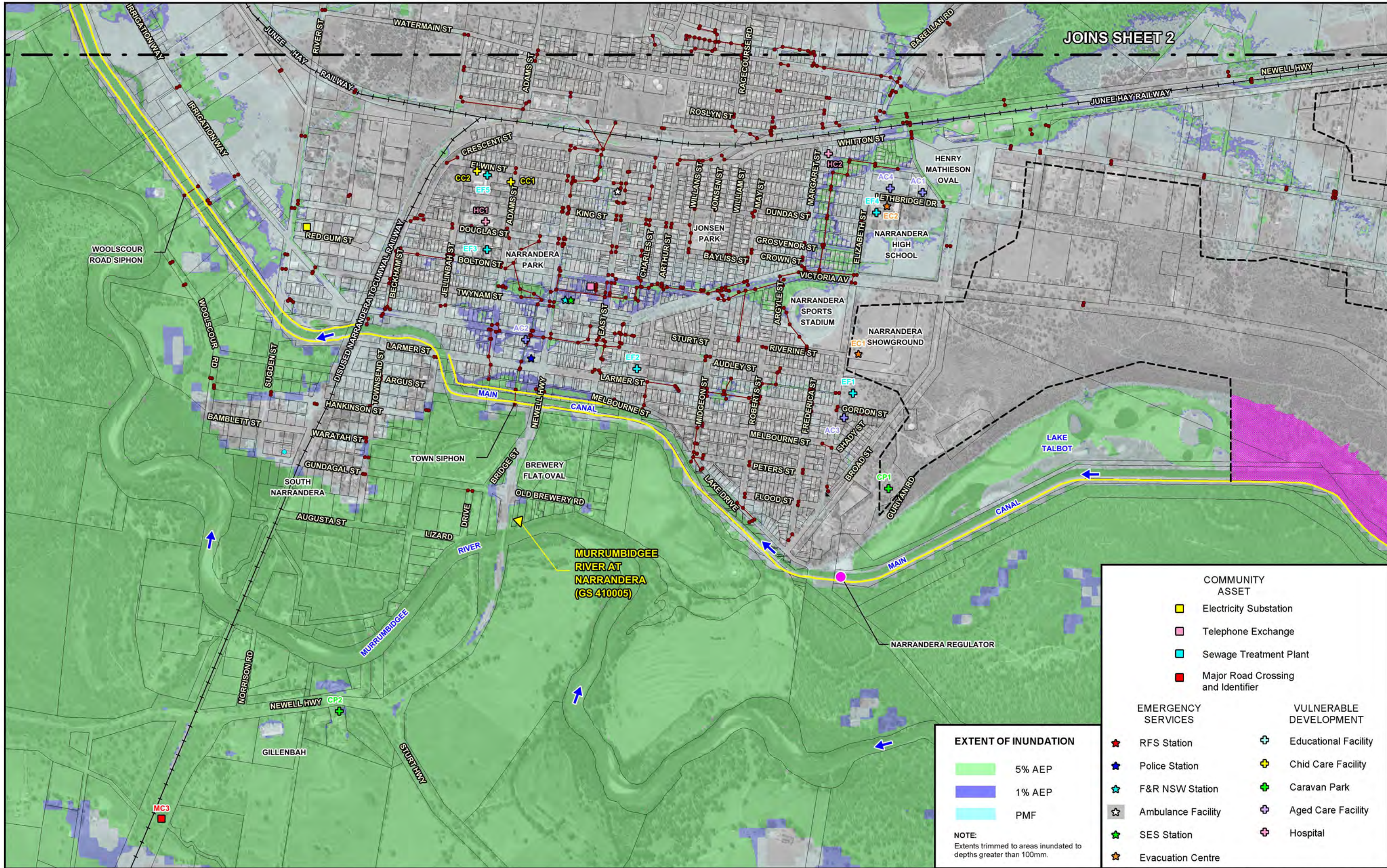


REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.9 (Sheet 2 of 3)

INDICATIVE EXTENT OF INUNDATION AND LOCATION OF VULNERABLE DEVELOPMENT AND CRITICAL INFRASTRUCTURE

JOINS SHEET 3



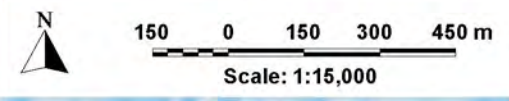
COMMUNITY ASSET	
■	Electricity Substation
■	Telephone Exchange
■	Sewage Treatment Plant
■	Major Road Crossing and Identifier

EMERGENCY SERVICES	VULNERABLE DEVELOPMENT
★	RFS Station
★	Police Station
★	F&R NSW Station
★	Ambulance Facility
★	SES Station
★	Evacuation Centre
+	Educational Facility
+	Child Care Facility
+	Caravan Park
+	Aged Care Facility
+	Hospital

EXTENT OF INUNDATION

- 5% AEP
- 1% AEP
- PMF

NOTE:
Extents trimmed to areas inundated to depths greater than 100mm.



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.

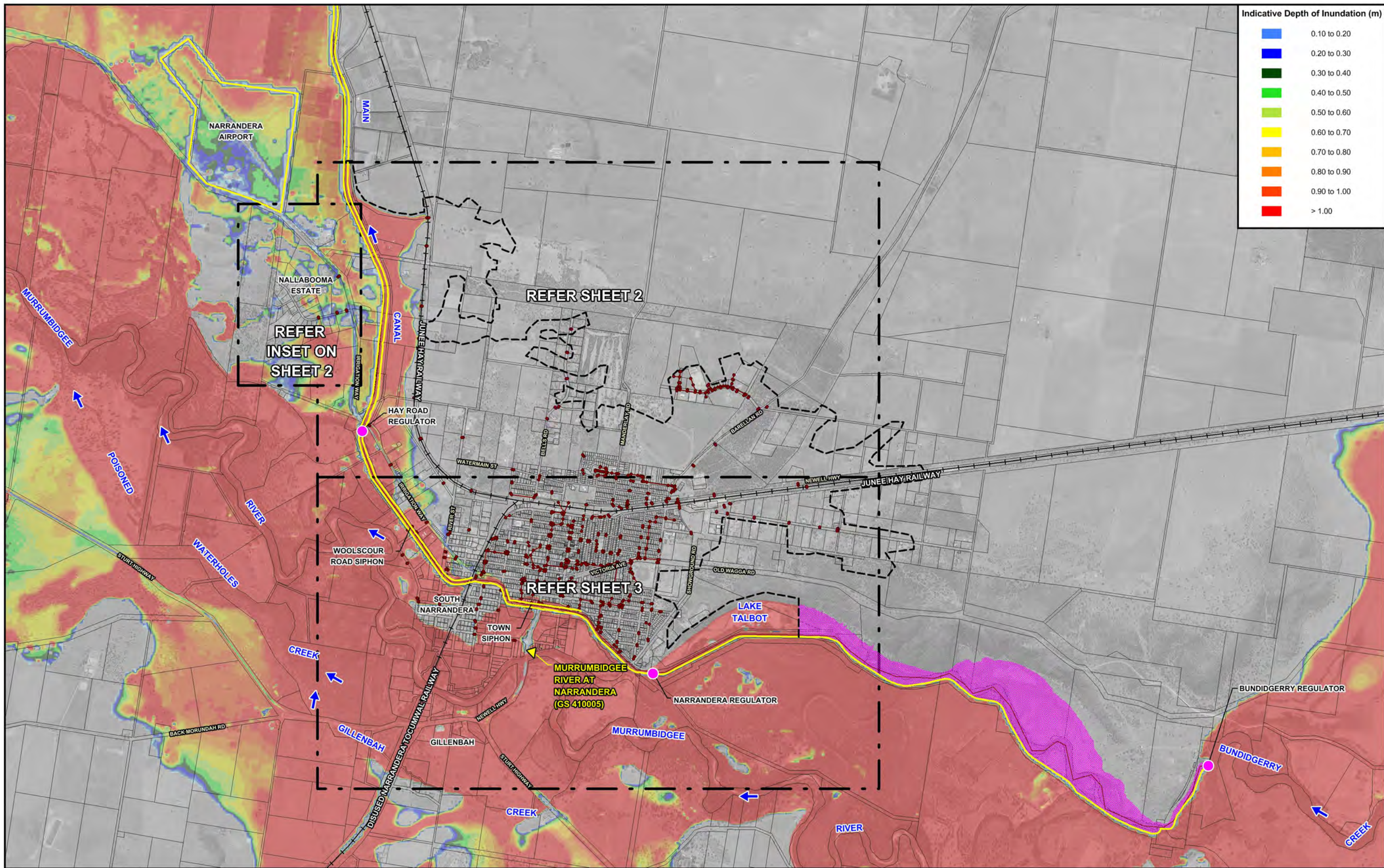
LEGEND

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

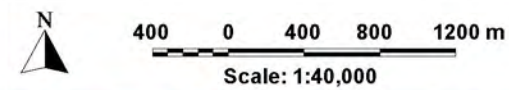
REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.9 (Sheet 3 of 3)

INDICATIVE EXTENT OF INUNDATION AND LOCATION OF VULNERABLE DEVELOPMENT AND CRITICAL INFRASTRUCTURE



Indicative Depth of Inundation (m)	
Light Blue	0.10 to 0.20
Blue	0.20 to 0.30
Dark 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



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.

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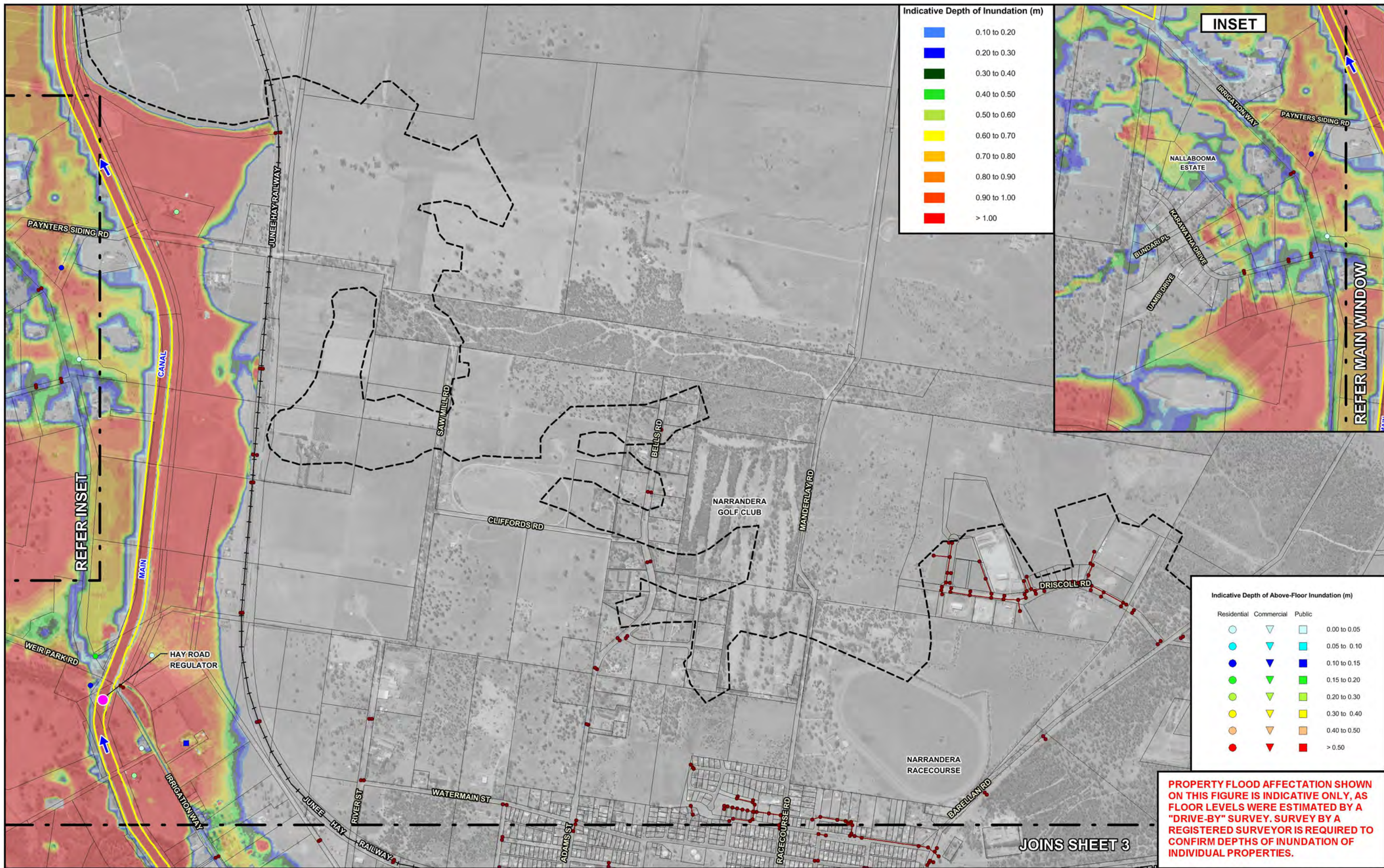
- LEGEND**
- Modelled Stormwater Network
 - Existing Canal Embankment / Levee
 - Railway
 - Limit of Overland Flow Mapping

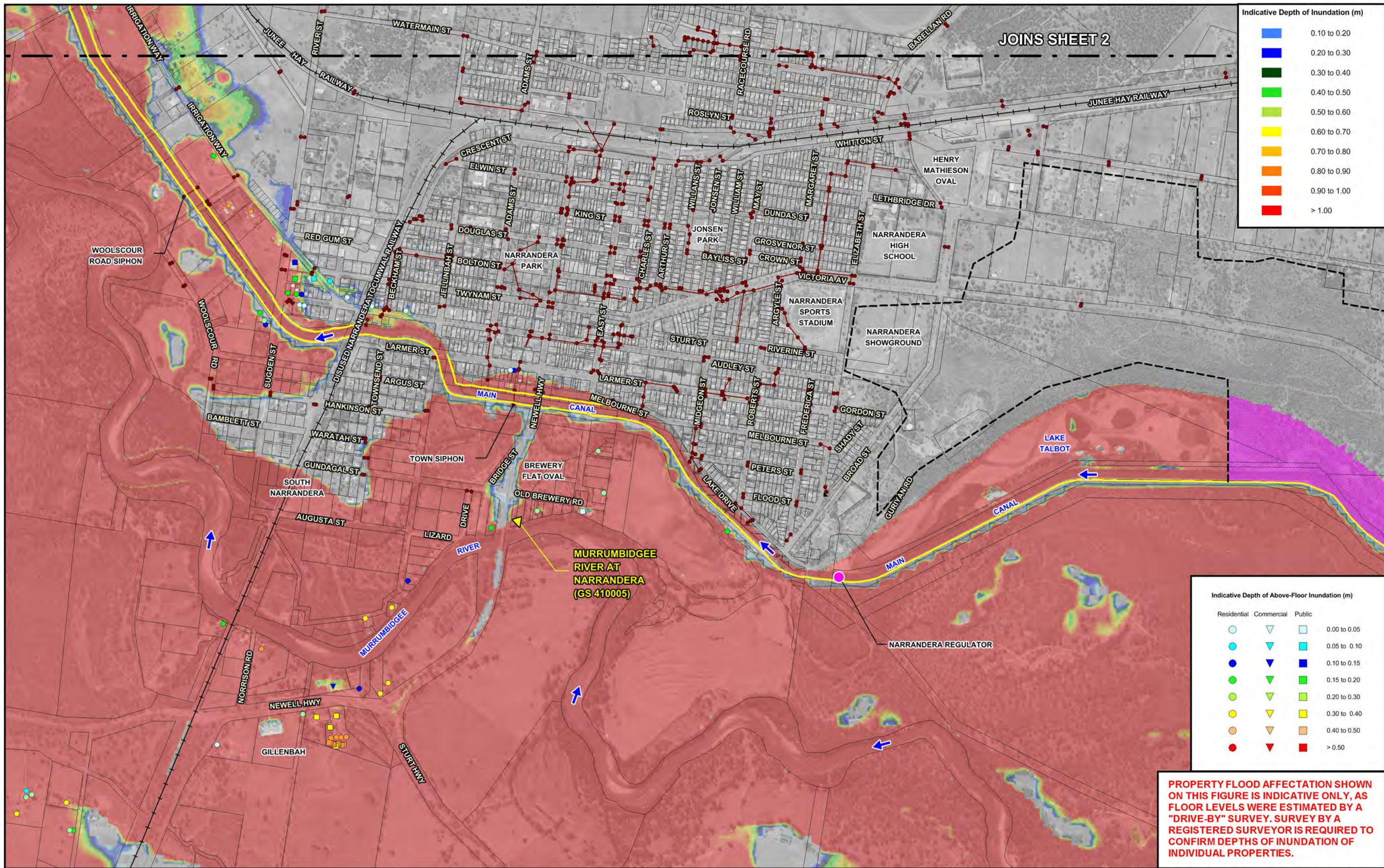
- WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.10
 (Sheet 1 of 3)

INDICATIVE EXTENT AND DEPTHS OF INUNDATION - PARTIAL FAILURE OF SOUTHERN MAIN CANAL EMBANKMENT - 1% AEP MURRUMBIDGEE RIVER FLOODING ONLY





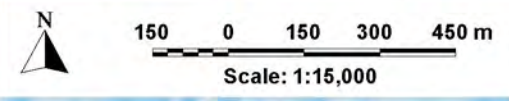
Indicative Depth of Inundation (m)

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
Dark Orange	0.80 to 0.90
Red-Orange	0.90 to 1.00
Red	> 1.00

Indicative Depth of Above-Floor Inundation (m)

Residential	Commercial	Public	Depth (m)
Light Blue Circle	Light Blue Triangle	Light Blue Square	0.00 to 0.05
Blue Circle	Blue Triangle	Blue Square	0.05 to 0.10
Dark Blue Circle	Dark Blue Triangle	Dark Blue Square	0.10 to 0.15
Green Circle	Green Triangle	Green Square	0.15 to 0.20
Light Green Circle	Light Green Triangle	Light Green Square	0.20 to 0.30
Yellow Circle	Yellow Triangle	Yellow Square	0.30 to 0.40
Orange Circle	Orange Triangle	Orange Square	0.40 to 0.50
Red Circle	Red Triangle	Red Square	> 0.50

PROPERTY FLOOD AFFECTATION SHOWN ON THIS FIGURE IS INDICATIVE ONLY, AS FLOOR LEVELS WERE ESTIMATED BY A "DRIVE-BY" SURVEY. SURVEY BY A REGISTERED SURVEYOR IS REQUIRED TO CONFIRM DEPTHS OF INUNDATION OF INDIVIDUAL 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.

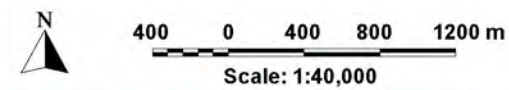
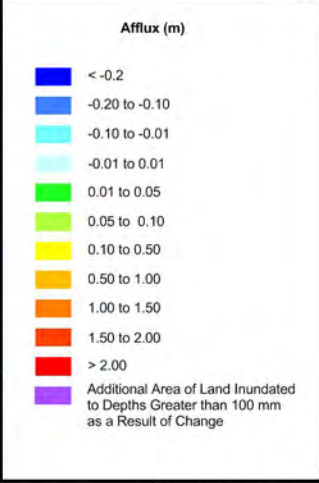
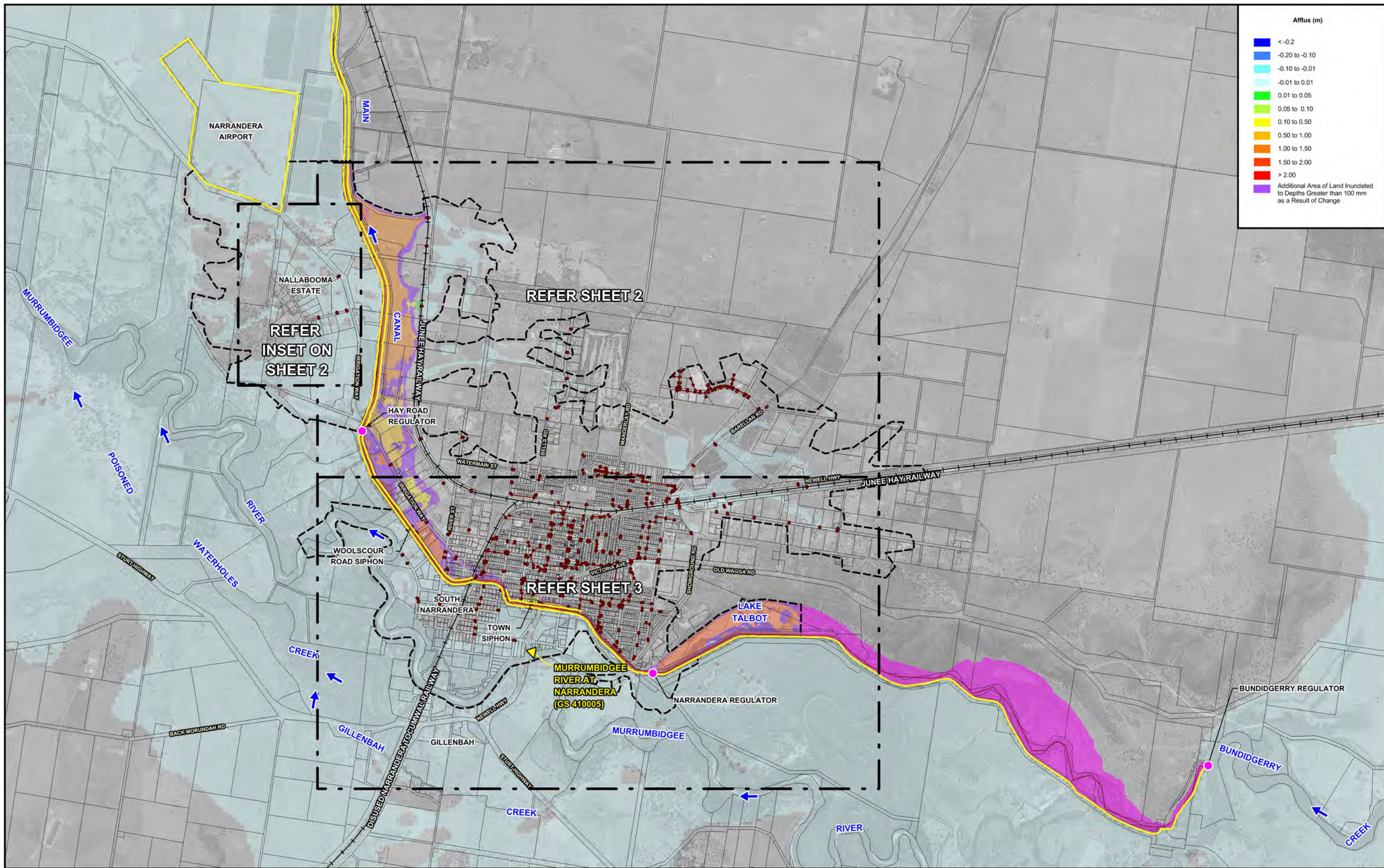
LEGEND

Red line with dots	Modelled Stormwater Network	Yellow triangle	WaterNSW Stream Gauge
Yellow line	Existing Canal Embankment / Levee	Pink circle	Murrumbidgee Irrigation Operated Regulator
Black line with cross-ticks	Railway	Pink rectangle	Flood Behaviour Not Defined Over This Area
Dashed black line	Limit of Overland Flow Mapping		

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.10 (Sheet 3 of 3)

INDICATIVE EXTENT AND DEPTHS OF INUNDATION - PARTIAL FAILURE OF SOUTHERN MAIN CANAL EMBANKMENT - 1% AEP MURRUMBIDGEE RIVER FLOODING ONLY



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.

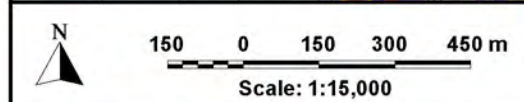
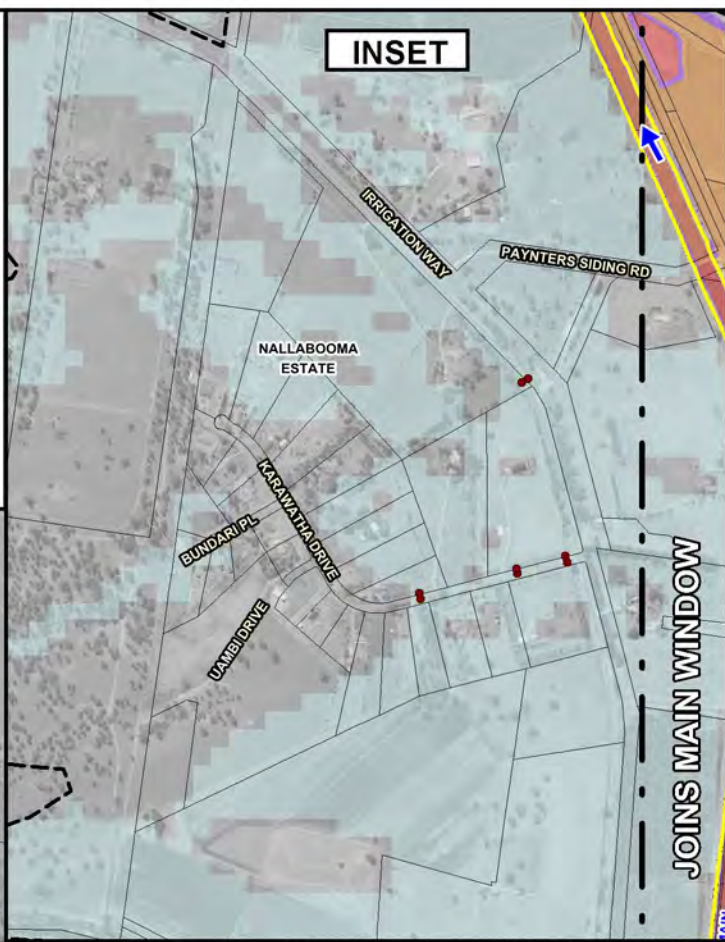
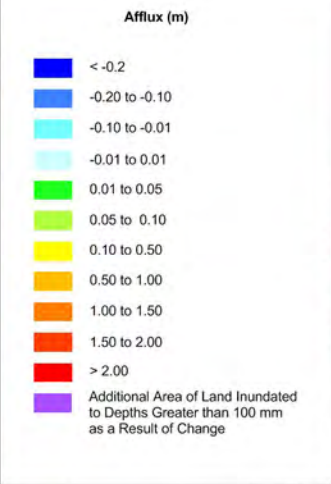
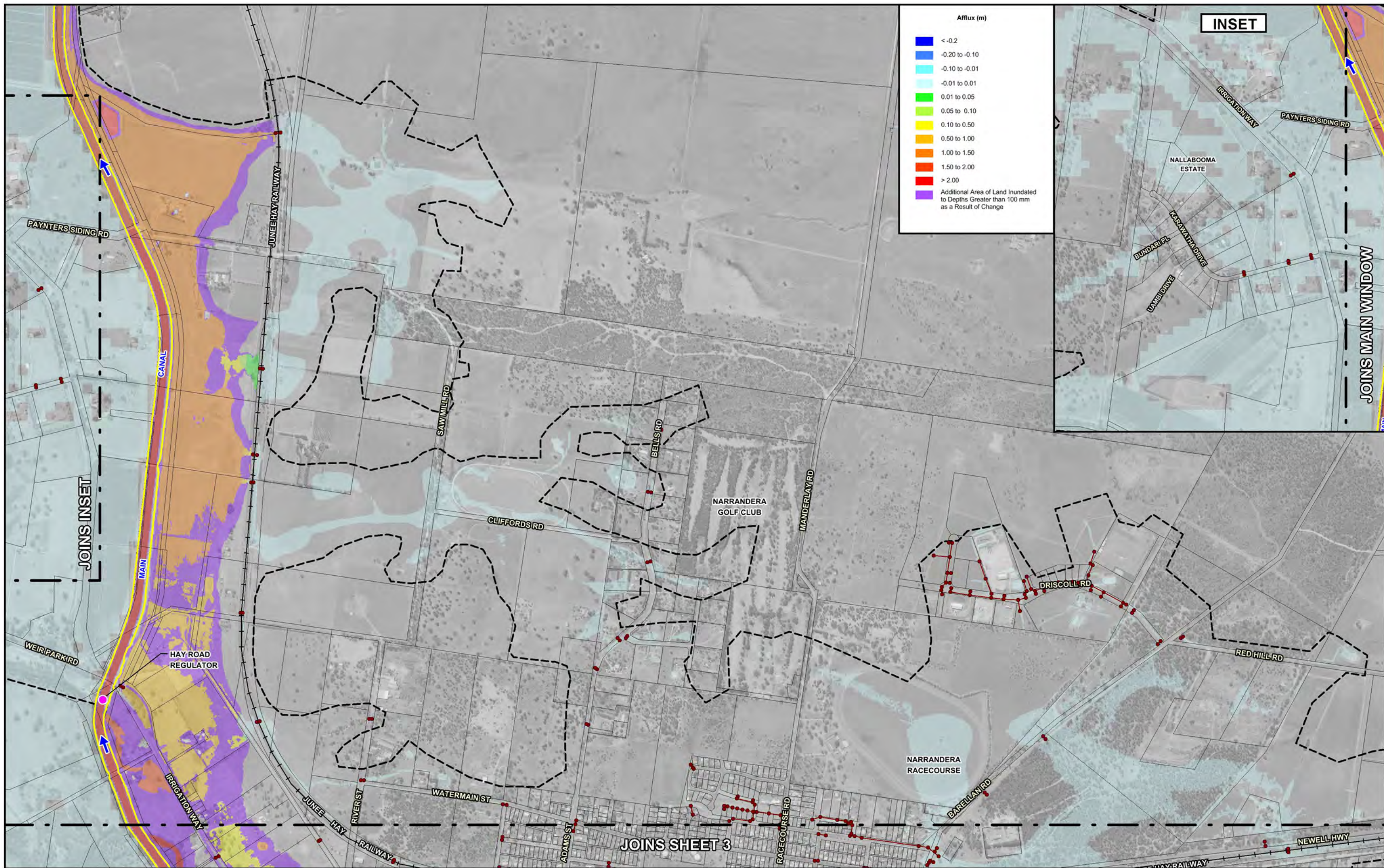
- LEGEND**
- Modelled Stormwater Network
 - Limit of Overland Flow Mapping
 - Existing Canal Embankment / Levee
 - Railway
 - ▼ WaterNSW Stream Gauge
 - Murrumbidgee Irrigation Operated Regulator
 - Flood Behaviour Not Defined Over This Area

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REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.11 (Sheet 1 of 3)

IMPACT OF PARTIAL FAILURE OF SOUTHERN MAIN CANAL EMBANKMENT ON FLOODING BEHAVIOUR - 1% AEP MURRUMBIDGEE RIVER FLOODING ONLY



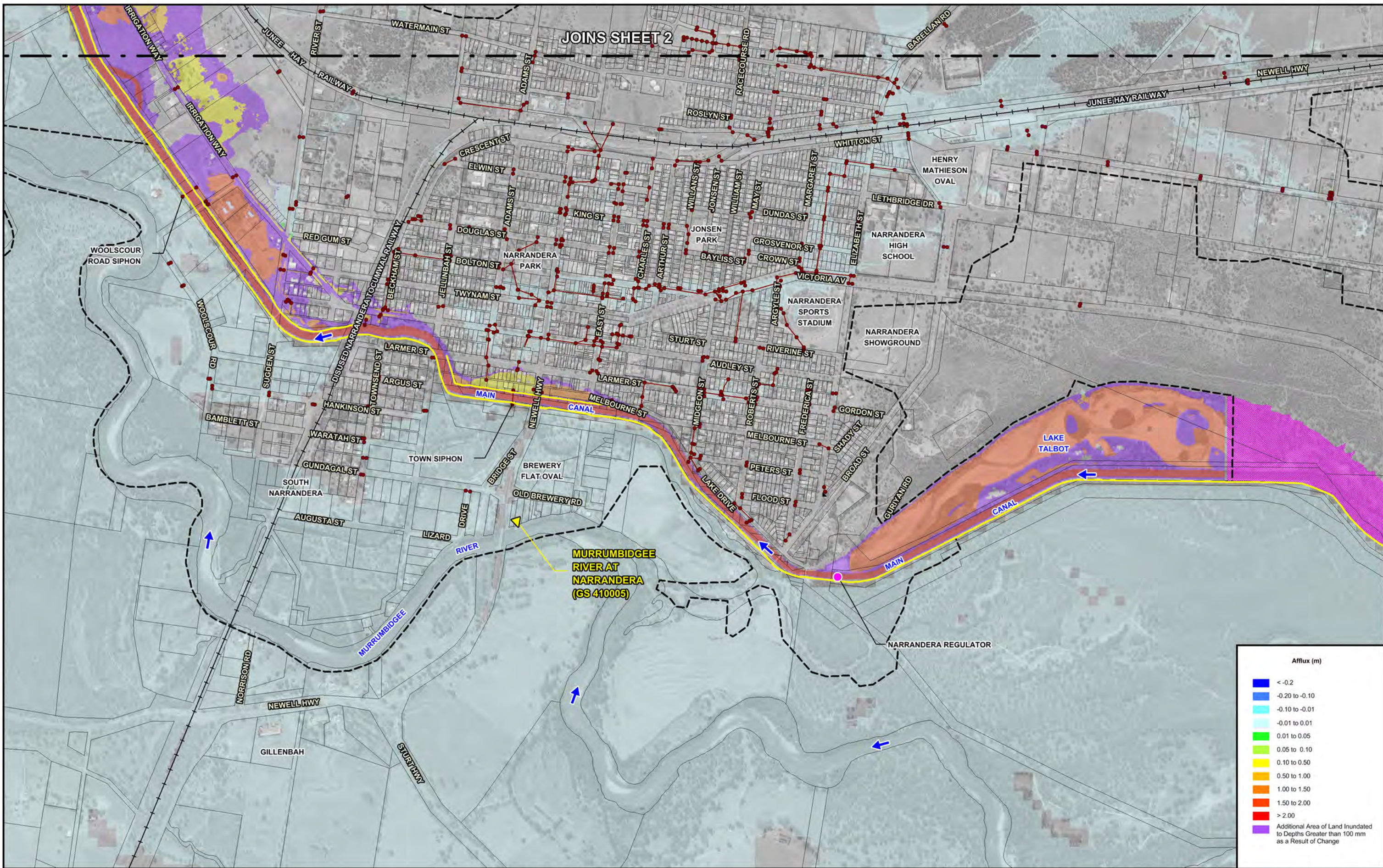
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
 The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

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

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.11
(Sheet 2 of 3)

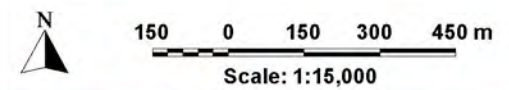
IMPACT OF PARTIAL FAILURE OF SOUTHERN MAIN CANAL EMBANKMENT ON FLOODING BEHAVIOUR - 1% AEP MURRUMBIDGEE RIVER FLOODING ONLY



JOINS SHEET 2

MURRUMBIDGEE RIVER AT NARRANDERA (GS 410005)

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 0.05
Yellow-Green	0.05 to 0.10
Yellow	0.10 to 0.50
Orange	0.50 to 1.00
Red-Orange	1.00 to 1.50
Red	1.50 to 2.00
Dark Red	> 2.00
Pink	Additional Area of Land Inundated to Depths Greater than 100 mm as a Result of Change



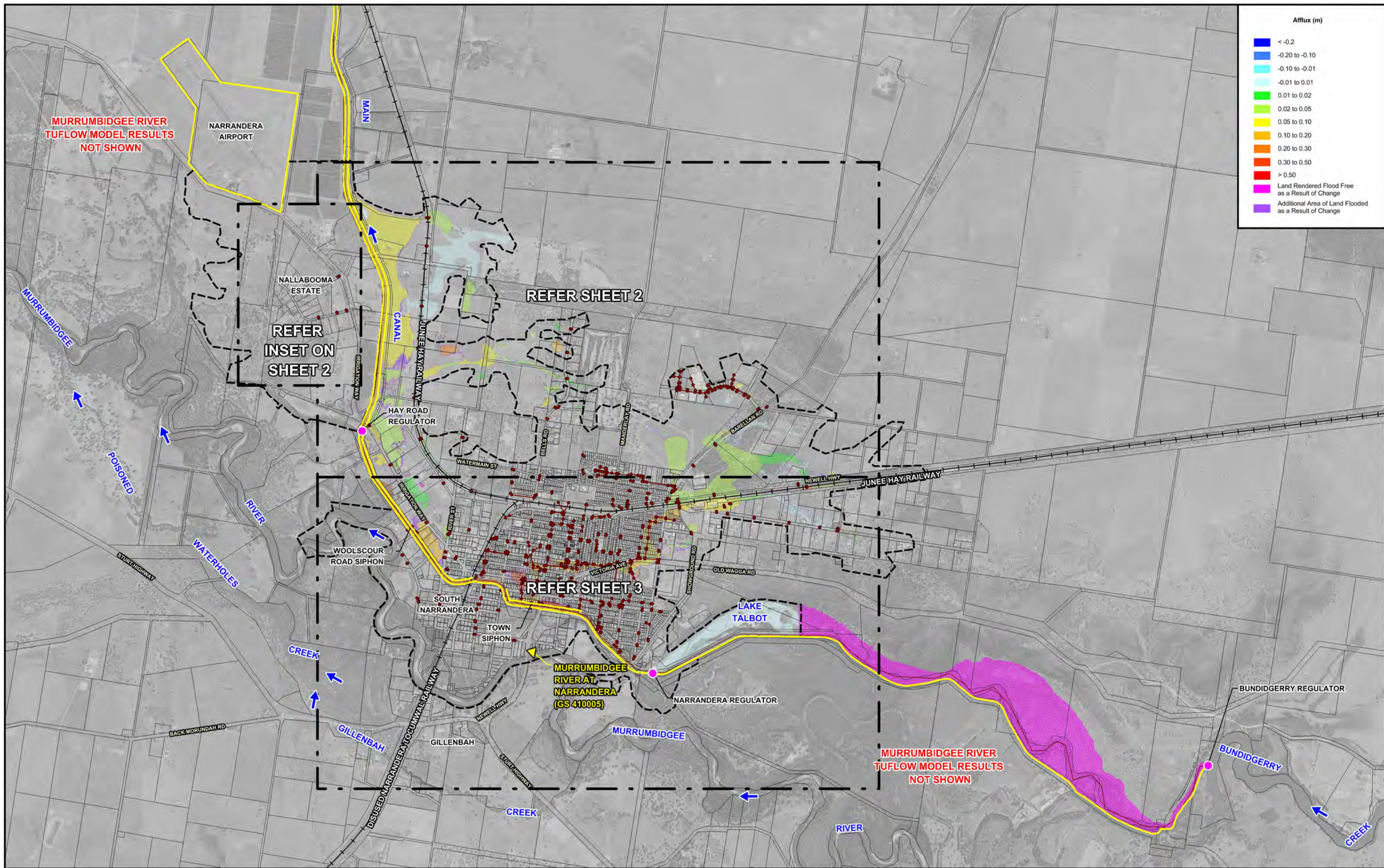
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

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

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

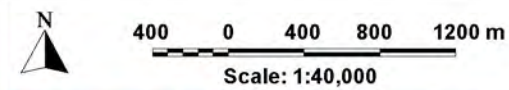
Figure 2.11 (Sheet 3 of 3)

IMPACT OF PARTIAL FAILURE OF SOUTHERN MAIN CANAL EMBANKMENT ON FLOODING BEHAVIOUR - 1% AEP MURRUMBIDGEE RIVER FLOODING ONLY



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.

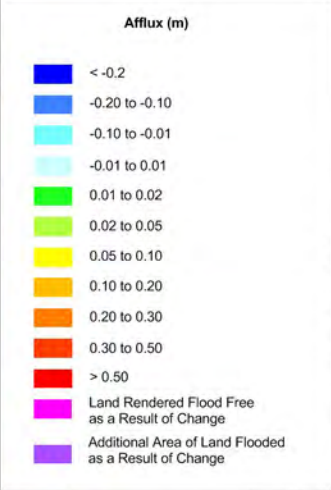
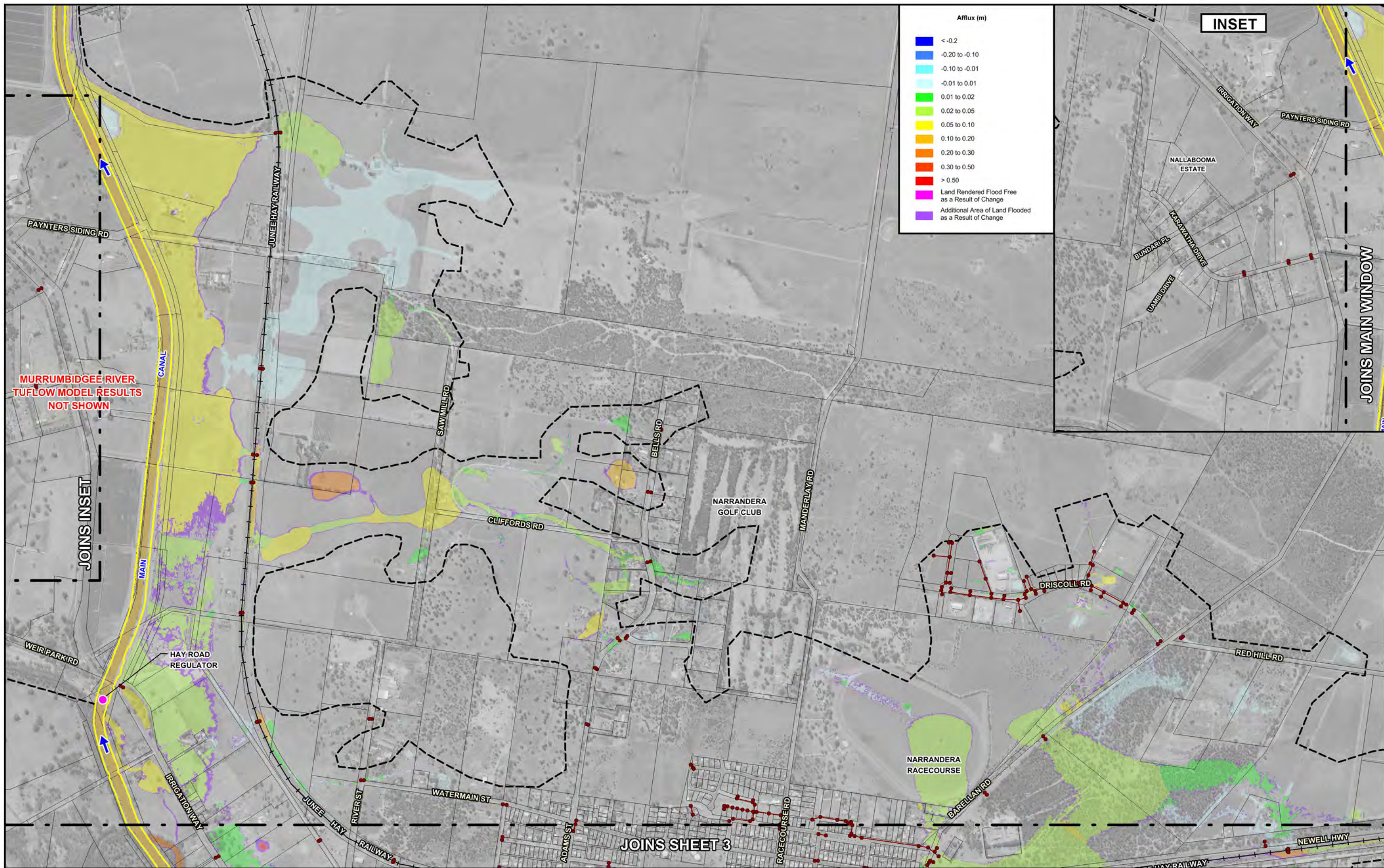
LEGEND

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

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

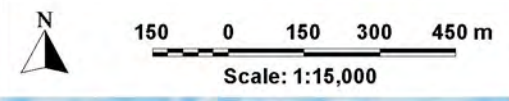
Figure 2.12 (Sheet 1 of 3)

POTENTIAL IMPACT OF FUTURE URBANISATION ON FLOODING AND DRAINAGE PATTERNS
 1% AEP LOCAL CATCHMENT FLOOD



MURRUMBIDGEE RIVER
TUFLOW MODEL RESULTS
NOT SHOWN

JOINS SHEET 3



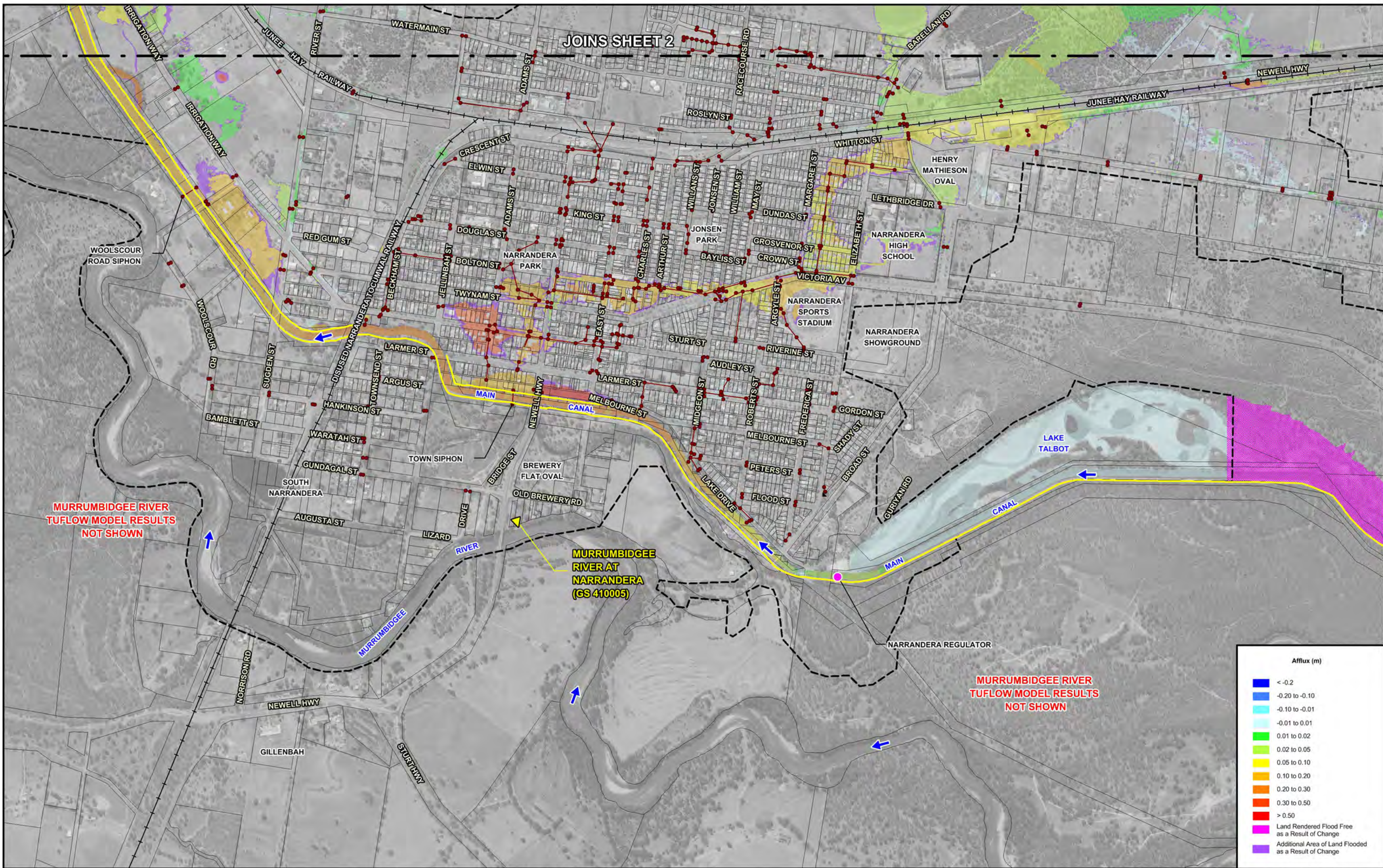
NOTE:
The extent of flooding shown was determined from airborne laser scanning survey and are approximate only.
The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

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

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

Figure 2.12
(Sheet 2 of 3)

POTENTIAL IMPACT OF FUTURE URBANISATION ON FLOODING AND DRAINAGE PATTERNS
1% AEP LOCAL CATCHMENT FLOOD

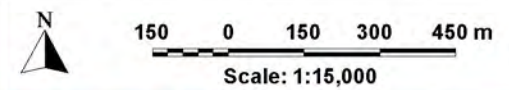


MURRUMBIDGE RIVER
TUFLOW MODEL RESULTS
NOT SHOWN

MURRUMBIDGE RIVER AT
NARRANDERA
(GS 410005)

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

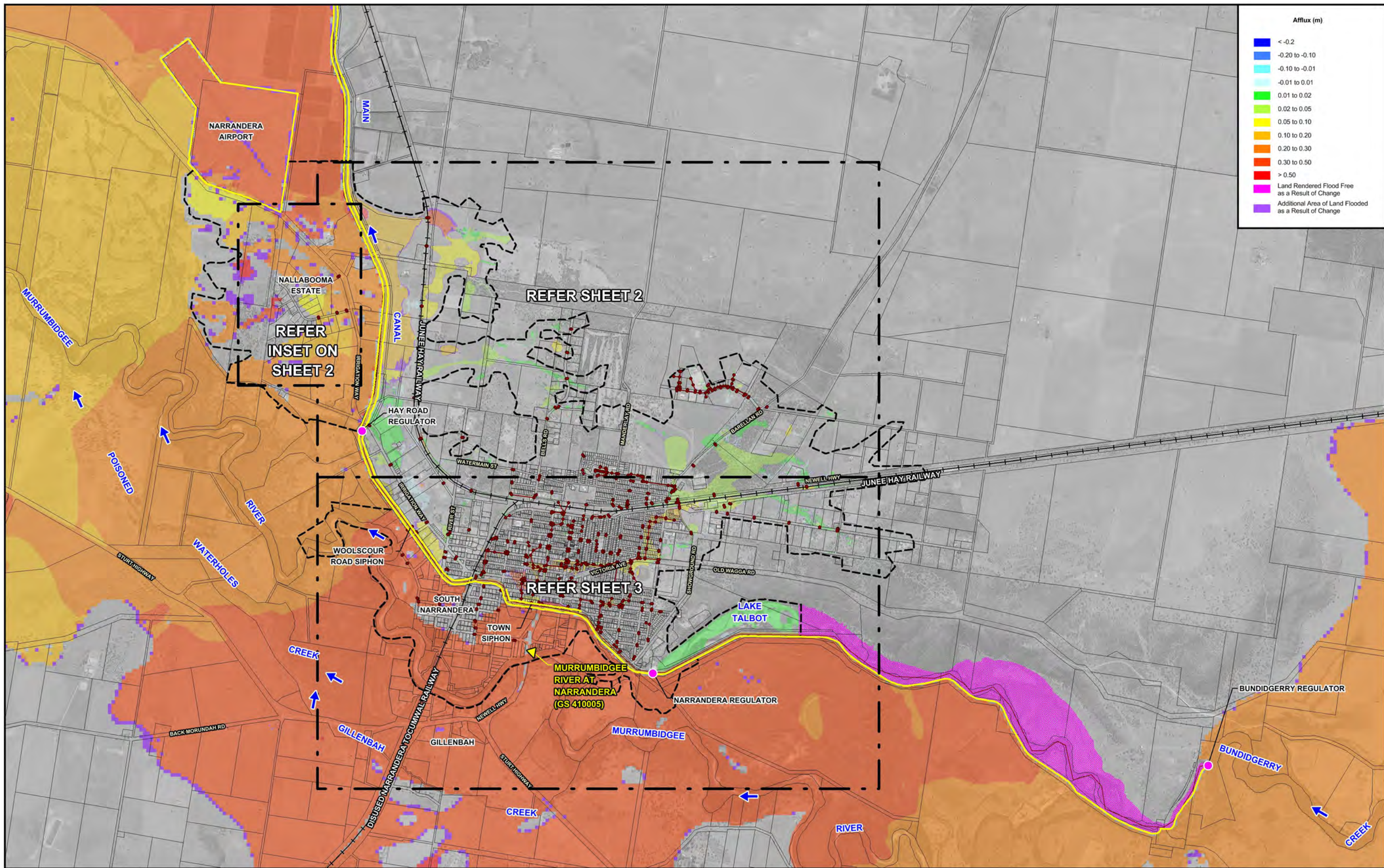
- ▼ WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

Lyall & Associates

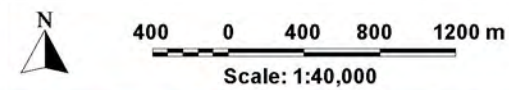
**REVIEW OF THE NARRANDERA FLOODPLAIN
RISK MANAGEMENT STUDY AND PLAN**

Figure 2.12
(Sheet 3 of 3)

POTENTIAL IMPACT OF FUTURE URBANISATION ON FLOODING AND DRAINAGE PATTERNS
1% AEP LOCAL CATCHMENT FLOOD



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
Pink	Land Rendered Flood Free as a Result of Change
Purple	Additional Area of Land Flooded as a Result of Change



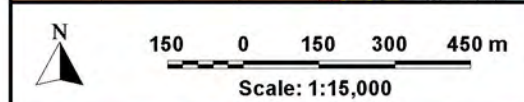
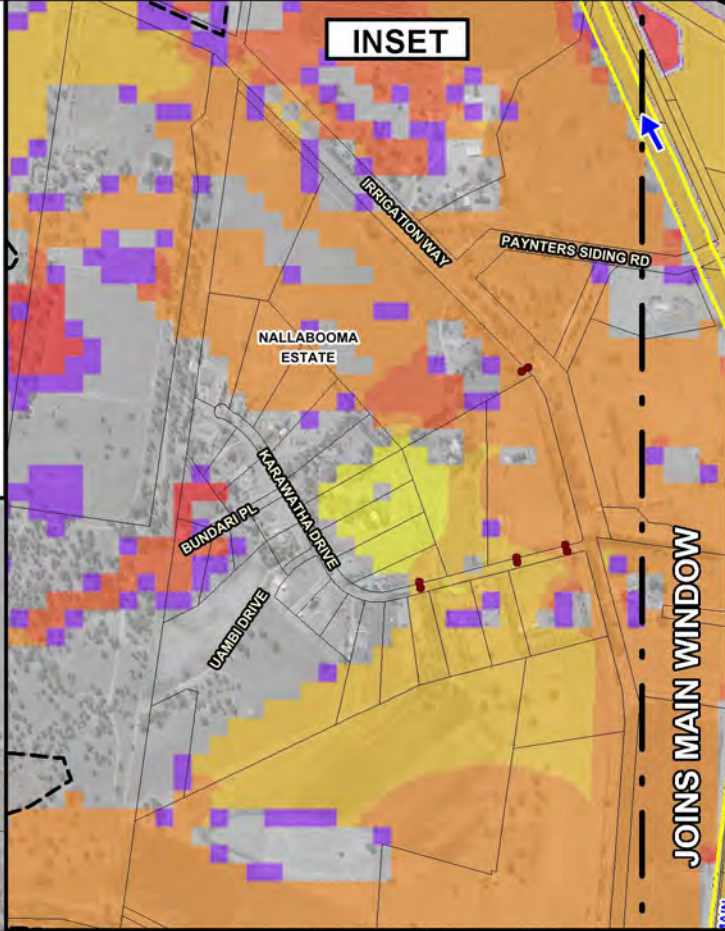
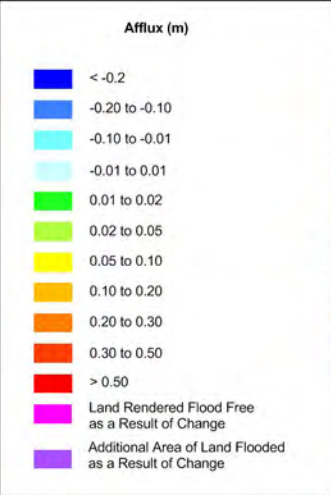
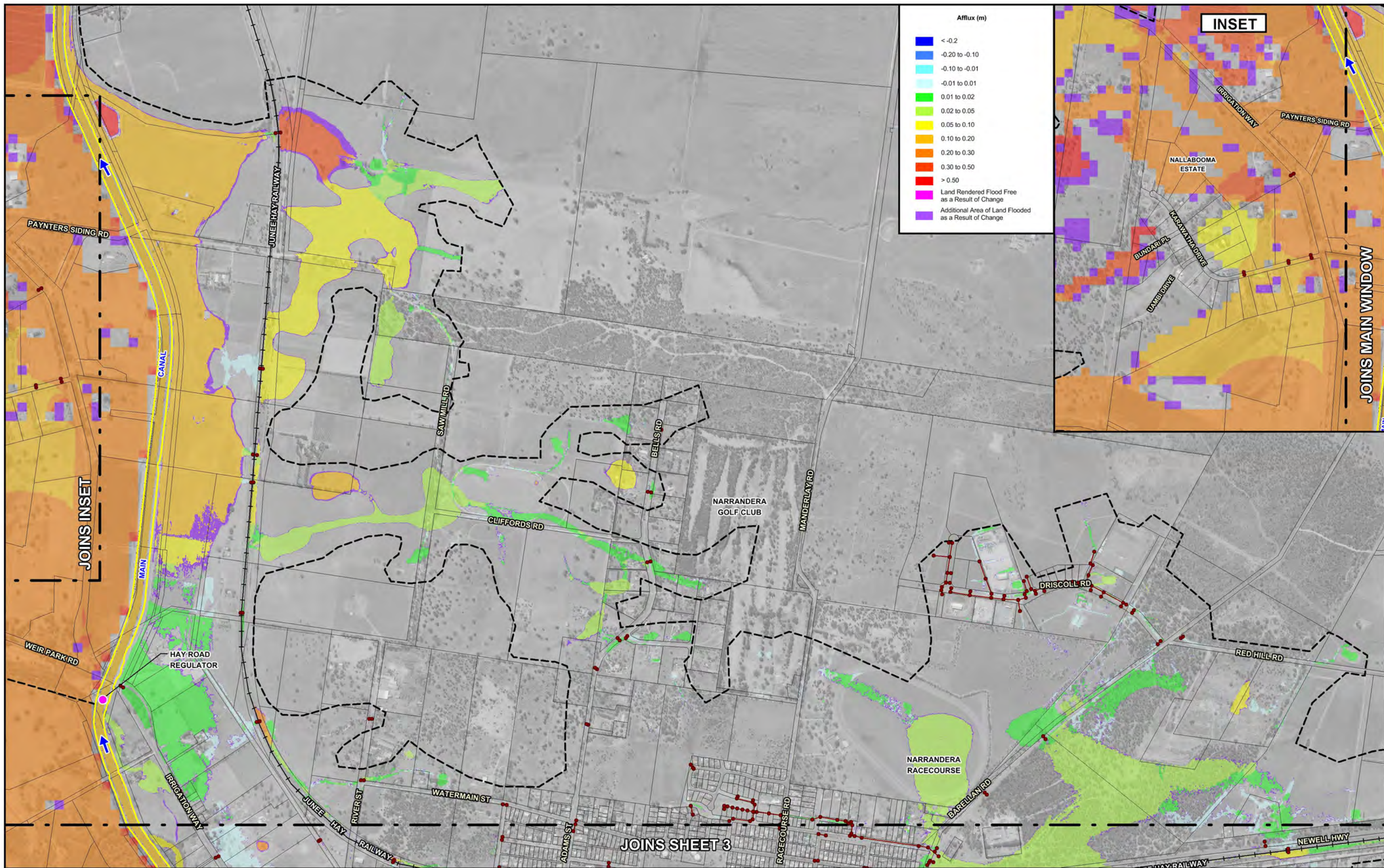
NOTE:
 The extent of flooding shown was determined from airborne laser scanning survey and are approximate only. The extent of inundation in individual allotments near the flood fringe should be confirmed by site specific survey.

LEGEND	
	Modelled Stormwater Network
	Limit of Overland Flow Mapping
	Existing Canal Embankment / Levee
	Railway
	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 2.13 (Sheet 1 of 3)

POTENTIAL IMPACT OF CLIMATE CHANGE ON FLOODING AND DRAINAGE PATTERNS
 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.

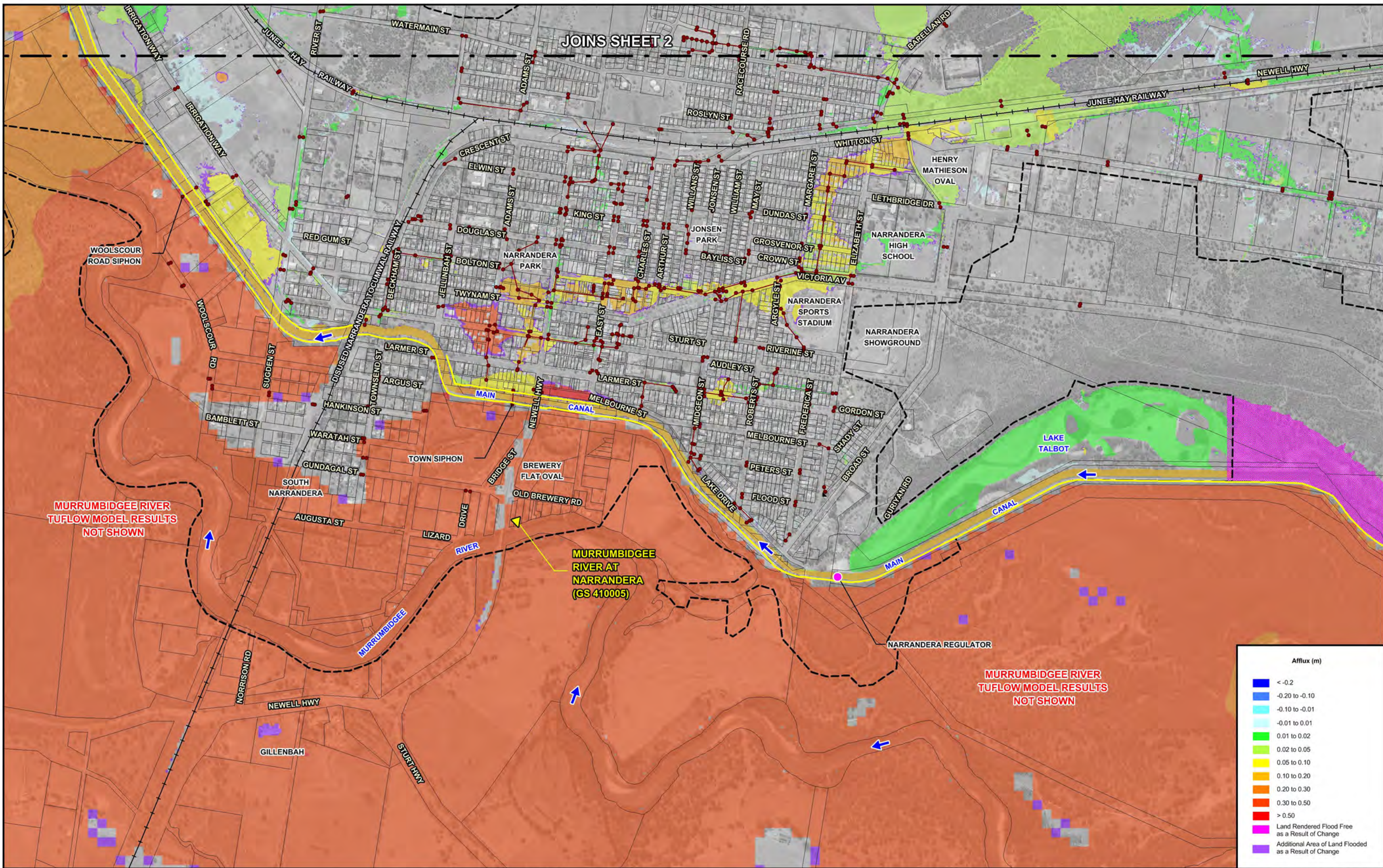
- LEGEND**
- Modelled Stormwater Network
 - Limit of Overland Flow Mapping
 - Existing Canal Embankment / Levee
 - | Railway

- Murrumbidgee Irrigation Operated Regulator

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.13 (Sheet 2 of 3)

POTENTIAL IMPACT OF CLIMATE CHANGE ON FLOODING AND DRAINAGE PATTERNS
 1% AEP



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Scale: 1:15,000

150 0 150 300 450 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**
- Modelled Stormwater Network
 - Limit of Overland Flow Mapping
 - Existing Canal Embankment / Levee
 - Railway

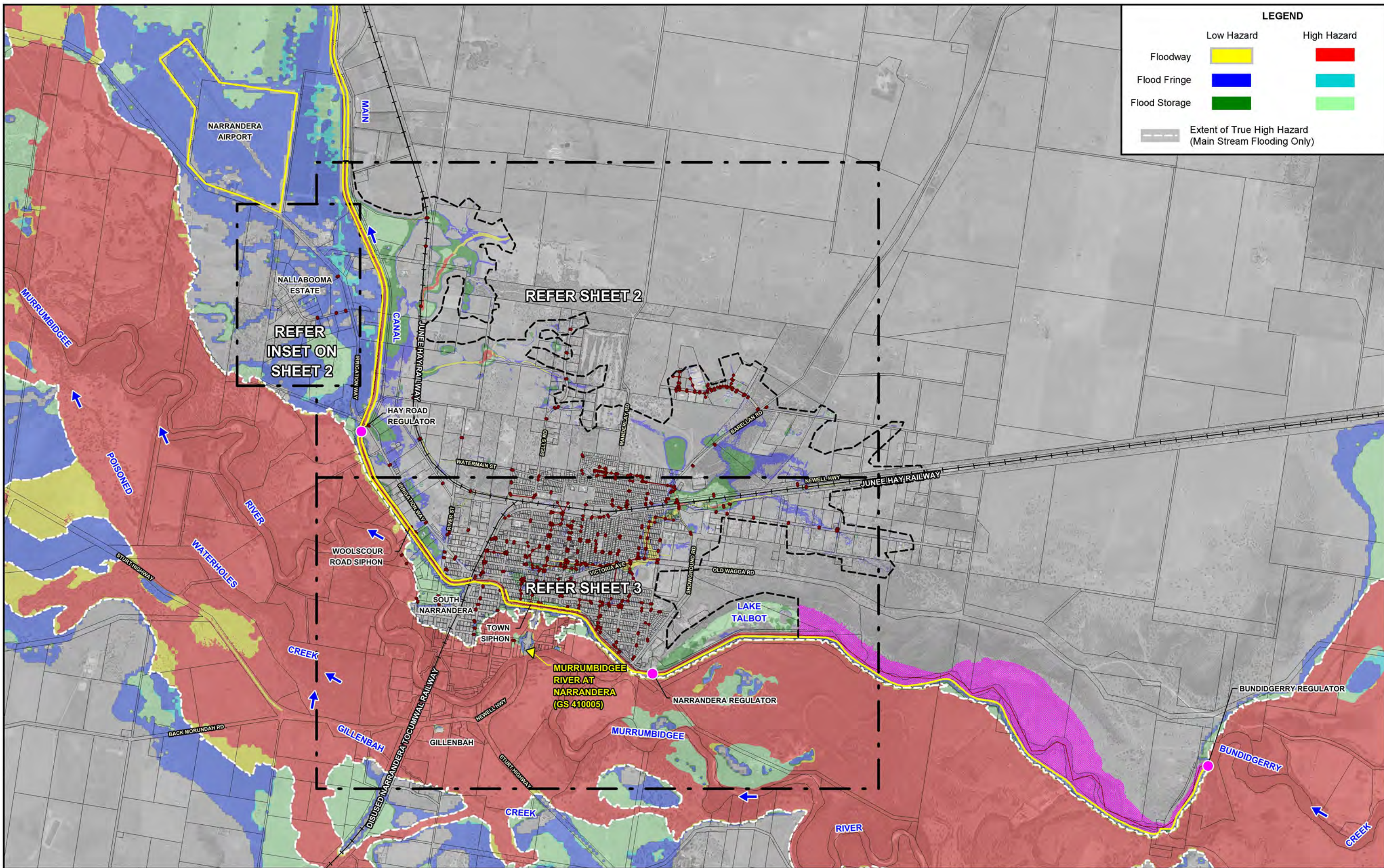
- WaterNSW Stream Gauge
- Murrumbidgee Irrigation Operated Regulator
- Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

POTENTIAL IMPACT OF CLIMATE CHANGE ON FLOODING AND DRAINAGE PATTERNS

1% AEP

Figure 2.13 (Sheet 3 of 3)



Scale: 1:40,000

400 0 400 800 1200 m

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.

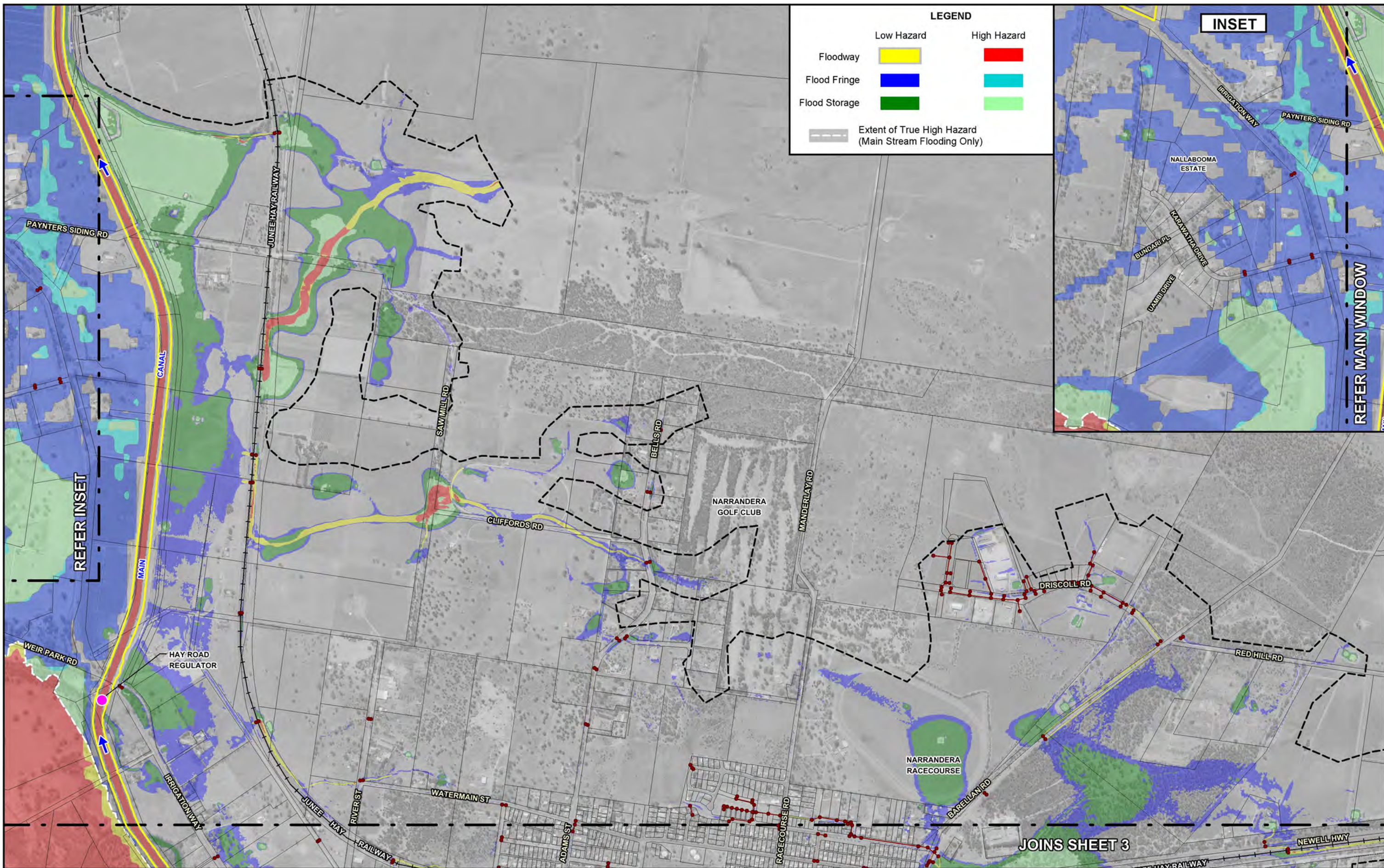
LEGEND

- 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

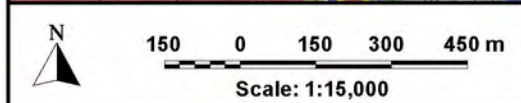
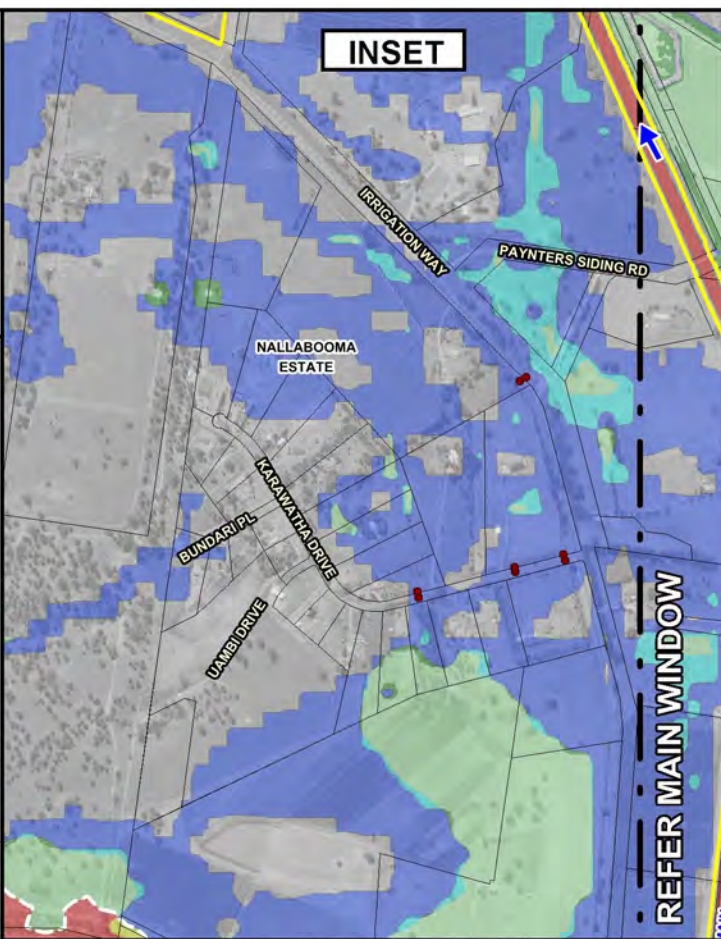
Figure 2.14 (Sheet 1 of 3)

FLOOD HAZARD AND HYDRAULIC CATEGORISATION OF FLOODPLAIN 1% AEP



LEGEND

	Low Hazard	High Hazard
Floodway	Yellow	Red
Flood Fringe	Blue	Cyan
Flood Storage	Green	Light Green
Extent of True High Hazard (Main Stream Flooding Only)	Red Outline	



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

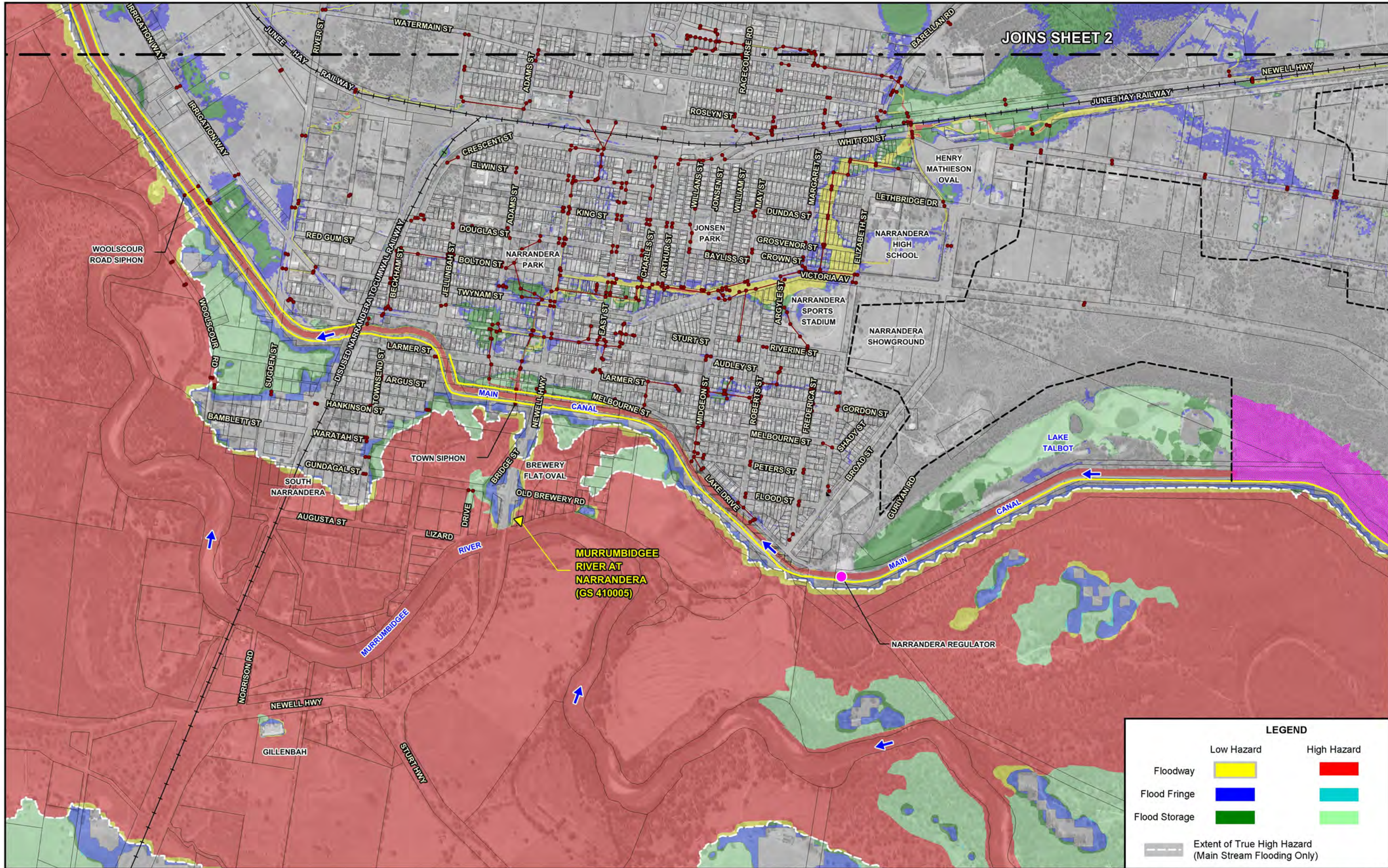
Red line with dots	Modelled Stormwater Network
Yellow line	Existing Canal Embankment / Levee
Black line with cross-ticks	Railway
Dashed black line	Limit of Overland Flow Mapping

Pink circle	Murrumbidgee Irrigation Operated Regulator
Pink shaded area	Flood Behaviour Not Defined Over This Area

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

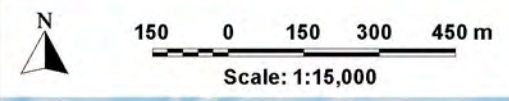
Figure 2.14 (Sheet 2 of 3)

FLOOD HAZARD AND HYDRAULIC CATEGORISATION OF FLOODPLAIN 1% AEP



LEGEND

	Low Hazard	High Hazard
Floodway	Yellow	Red
Flood Fringe	Blue	Cyan
Flood Storage	Green	Light Green
Extent of True High Hazard (Main Stream Flooding Only)	Dashed Line	



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	Flood Behaviour Not Defined Over This Area
Limit of Overland Flow Mapping	

REVIEW OF THE NARRANDERA FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN

Figure 2.14 (Sheet 3 of 3)

FLOOD HAZARD AND HYDRAULIC CATEGORISATION OF FLOODPLAIN
 1% AEP