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MARTINUS INLAND RAIL



FLOOD DESIGN REPORT

A2I | Albury to Illabo

Package: A2I – Wagga Wagga Yard

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PROJECT DOCUMENT NUMBER:

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GLOSSARY

Specific terms and acronyms used throughout this plan and sub-plans are listed and described in the table below

Table 1: Definitions

Term	Definition
A2I	Albury to Illabo
A2P	Albury to Parkes Enhancement Project
AEP	Annual Exceedance Probability
ADC	Assumptions, Dependencies and Constraints
AHD	Australian Height Datum
ALCAM	Australian Level Crossing Assessment Model
ARF	Areal Reduction Factor
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
ARTC	Australian Railway Track Corporation
BoD	Basis of Design
BoM	Bureau of Meteorology
CIZ	Construction Impact Zone
CO	Construct Only
CRS	Coordination Reference System
CSSI	Critical State Significant Infrastructure
D&C	Design and Construct
DCN	Design Change Notice
DDR	Detailed Design Review
EMC	Electromagnetic compatibility
EDPM	Engineering, Design and Project Management
ECMP	Electromagnetic compatibility management plan
EIS	Environmental Impact Statement
FDR	Feasibility Design Review
FS	Finish-Start constraint type
FSL	Finished Surface Level
GIR	Geotechnical Interpretative Report
HF	Human Factors
I2S	Illabo to Stockinbingal
IFC	Issued for Construction

Term	Definition
IR	Inland Rail
ITC	Incentivised Target Cost
IV	Independent Verifier
Km	Kilometres
LPA	Licensed Project Area
MIRDA	Master Inland Rail Development Agreement
NCR	Non-Conformance Report
NLPA	Non-Licensed Project Area
NtP	Notice to Proceed
PDR	Preliminary Design Review
PSR	Project Scope and Requirements
QDL	Quantitative Design Limits
REF	Review of Environmental Factors
RFI	Request for Information
S2P	Stockinbingal to Parkes
SAQP	Sampling, Analysis and Quality Plan
SDR	Systems Definition Review
SEMP	System Engineering Management Plan
TfNSW	Transport for New South Wales
TWL	Tail Water Level
V & V	Verification and Validation
WAD	Works Authorisation Deed
WAE	Work-as-Executed

1 A2P PROJECT INTRODUCTION

1.1 Albury to Parkes (A2P)

As part of the Inland Rail program of projects, the Australian Rail Track Corporation (ARTC) has appointed Martinus as the delivery contractor for the Albury to Parkes (A2P) project, which comprises the brownfield sections between Albury and Illabo (A2I) and Stockinbingal to Parkes (S2P). The greenfield portion between Illabo to Stockinbingal (I2S) is not a part of the A2P project scope.

1.2 Project Scope

The S2P section will be delivered under an REF and as such construction works associated with the two (2) Construct Only packages can commence at Contract Award. The Design and Construct for the other seven (7) projects sites will also commence at Contract Award.

The A2I section will be delivered under an EIS and requires a Notice to Proceed from ARTC before works can commence on site. Design for A2I will however commence at Contract Award. The project received State Planning approval on 8th Oct 2024, and Martinus received the Notice to Proceed from IRPL on 18 Oct 2024.

Within the EIS for A2I section there are twenty (20) locations, within which there are thirty (30) Design and Construct (D&C) projects of varying degrees of design gate development. A further location and project for Junee Drivers Platforms has been added through Inland Rail Direction. Design packages are listed below:

- Murray River bridge (Structure modifications)
- Albury Station Yard (Track slews, track reconfigurations)
- Albury Station Yard Track Slews (retained 3-track alignment)
- Albury Station Yard Footbridge (footbridge replacement), both pre- and post- SDRP-response
- Riverina Highway bridge (Track lowering)
- Billy Hughes bridge (Track lowering)
- Tabletop Yard (Structure modification)
- Culcairn Station Yard (Track slews and bridge removal)
- Henty Yard (Track slews)
- Yerong Creek Yard (Track slews)
- The Rock Yard (Structure modification)
- Uranquinty Yard (Track slews)
- Pearson Street bridge (Track lowering)
- Cassidy Parade footbridge (Bridge replacement), both pre- and post- SDRP-response
- Edmondson Street Bridge (stand-alone road bridge)
- Edmondson Street Footbridge (stand-alone road bridge)
- Edmondson Street bridge and footbridge (combined Bridge replacement), post- SDRP-response
- Wagga Wagga Station Yard (Track slews)
- Wagga Wagga Footbridge (footbridge replacement), both pre- and post- SDRP-response
- Bomen Yard (Track slews)
- Harefield Yard (Track slews)
- Kemp Street Bridge (stand-alone road bridge)
- Kemp Street Footbridge (stand-along footbridge)
- Kemp Street bridge and footbridge (combined Bridge replacement)
- Junee Station Yard (Track slews and bridge removal)
- Junee Driver Platforms – JE11 and JE70
- Olympic Highway Underbridge (Track reconfiguration and Structure modification)
- Junee to I2S dual track section (Track slews)
- LX605 & LX1472 Activations
- LX605 relocation and LX1472 closure, both 16m and 4m slew options

Within the S2P section, there are two (2) Construct only projects:

- Daroobalgie New Loop

- Wyndham Avenue (Track lowering)

and seven (7) Design and Construct (D&C) projects:

- Milvale Yard (Structure modification)
- Bribbaree Yard (Track slews)
- Quandialla Yard (Structure modification)
- Caragabal Yard (Track slews)
- Wirrinya Yard (Track slews)
- Lachlan River bridge (Structure modifications)
- Forbes Station (Track slews and awning modifications)

The D&C scope typically includes works associated with route clearance to accommodate the new F2M clearance envelope, necessary to accommodate the double-stacked freight container trains and this includes.

- Structure modifications
- Track reconfigurations
- Bridge replacements
- Track lowering
- Track slews and level crossing upgrades
- Bridge removal

1.3 Site Description

This study conducts a flood assessment for Wagga Wagga Yard located on the northern side of Wagga Wagga City as shown in the figure below. The background and previous studies for each site are listed below.



Figure 1: Site Location

1.3.1 Background

The Wagga Wagga Yard forms part of the Albury to Illabo Section works between Chainage (CH) 520.550km to 521.700km. The Station Yard is located between Railway Street and Station Place in Wagga Wagga. The proposed solution involves track slews and modification of the Main Line in conjunction with associated site drainage designs. The maximum track lift within Wagga Wagga Yard is proposed to be 94mm at CH 520.720km and there are also localised track lowering of up to 11mm proposed at CH 521.055km.

1.4 Objectives

This report has been prepared to support the delivery of the Wagga Wagga Yard and comply with the CSSI Conditions of Approval (CoA) and Updated Mitigation Measures (UMM) for quantitative flood modelling demonstrating compliance with pre- and post- development criteria. This report provides a flood impact assessment for the Issued For Construction (IFC) stage. The flood assessment aims to estimate the flood behaviour within the study area, and to assess the potential flood impacts as a result of the design outside of the project boundary.

This report should be read in conjunction with the Detailed Design Report – Wagga Wagga Yard (5-0052-210-PEN-W7-RP-0001)

1.5 Scopes

The scope of this study includes:

- Carrying out the flood assessment for the design in DDR stage (DDR stage design was adopted in IFC stage assessment; refers to Sectio 1.10) for design events of 10%, 5%, 2%, 1%, AEPs, 1% AEP with Climate Change and PMF (Probable Maximum Flood).
- Checking flood assessment results with the criteria including flood impact and flood immunity.
- Proposing any mitigation measures (if required).

1.6 Previous Studies

1.6.1 Flood Studies

The table below summarises all the flood studies associated with the Wagga Wagga yard site.

Table 2: A Summary of the Previous Flood Studies

Item No.	Flood Study	Description	Comments
1	Wagga Wagga Major Overland Flow Flood Study (WMAwater, 2011)	This flood study provided detailed local design flooding information for an area of 167 km^2 on a 5m grid resolution. The hydrologic and hydraulic (WBNM /TUFLOW) modelling system was utilised, calibrated and validated to historical events. ARR1987 was adopted.	-
2	Wagga Wagga Major Overland Flow Floodplain Risk Management Scoping Study – Final Report (WMAwater, 2012)	This study was conducted to contextualise findings from item 1 before a Floodplain Risk Management Study commenced and recommendations were made.	-
3	Wagga Wagga Major Overland Flow Model Update Report (WMAwater, 2015)	This flood study updated the flood models originally established in item 1 by adopting the recommendations from item 2.	-
4	Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan (WMAwater, 2018)	This study and plan assessed and ultimately recommended a broad range of mitigation options to manage flood risk in Wagga Wagga due to Murrumbidgee River flooding.	-
5	Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (MOFFS) (WMAwater, 2021)	This study and plan updated the hydrology and hydraulic models used in Items 1 and 3. ARR2019 has been used. The ARR2019 flood level results have been compared against the ARR1987 ones and it showed that ARR2019 is 0.05 m - 0.3m higher than the ones from ARR1987. Therefore ARR2019 is adopted as ARR1987 methodologies are likely to underestimate the flood risk throughout overland catchment areas. It is noted that ARR2019 flood extents remain largely unchanged compared with ARR1987 results.	TUFLOW and WBNM models in MOFFS were adopted and updated in this flood assessment. The TUFLOW model parameters can be found in Table 12.

1.6.2 Reference Design

No detailed flood assessment was undertaken for the Wagga Wagga Yard during the Reference Design, as outlined in the report Albury to Illabo (A2I) and Stockinbingal to Parkes (S2P) Projects Reference Design Report – Wagga Wagga (June 2022):

- Albury to Illabo (A2I) and Stockinbingal to Parkes (S2P) Projects Reference Design Report – Wagga Wagga (June 2022)

For the Reference Design (by Others), flood mapping information that was obtained from Wagga Wagga City Council was utilised. It was assessed that the site was not impacted by major regional flooding from the Murrumbidgee River. However, overland flooding from local catchments affected the site and adjacent areas for the 1% AEP event where the maximum flood depths were estimated to be approximately 400-500 mm. It was estimated that the existing track flood immunity was less than the 20% AEP event.

1.6.3 Environmental Impact Statement

An EIS which has been approved, supports the application for approval of the Proposal under Division 5.2 of the Environmental Planning and Assessment Act 1979 (EP&A Act). It addresses the environmental assessment requirements set by the Secretary of the NSW Department of Planning, Industry and Environment, which is commonly referred to as the SEARs. The A2I CSSI Environmental Impact Statement contains the following relevant prior assessment documents:

- Albury to Illabo Environmental Impact Statement (EIS) Technical Paper 11 – Hydrology, flooding and water quality (July 2022) (currently under planning assessment)

It was found that the site was not affected by flooding from the Murrumbidgee River up to the 1% AEP event, as shown in Figure 2.

Nonetheless, the MOFFS report (WMAwater, 2021) indicated that the site is affected by local flooding during the 5% and 1% AEPs events (Refer to Figure 3). A flood assessment was undertaken using the hydraulic model data provided by Wagga Wagga City Council. Initial flood model results indicated a small amount of afflux in the industrial area located 400 m to the east of the site. Drainage was not included in the model and was expected to attenuate the predicted afflux.

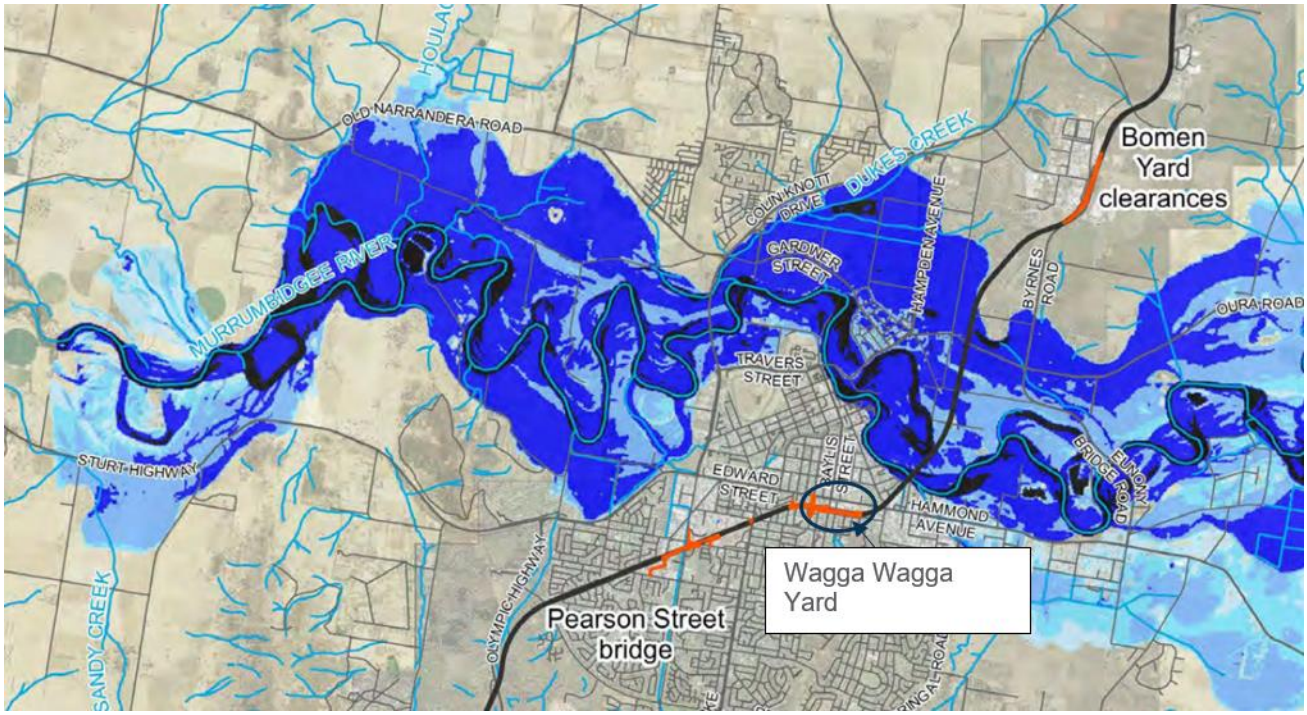


Figure 2: Regional Flooding for the 1% AEP Event

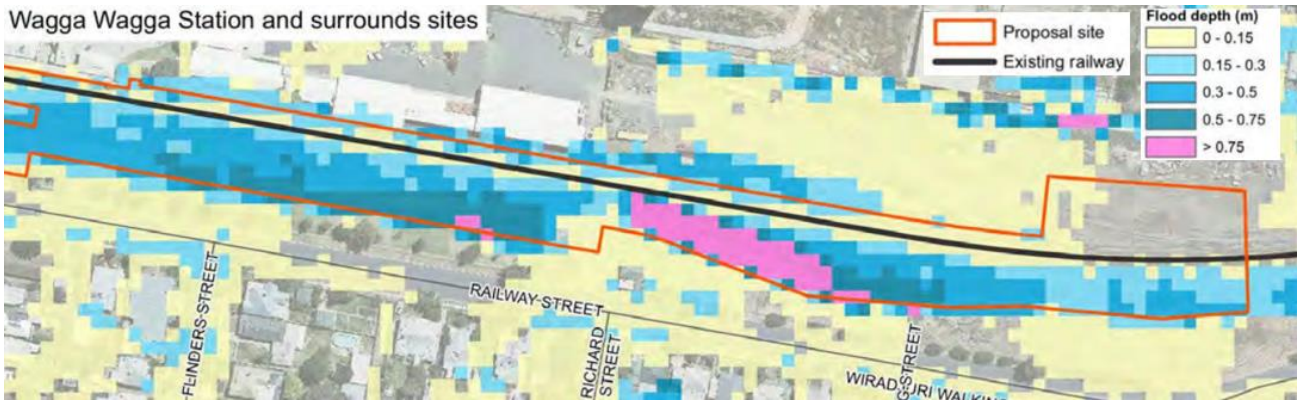


Figure 3: 1% AEP Local Flooding (Image source: Albury to Illabo EIS Technical Paper 11 (July 2022))

1.7 Purpose and Requirements

The primary purpose of this IFC flood assessment report is to describe how the design development and the associated review process were managed.

A series of tasks and activities that the design development and design reporting process needs to address and include is described in the set of requirements within the Condition of Approval (CoA), PSR Annexure F, and Inland Rail's Design Management Specification.

1.8 Information Documents

The following documents have been provided 'For Information' and have been referenced/reviewed as part of the design development:

- Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMA Water, 2021). This flood study supersedes the other flood study listed in Table 2 as it is the most recent flood study.
- Albury to Illabo (A2I) and Stockinbingal to Parkes (S2P) Projects Reference Design Report – Wagga Wagga (WSP, June 2022), 2-0008-210-PEN-03-RP-0002
- Albury to Illabo Environmental Impact Statement (EIS) Technical Paper 11 – Hydrology, flooding and water quality (WSP, July 2022), 2-0008-210-EAP-00-RP-0010 (under assessment)

1.9 Inputs

The inputs to this flood assessment report include:

- Australian Standards and Guidelines: AS 7637 Railway Infrastructure – Hydrology and Hydraulics
- Australian Rainfall and Runoff: A Guide to Flood Estimation 2019 v4.1
- Austroads Guide to Bridge Technology – Part 8: Hydraulic Design of Waterway Structures
- Inland Rail Climate Change Risk Assessment Framework

1.9.1 Input Data

The table below outlines the available information relevant to the site and used for flood modelling.

Table 3: Available Information

Item	Information	Type	Description / Comments
General			
1	Flood model used in Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021)	TUFLOW model	Received from ARTC on 29/08/2023.
2	WBN files used in Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021)	WBN* (PMF for GSDM* only, 0.2% AEP, 0.5% AEP, 1%AEP, 2% AEP, 5% AEP, 10% AEP, 20% AEP)	Received on 29/08/2023 (refer to DJV RFI-007). WBN files (generated by Storm injector) include a single temporal pattern for durations 120 minutes, 360 minutes and 720 minutes for events 0.2% AEP, 0.5% AEP, 1% AEP, 2% AEP, 5% AEP, 10% AEP,

Item	Information	Type	Description / Comments
General			
			20% AEP and 90 minutes & 180 minutes for PMF.
3	Additional GIS files with Indirectly Connected Area (ICA) and catchment data related to Hydrology. (RFI 020)	GIS files	Received from Wagga Wagga City Council on 22/11/2023 as part of the response to RFI 020
4	LiDAR 2020 (The data used to create this DEM has an accuracy of 0.3m (95% Confidence Interval) vertical and 0.8m (95% Confidence Interval) horizontal)	TIF format in 1m resolution in GDA2020 projection	Downloaded from https://elevation.fsdf.org.au/ on 26/09/2023.
Site Specific			
5	5-0052-210-ISV-W0-MD-0001-WAGGA_FEATURE_SURVEY.dwg	Site Survey in GDA 94 projection	Received from ARTC on 06/09/2023
6	A2P WGA EXT GDA20Z55.12da	Updated Verified Point cloud data – Site survey in GDA2020 projection	Received from Martinus on Received 12/04/2024
7	SURVEY W7 MGA20 SURVEY DTM 21 W7 ISV.flt SURVEY W5 W6 MGA20 RAIL SURVEY DTM 21 W5 W6 ISV 000.flt	FLT grid file (1m grid)	Verified point cloud data – Site survey in the GDA2020 projection – Wagga Wagga Yard and Edmondson Street bridge Received from Civil Team on 12/04/2024
8	A2P EDM EXT GDA20Z55 COMBINED_241021.12daz A2P CAS EXT GDA20Z55 COMBINED_241021.12daz A2P PSN EXT GDA20Z55 COMBINED_241021.12daz A2P WAG EXT GDA20Z55 COMBINED_241021.12daz	12da file	Detailed topography survey received from ARTC on 21/10/2024
9	20241017 Wagga Wagga Yard Assumed Existing System.pdf	PDF file	DDR Existing drainage data. Received from DJV Drainage team on 18/10/2024
10	WAGGA YARD DRAINAGE STRINGS.12daz 5-0052-210-CDR-W7-MD-0106_WAGGA_YARD_DRAINAGE_PIT_SCHEDULE.xlsx	12Da file and Excel file	DDR Design drainage data. Received from DJV Drainage team on 27/11/2024
11	BALLAST 21 W7 MR21W7001.dem CAPPING 21 W7 MR21W7001.dem	Dem Grid file (0.2m grid) in GDA2020 projection	DDR Civil Design Tin for ballast capping and associated channel in the GDA2020 projection Received from DJV Drainage team on 28/11/2024
12	5-0052-210-CAL-W7-MD-0003-WAGGA_WAGGA_YARD_3D_RAIL_DESIGN_STRINGS_DWG.dwg	Dwg file in GDA2020 projection	DDR Design Rail Strings received from DJV Civil team on 13/11/2024
13	A2P WAG EXT GDA20Z55 COMBINED_250514.12da	12Da file	IFC existing drainage data for Wagga Yard. Received from DJV Drainage team and Martinus on 25/05/2024 (This data was used only for the sensitivity test. Refer Section 1.10)

Item	Information	Type	Description / Comments
General			
14	BALLAST 21 W7 MR21W7001.dem CAPPING 21 W7 MR21W7001.dem	Dem Grid file (0.2m grid) in GDA2020 projection	IFC Wagga Yard Civil Design Tin for ballast capping and associated channel in the GDA2020 projection Received from DJV Drainage team on 30/06/2025 (This data was used only for the sensitivity test. Refer Section 1.10)
15	5-0052-210-CDR-W7-MD-0001-WAGGA_WAGGA_YARD_3D_DRAINAGE_STRINGS_12DA.12da	12Da file	IFC Design drainage data. Received from DJV Drainage team on 04/09/2025 (This data was used only for the sensitivity test. Refer Section 1.10)
16	A2P EDM EXT GDA20Z55 COMBINED_250511.12da	12Da file	IFC Survey TIN for Edmondson. Received from Martinus on 12/05/2025. (This data was used only for the sensitivity test. Refer Section 1.10)
17	5-0052-210-DDR-W5-MD-0001-EDMONDSON_STREET_BRIDGE_EX DRAINAGE_PLAN.12daz	12Da file	IFC Existing drainage data for Edmondson Street Bridge. Received from DJV Drainage team on 14/07/2025.
18	DESI 210 DCW W8 FLOOD 20250702.dem	Dem Grid file (0.2m grid) in GDA2020 projection	IFC Wagga Mothers Footbridge Civil Design received from DJV Civil team on 02/07/2025 (This data was used only for the sensitivity test Refer Section 1.10)
19	Combined - 20250415 - DDR Wagga Footbridge checkprint.pdf 5-0052-210-CCW-W8-MD-2002-WAGGA_STATION_FOOTBRIDGE_2D_CIVIL_DESIGN_STRINGS_DWG.dwg	PDF and Dwg file in GDA2020 projection	DDR Wagga Mothers footbridge Design received from DJV Bridge team on 16/04/2025 (This data was used only for the sensitivity test Refer Section 1.10)
20	DEM 210 DCW W5 FLOOD DEM 250710.dem DEFLECTION WALLS DEM 0.2m grid.dem	DEM	IFC Edmondson Street Bridge and Footbridge Design Civil Design TIN in the GDA2020 projection Received from DJV Civil team on 10/07/2025 (This data was used only for the sensitivity test. Refer Section 1.10)
21	5-0052-210-DDR-W5-MD-2004-EDMONDSON_STREET_BRIDGE_3D_DRAINAGE_DESIGN_STRINGS_12DA.12da 010725 EDMONDSON DRAINAGE SCHEDULE.xlsx	12Da file and Excel file	IFC Edmondson Street Bridge and Footbridge Proposed drainage data. Received from DJV Drainage team on 24/06/2025. (This data was used only for the sensitivity test Refer Section 1.10)

*: GSDM stands for Generalised Short-Duration Method.
* "WBN" is the extension of the WBNM file.

1.10 IFC Design Sensitivity

1.10.1 Model Update

A sensitivity analysis was made to assess the flooding condition for Edmondson Street, Wagga Yard and Wagga footbridge based on the updated IFC stage survey and IFC design. The updates include:

- Addition of the latest survey topography for Edmondson (Survey received on 12/05/2025). The Survey update was only limited to obvert levels and localised surface tins around railway corridor culvert headwalls.
- Updated existing pipe data as per survey (Data received from the Drainage Team on 14/07/2025)

- Inclusion of the IFC designs for the design scenarios for packages:
  - Edmondson Street Bridge and the Footbridge (Minor Civil and drainage updated)
  - Wagga Mothers Bridge (Minor Civil updates)
  - Wagga Yard (Minor Civil and drainage)

1.10.2 Assessment

Storm events of the 1% AEP and 2% AEP (based on the DDR results, the afflux value from the 2%AEP is higher than the 5% AEP and 10% AEP) have been run for the IFC Design Sensitivity analysis. The details of illustrations for the 1% AEP events are provided in Appendix F for the Wagga Yard area and the 2% AEP results are attached after 1% AEP.

- In both events (1% and 2% AEPs), the changes in flood level, changes in flood velocity and changes in flood hazard comply with PSR and CoA.
- Generally, the value of changes in flood levels, changes in flood velocity and changes in flood hazard between DDR and IFC are similar (refer to Appendix F). This does not change any flood immunity.

1.10.3 Findings

- For the assessment of the 1% AEP and 2% AEP based on the new survey and design, it shows minor differences in terms of changes in flood level, changes in flood velocity and changes in flood hazard when compared with DDR. Therefore, it is not expected to identify any non-compliance in the 5% AEP and 10% AEP.
- Based on this assessment, it is not necessary to re-run the all flood events (PMF, 1%AEP CC, 1%AEP, 2% AEP, 5% AEP and 10% AEP) for Wagga Yard due to such minor changes (refer to Appendix F).

Given that the changes in the IFC are minimal compared to the DDR, the flood assessment will not result in any non-compliance. Therefore, the flood assessment results and maps from the DDR stage will be utilised to inform the IFC flood assessment from Section 2 onwards

1.11 Outputs

The list of flood maps and the flood maps are included in Appendix A.

1.12 Limitations and Assumptions

The following limitations and assumptions are applied to the current study for the DDR stage.

- Existing drainage data for the site was adopted based on comparing the MOFFS TUFLOW model (WMAwater, 2021) and detailed survey (Item 8 in Table 3) with assumptions for missing drainage details as provided by the DJV Drainage team (Item 9 in Table 3)
- Bridge structure abutments of the Wagga Wagga Mothers bridge (Wagga Wagga Footbridge) that is located onsite have been modelled as blockages to floodwater. The bridge decks and piers have not been modelled due to their lack of impact on the flood behaviour at the site. The bridge deck is set at a height that does not affect the flood water behaviour, and the bridge piers are minor steel piers with a thickness of approximately less than 150 mm, which is not expected to significantly impact the flood behaviour. A flood design report for Wagga Wagga footbridge has been completed as part of the separate package “W8 – Wagga Wagga Footbridge”. Refer to Report 5-0052-210-IHY-W8-RP-0001.
- An assessment of temporary works and staging has not been undertaken as it is out of the flooding scope.
- Blockage assessment is carried out for the 1% AEP design scenario as per the guidance set out in ARR2019 for the culverts within the project boundary while 20% blockage is adopted for all the other culverts, pits and pipes outside the project boundary.

2 COMPLIANCE WITH REQUIREMENTS

2.1 Project Scope and Requirements

The detailed design has been assessed to check if it meets the Project Scope and Requirements (PSRs). This is demonstrated throughout the flood assessment with Table 4 below summarising the Wagga Wagga Yard Design's Compliance with the PSRs.

Table 4: Flooding Criteria within PSR Annexure B Technical Requirements

Requirement	Identifier	A2P Technical Requirements Description	Compliance Evidence Reference
Project Wide	5.4.10	Without limiting the environmental management requirements in Annexure F, section 6.1.1, all D&C Works in watercourses shall comply with the NSW Department of Primary Industries Standards: Policy and Guidelines for Fish Friendly Waterway Crossings; Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings; and Policy and Guidelines for Fish Habitat Conservation and Management Update.	N/A (structure modifications do not affect waterway flow)
Project Wide	5.4.2	Where existing flood immunity is lower than ARTC SMS minimum requirements, the functional requirements for flood immunity take precedence over the ARTC SMS.	The ARTC minimum requirement is 1% AEP. However, the top of track is overtopped in the 10% AEP in the existing scenario. Thus, the existing immunity will be less than 10% AEP. The existing immunity is maintained under design conditions. Refer to Section 6.3.
Project Wide	5.4.3	Where existing flood immunity is higher than ARTC SMS minimum requirements, the ARTC SMS requirements for flood immunity take precedence over the functional requirements.	The ARTC minimum requirement is 1% AEP. However, the top of track is overtopped in the 10% AEP in the existing scenario. Thus, the existing immunity will be less than 10% AEP. The existing immunity is maintained under design conditions. Refer to Section 6.3.
Project Wide	5.4.5	Bridge and culvert hydraulics shall comply with Austroads Guide to Bridge Technology Part 8: Hydraulic Design of Waterway Structures.	There are no bridge structures or Waterway structures within Wagga Yard Scope.
A2I Technical Requirements	IR-SR-A2I-116	The System shall comply with 0-0000-900-ESS-00-ST-0001 Inland Rail Climate Change Risk Assessment Framework.	Climate change assessment was carried out by running the 1% AEP + 2090 RCP 8.5 and identifying that the bridge has low hazards. Refer to Section 6.4
A2I Technical Requirements	IR-SR-A2I-349	The Corridor System for Enhancement Corridors shall have a flood immunity of no worse than existing.	The existing immunity is maintained under design conditions. Refer to Section 6.3.
A2I Technical Requirements	IR-SR-A2I-350	The Corridor System, where the existing track is lowered, shall maintain the existing flood immunity.	The existing immunity is maintained under design conditions. Refer to Section 6.3.
A2I Technical Requirements	IR-SR-A2I-352	The Corridor System shall prevent damage of the formation due to ponding of water.	No damage to the formation. Existing Immunity is maintained. Proposed

Requirement	Identifier	A2P Technical Requirements Description	Compliance Evidence Reference
			condition accommodates channels and additional drainage pipe to drain the site. Refer to Sections 6.2 & 6.3.
A2I Technical Requirements	IR-SR-A2I-458	The Corridor System shall prevent ponding in longitudinal open channels.	The proposed channels have grading towards proposed culvert outlets which prevents ponding. Refer to Drainage Design section 4.5 on Wagga Yard Design report (5-0052-210-PEN-W7-RP-0001)
A2I Technical Requirements	IR-SR-A2I-459	The Corridor System for Enhancement Corridors shall provide mitigation for flood impacts no worse than existing condition.	Existing condition is maintained. Flood impacts no worse than existing condition. Refer to Section 6.4.
A2I Technical Requirements	IR-SR-A2I-464	The Corridor System shall cause no adverse impacts either inside or outside the rail corridor when diverting water away from the track.	Existing condition is maintained. flood impacts no worse than existing condition. Refer to Section 6.4.
A2I Technical Requirements	IR-SR-A2I-465	The Corridor System shall minimise changes to the existing or natural flow patterns.	Existing condition is maintained. flood impacts no worse than existing condition. Refer to Section 6.2 & 6.4
A2I Technical Requirements	IR-SR-A2I-541	The Structures System new underbridges shall withstand the 0.05% annual exceedance probability design flood event.	N/A. There is no new underbridge structure change.
A2I Technical Requirements	IR-SR-A2I-735	The Third-Party System private roads shall have flood immunity no worse than existing.	No third-party private roads are impacted. Refer to Section 6.4.1
A2I (Annexure F)	6.1.1	Without limiting clauses 8 and 14 of the Deed, the Contractor shall ensure that the Contractor's Activities and the Works comply with the following for A2I, the Conditions of Approval and the environmental assessment reports available on https://www.planningportal.nsw.gov.au/major-projects/projects/inland-rail-albury-illabo"	Refer to Section 5

2.2 Conditions of Approval – Flooding

The Conditions of Approval (CoA) have been provided as part of the CSSI approval and Inland Rail Deed of Variation. The detailed design has been assessed to check if it meets the CoA and the compliance is presented in the table below.

Table 5: Conditions of Approval Compliance Table – Flooding

Condition	Condition or Criteria	Compliance Evidence Reference
E38	All practicable measures must be implemented to ensure the design, construction and operation of the CSSI will not adversely affect flood behaviour, or adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.	Compliant. Refer to Section 6.
E39	The CSSI must be designed with the objective to meet or improve upon the flood performance identified in the documents listed in **Condition A1**. Variation consistent with the requirements of this approval at the rail corridor is permitted to effect minor changes to the design with the intent of improving the flood performance of the CSSI.	Compliant. Refer to Section 6.

Condition	Condition or Criteria	Compliance Evidence Reference
E40	Updated flood modelling of the project's detailed design must be undertaken for the full range of flood events, including blockage of culverts and flowpaths, considered in the documents listed in **Condition A1**. This modelling must include:	Compliant. Refer to Sections 4 and 6.
E40	a) Hydrologic and hydraulic assessments consistent with *Australian Rainfall and Runoff – A Guide to Flood Estimation* (GeoScience Australia, 2019);	Compliant. Refer to Section 4.
E40	b) Use of modelling software appropriate to the relevant modelling task;	Compliant. Section 4 shows that the appropriate software (TUFLOW) was used
E40	c) Field survey of the existing rail formation and rail levels, should be included within the models; and	Compliant. The existing rail level was used to inform the flood immunity. Refer to Section 6.
E40	d) Confirmation of predicted afflux at industrial properties adjacent to Railway Street, Wagga Wagga based on field survey.	Compliant. The railway street survey was added in to the model to analyse predicted afflux. Refer to Section 6.
E40	Updated flood modelling must be made publicly available in accordance with **Condition B18**.	Flood design report and independent review of the flood design report shall be provided to IR, through this submission, for IR to upload on the IR website, as per CoA B18 responsibility allocation.
E41	The Proponent's response to the requirements of **Conditions E38** and **E40** must be reviewed and endorsed by a suitably qualified flood consultant, who is independent of the project's design and construction and approved in accordance with **Condition A16,** in consultation with directly affected landowners, DCCEEW Water Group, TfNSW, DPI Fisheries, BCS, NSW State Emergency Service (SES) and relevant Councils.	Independent review of the flood modelling, model and Flood Design Report is undertaken by the Proof Engineer's specialist contractor, who satisfies and complies with the requirements of A16. Consultation with the Council and other stakeholders is being undertaken through a formal review of this Flood Design Report.
E42	The CSSI must be designed and constructed to limit impacts on flooding characteristics in areas outside the project boundary during any flood event up to and including the 1% AEP flood event, to the following:	See items below
E42	(a) a maximum increase in inundation time of one hour, or 10%, whichever is greater;	Compliant. Refer to Section 6.4.4.
E42	(b) a maximum increase of 10 mm in above-floor inundation to habitable rooms where floor levels are currently exceeded;	Compliant. No flood level increase of 10mm in above-floor inundation on any properties. Refer Section 6.4.1.
E42	(c) no above-floor inundation of habitable rooms which are currently not inundated;	Compliant. No increase for above floor inundation of habitable rooms on any properties. Refer Section 6.4.1.
E42	(d) a maximum increase of 50 mm in inundation of land zoned as residential, industrial or commercial;	Compliant. No flood level increase of more than 50mm in residential, industrial and commercial areas. Refer Section 6.4.1.

Condition	Condition or Criteria	Compliance Evidence Reference
E42	(e) a maximum increase of 100 mm in inundation of land zoned as environment zone or public recreation;	Compliant. No flood level increase of more than 100mm in the environment zone or public recreation. Refer to Section 6.4.1
E42	(f) a maximum increase of 200 mm in inundation of land zoned as rural or primary production, environment zone or public recreation;	Compliant. No flood level increase of more than 200mm in rural or primary production, environment zone or public recreation. Refer to Section 6.4.1
E42	(g) no increase in the flood hazard category or risk to life; and	Compliant Refer to Section 6.4.3
E42	(h) maximum relative increase in velocity of 10%, or to 0.5m/s, whichever is greater, unless adequate scour protection measures are implemented and/or the velocity increases do not exacerbate erosion as demonstrated through site-specific risk of scour or geomorphological assessments	Compliant Refer to Section 6.4.2 Both a relative velocity increase of 10%, and relative velocity increase of 0.5m/s, have been considered, and the criteria of relative velocity increase of 0.5m/s has been adopted as it is the governing and worse-case criteria
E42	Where the requirements set out in clauses (d) to (f) inclusive cannot be met alternative flood levels or mitigation measures must be agreed to with the affected landowner.	Clause (d) to (f) are compliant
E43	A **Flood Design Report** confirming the:	
E43	a) final design of the CSSI meets the requirements of **Condition E42;** and	Compliant Refer to Section 6
E43	b) the results of consultation with the relevant council in accordance with **Condition E46**	Refer to E46
E43	must be submitted to and approved by the Planning Secretary prior to the commencement of permanent works that would impact on flooding.	This report will be submitted to the Planning Secretary for approval prior to the commencement of permanent works that would impact on flooding.
E44	The **Flood Design Report** required by **Condition E43** must be approved by the Planning Secretary prior to works that may impact on flooding or the relevant council's stormwater network.	This report will be submitted to the Planning Secretary for approval prior to the commencement of permanent works that would impact on flooding.
E45	Flood information including flood reports, models and geographic information system outputs, and work as executed information from a registered surveyor certifying finished ground levels and the dimensions and finished levels of all structures within the flood prone land, must be provided to the relevant Council, BCS and the SES in order to assist in preparing relevant documents and to reflect changes in flood behaviour as a result of the CSSI. The Council, BCS and the SES must be notified in writing that the information is available no later than one (1) month following the completion of construction. Information requested by the relevant Council, BCS or the SES must be provided no later than six (6) months following the completion of construction or within another timeframe agreed with the relevant Council, BCS or the SES.	Flood information will be provided to the relevant Council, BCS and the SES in order to assist in preparing relevant documents and to reflect changes in flood behaviour as a result of the CSSI in accordance with the requirements of CoA E45
E46	The design, operation and maintenance of pumping stations and storage tanks and discharges to council's	Local drainage flow regime, catchment area and imperviousness remain the same as per existing

Condition	Condition or Criteria	Compliance Evidence Reference
	stormwater network must be developed in consultation with the relevant council. The results of the consultation are to be included in the report required in **Condition E47.**	condition, there is no additional flow towards the existing Council's stormwater network. The design has not worsened the existing condition. Discharges to the council's stormwater networks have been consulted with Wagga Wagga City Council during the briefing workshops, various stages of design submissions with the Council's comments closed out, details are documented in 5-0052-210-PEN-W7-RP-0001.

2.3 Updated Mitigation Measures - Flooding

The Updated Mitigation Measures (UMM) have been provided and the detailed design has been assessed to meet the UMM and the compliance is presented in the table below.

Table 6: Updated Mitigation Measures Compliance Table - Flooding

Condition	Condition or Criteria	Compliance Evidence Reference	Comment if non-compliant
HFWQ3	Further consultation will be undertaken with local councils and other relevant authorities to identify opportunities to coordinate the proposal with flood mitigation works committed to as part of the council's flood management plans, or other strategies.	Consultation with the Council and other relevant authorities will be undertaken through a formal review of this Flood Design Report.	NA
HFWQ4	At Wagga Wagga Yard enhancement site, flood modelling would be carried out during detailed design to confirm predicted afflux at industrial properties located at Railway Street and compliance with the Quantitative Design Limits for Inland Rail. This would be informed by topographic and building floor surveys and a review of localised drainage structures (as required). Quantitative assessment of the sites of low and moderate hydraulic complexity will be carried out during detailed design and will consider the impact of the Possible Maximum Flood event at built-up areas (where information is available) and the tenure of the upstream areas that are impacted by drainage and/or flooding. The outcomes of the assessment are to be provided to DCCEW– BCS	Compliant. The received topography survey was added to the model, and the industrial area did not experience adverse impacts. The flood impact on the industrial area has been assessed in Section 6.4.6. The flood impact is compliant as the proposed conditions of Wagga Wagga Yard do not worsen the existing flooding conditions in the industrial area. Compliant. A quantitative assessment has been undertaken. Refer to Section 6.	NA
HFWQ5	At Riverina Highway bridge enhancement site, flood and drainage network modelling (including capacity and operation of the stormwater storage and pump system) will be carried out during detailed design to confirm predicted compliance with the Quantitative Design Limits (QDLs)* for Inland Rail. The modelling would be undertaken in consultation with Albury City Council.	This criteria is related to the Riverina Highway track lowering site but not the Wagga Wagga Yard enhancement site, which is the subject of this report.	NA

* QDL is superseded by CoA E42.

3 CHANGE MANAGEMENT

This section summarises the changes made to this design package due to changes in the project scope and/or evolution of the design.

3.1 Concept Design to SDR

Key design changes between the Concept Design and the SDR Design are listed in the table below.

Table 7: Design Differences Between Proposal and SDR

Item	Difference	Reason for Difference
1	No major changes to the Concept design.	Refined track alignment

3.2 SDR to PDR

Key design changes between the SDR and the PDR Design are listed in the table below.

Table 8: Design Differences Between SDR and PDR

Item	Difference	Reason for Difference
1	Updated hydrology, which resulted in changes in critical durations for each AEP event.	Additional information was provided with regards to provided hydrology,
2	Incorporation of the latest existing conditions survey	An updated existing conditions survey was undertaken
3	Incorporation of updated rail design (ballast and capping)	New rail design
4	Incorporation of design drainage (cess drain + pipes)	New drainage design
5	Incorporation of basin mitigation measures	New mitigation option

3.3 PDR to DDR

Key design changes between the PDR and the DDR Design are listed in the table below.

Table 9:Design Differences Between PDR and DDR

Item	Difference	Reason for Difference
1	Incorporation of the latest existing conditions survey	A new existing conditions survey was undertaken
2	Updated Existing Drainage data	Updated based on detailed survey and council flood model based on data provided by DJV drainage team.
3	Incorporation of updated rail design (ballast, capping and top of Rail)	New rail design
4	Incorporation of design drainage (cess drain + pipes)	New drainage design
5	Incorporation of Edmondson Street bridge, Edmondson footbridge (5-0052-210-IHY-W5-RP-0001) and Cassidy Parage Bridge Design (5-0052-210-IHY-W4-RP-0001) elements.	Creation of Master Design Scenario

3.4 DDR to IFC

Key design changes between the DDR and the IFC Design are listed in the table below.

Table 10: Design Differences Between DDR and IFC:

Item	Difference	Reason for Change
1	Updating sections and text throughout the report	To address ARTC / PE / TfNSW review comments
2	Conducted sensitivity analysis based on IFC design and survey (Refer to section 1.10)	New IFC drainage survey for Wagga Yard New IFC Drainage Design for Edmondson Street bridge and Edmondson footbridge New IFC Civil Design for Edmondson Street bridge and Edmondson footbridge

4 MODELLING METHODOLOGY

The overall approaches for flood modelling are listed below:

- Utilise the hydrological model and generate flow hydrographs for input to the hydraulic model for all events to perform critical duration analysis.
- Update the received TUFLOW model by incorporating the latest LiDAR (Section 4.2.1) and survey. Use the updated TUFLOW model to predict hydraulic behaviour and this will be formed as the existing model for this study.
- Compare the updated existing condition TUFLOW model results against the received model results (refer to Section 5).
- Incorporate the Edmondson Street Bridge and Footbridge design (5-0052-210-IHY-W5-RP-0001) and Cassidy Parade Footbridge design (5-0052-210-IHY-W4-RP-0001) into the Master Design condition to understand the cumulative impact on the site.
- Update the TUFLOW model from the existing condition to the master design condition model by incorporating the rail and drainage design into the existing model.
- Conduct a climate change risk sensitivity assessment for the 1% AEP to inform the potential impact on the railway track flood immunity.
- Conduct a blockage assessment as per ARR 2019 procedures
- The flood impact was assessed up to the 1% AEP + Climate Change (Refer to Section 4.2.3.1 for details) and the flood results were shown up to including the PMF event to allow understanding of flood risk.

4.1 Hydrologic Modelling

The WBNM (City Catchment) was utilised to generate flow hydrographs for input to the hydraulic model. The hydrology model covers Glenfield Drain as well as the Wagga Wagga CBD and outer areas lying on the southern Murrumbidgee River floodplain. Refer to the figure below for the sub-catchment extents of the hydrology model.

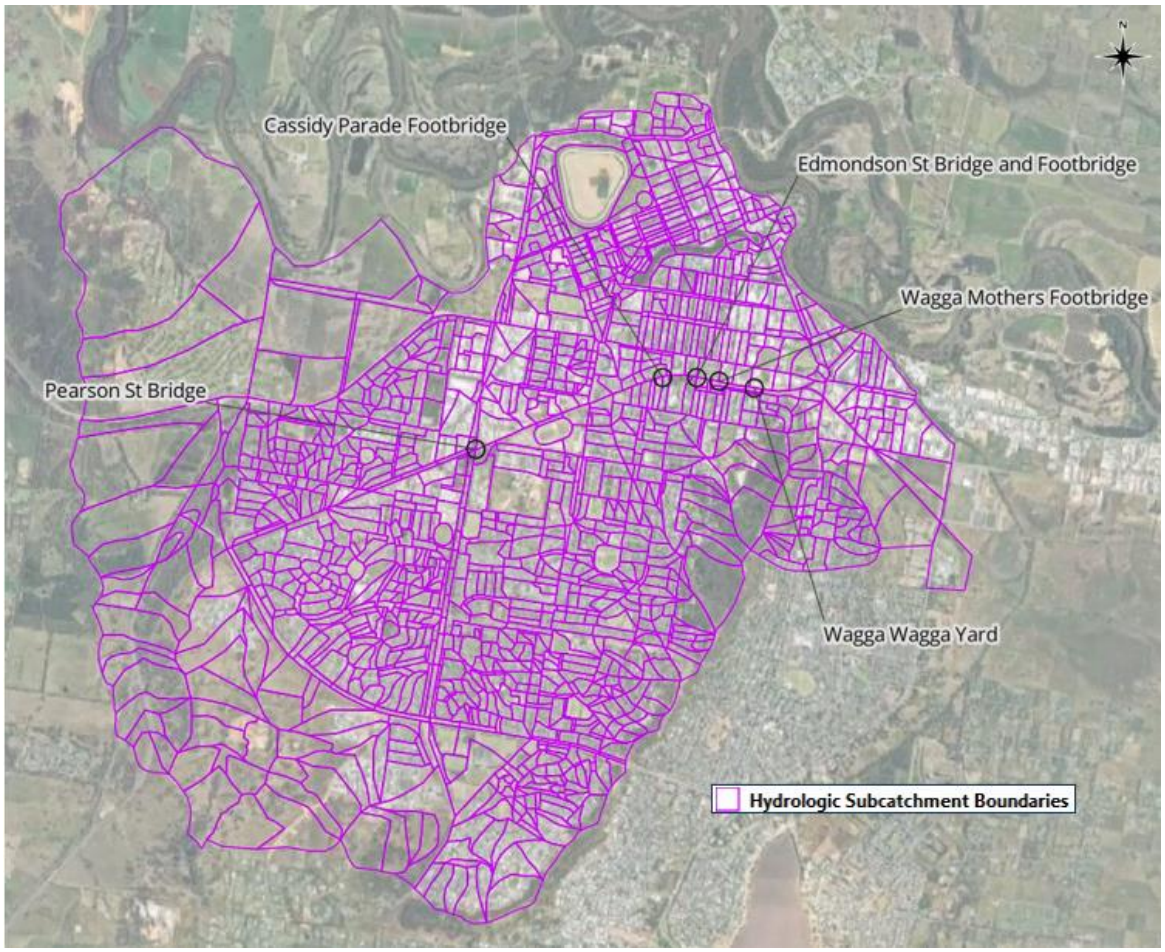


Figure 4: Hydrologic Sub-catchment Extents

As stated in Item 2 in Table 3, only WBN running files generated by the Storm Injector were received, and those files could not be run directly through the WBNM software due to the lack of ICA and geometry data. To produce the inflow hydrographs for critical duration analysis, Storm Injector HL (V 1.3.9.0) was used alongside the provided ICA and geometry data (Item 3, Table 3,). However, generating identical hydrograph inflow values proved challenging. As a conservative approach, slightly higher inflow values (generally 0.0035 m^3/s) than the received ones were created, which were then utilised in the hydraulic assessment. Table 11 presents a comparison between the received and adopted WBN files.

Table 11: Model Parameters of Hydrology Model

Parameters	Received Hydrology Model	Adopted Hydrology Model
Hydrology model and version	WBNM model (v2017) with WBN files	WBNM model (v2017) using Storm injector HL (v 1.3.9.0).
Total catchment area	3835 ha (38.35 km^2).	3835 ha (38.35 km^2).
Events	PMF (1987), 0.2% AEP, 0.5% AEP, 1% AEP, 2% AEP, 5% AEP, 10% AEP, 20% AEP	1% AEP + Climate Change, 1%AEP, 2% AEP, 5% AEP, 10% AEP. PMF
Duration Temporal pattern received/generated	Single temporal pattern for durations 120 minutes, 360 minutes and 720 minutes 90 minutes and 180 minutes for PMF	Ensemble temporal pattern for duration ranging from 10 minutes to 720 minutes
Indirectly Connected Area (ICA)	Utilised received inflow hydrographs for events 1%AEP, 2% AEP, 5% AEP and 10% AEP which had ICA included. No 1% AEP + Climate Change event inflow hydrographs were received.	The hydrology model was updated with relevant ICA values from the data received from the Wagga Wagga City Council (Item 3 in Table 3) and generated relevant inflow hydrographs for the hydraulic models. These inflow hydrographs were then used in the model for the flood assessment.

Flow hydrographs were generated for input to the hydraulic model for the 10% AEP, 5% AEP, 2% AEP, 1% AEP, 1% AEP + Climate Change events to perform critical duration analysis (Refer to Table 13 in the Hydraulic modelling).

The PMF Hydrology model was based on the ARR1987 guidelines. This was then updated as per ARR2019 guidelines incorporating an ensemble of 11 temporal patterns for GSDM PMF from 15 minutes to 180 minutes.

4.2 Hydraulic Modelling

4.2.1 Existing Model Update

The existing model was updated based on the received TUFLOW from MOFFS (WMAwater, 2021) mentioned in Section 1.6.1. A summary of the received model and updated model parameters can be found in Table 12.

The model extent encompasses Wagga Wagga's central business district (CBD), and surrounding regions situated along the southern floodplain of the Murrumbidgee River, spanning an area of approximately 42 km^2 (Refer to Figure 5).

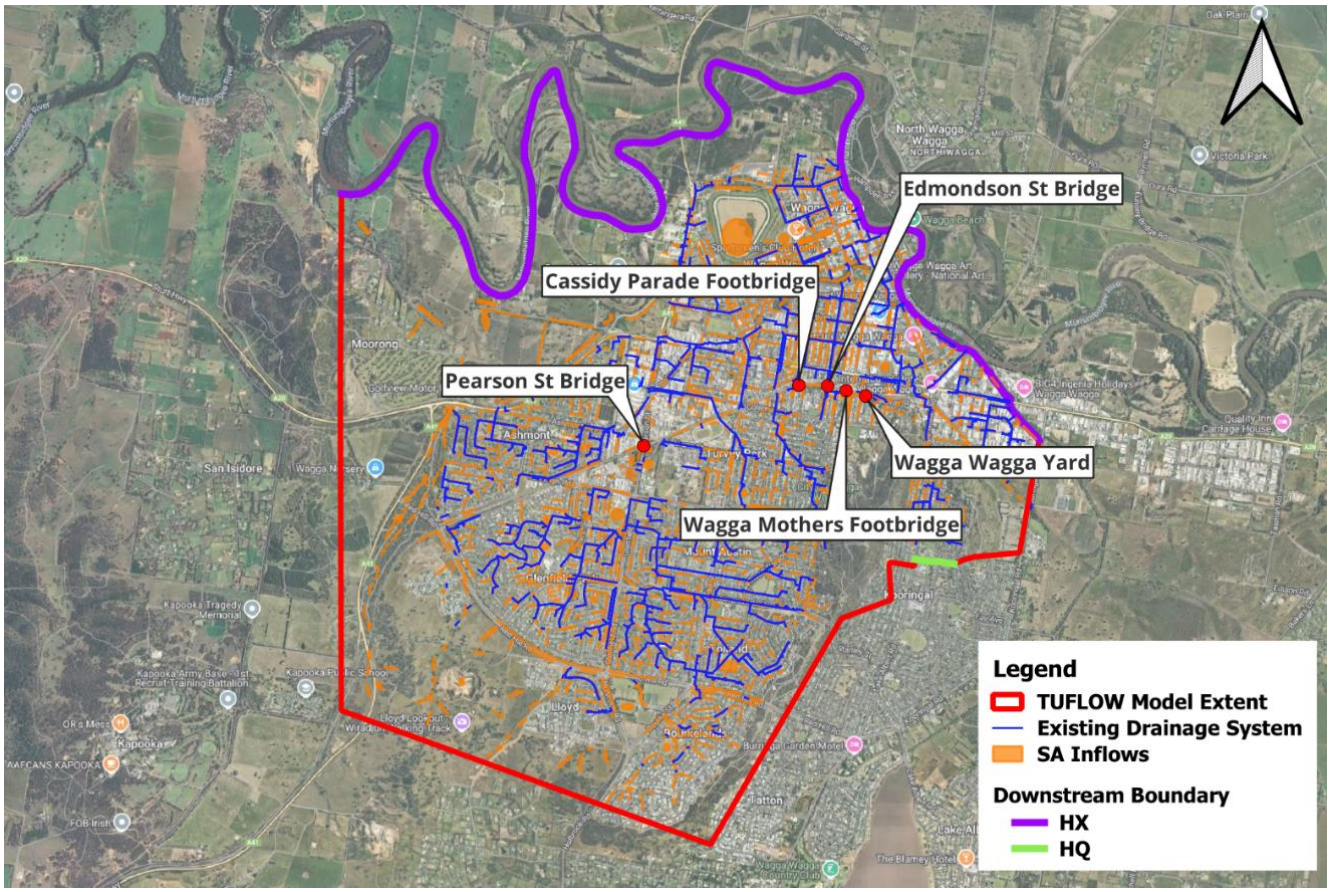


Figure 5: TUFLOW Model Extent

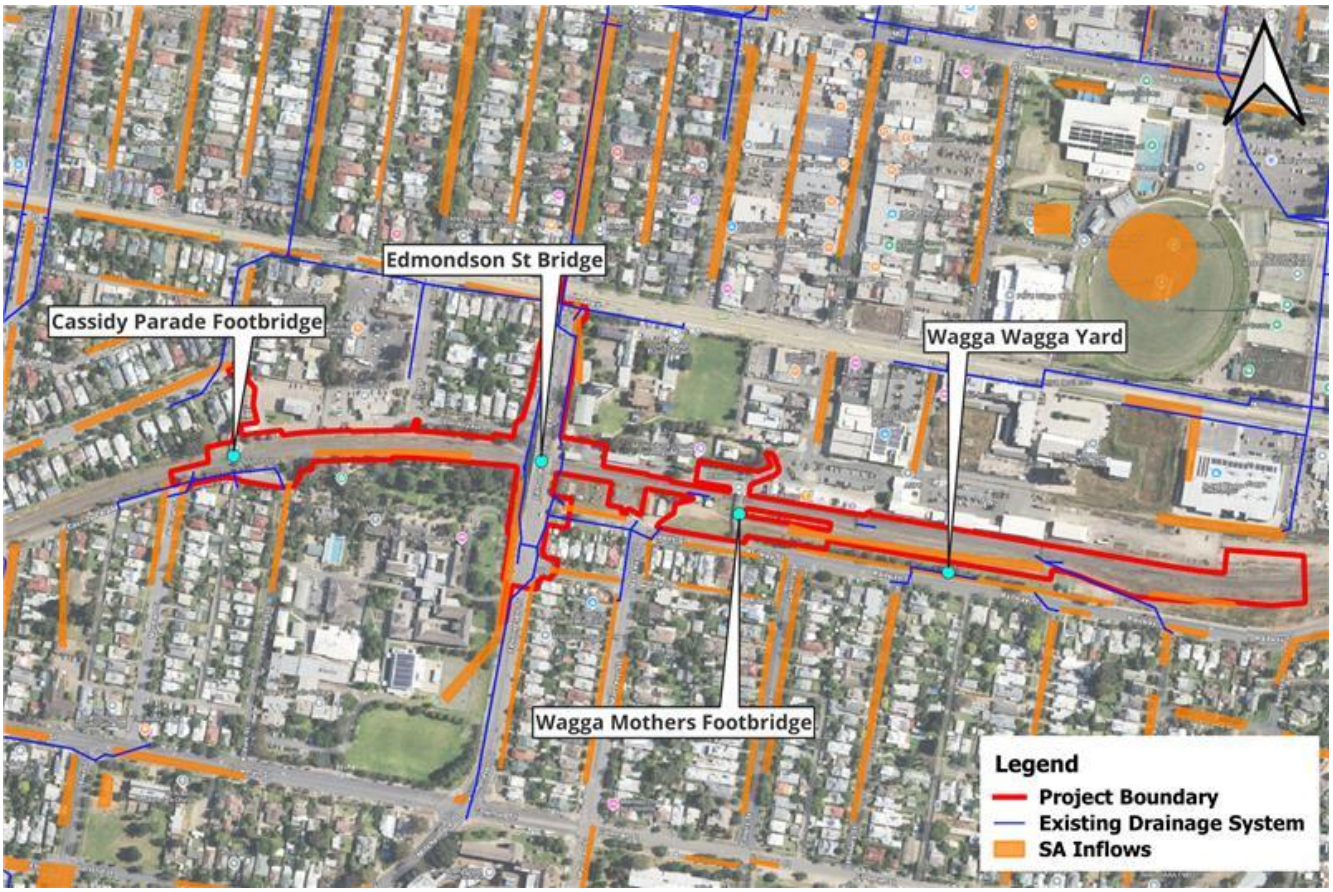


Figure 6: Edmonson Street Bridge and Footbridge (Zoomed in)

Table 12: Model Parameters in the Updated Existing Model and MOFFS 2021 TUFLOW Model

Parameters	MOFFS 2021 Model	Updated TUFLOW Model
Build	TUFLOW 2018-03-AC HPC	TUFLOW.2020-10-AF HPC (Refer to Section 4.2.1.2- "TUFLOW model version and grid size" for more details)
Coordination Reference System (CRS)	GDA94 MGA 55	GDA2020 MGA 55
Grid Size	5m	1.25m within the quadtree area (Site area) and 5m outside of the quadtree area (Refer to Figure 8). Refer to the following Section of "TUFLOW model version and grid size" for more details.
Hydrology	WBNM ARR2019	WBNM ARR2019
Inflow type	SA Polygon	SA Polygon
Key Structures	No bridge was included	The existing Edmondson Street Bridge and Wagga Wagga footbridge abutment was represented in the model.
Extent	Wagga Wagga's central business district (CBD) and surrounding regions are situated along the southern floodplain of the Murrumbidgee River.	Wagga Wagga's central business district (CBD) and surrounding regions are situated along the southern floodplain of the Murrumbidgee River.
Downstream Boundary	Dynamic downstream water boundary and slope boundary	Dynamic downstream water boundary and slope boundary
Timestep	Dynamic	Dynamic
Building Representation	Null polygon	Null polygon
Topography	▪ 1 m resolution LiDAR collected in 2008 ▪ 5 m x 5 m resolution photogrammetry was obtained from Geoscience Australia – Elevation Information System (ELVIS) ▪ 2014 LiDAR was used for two basins upstream of Jubilee Park on Bourkelands Drive	▪ 1 m resolution LiDAR collected in 2008 ▪ 5 m x 5 m resolution photogrammetry was obtained from Geoscience Australia – Elevation Information System (ELVIS) ▪ 2014 LiDAR was used for two basins upstream of Jubilee Park on Bourkelands Drive ▪ 2020 LiDAR for sites ▪ Site survey and verified cloud point data (Refer to Item 5, 6 and 7 in Table 3)
Roughness	▪ Pasture: 0.045 ▪ 1D cross-section elements: 0.040 ▪ Lots: 0.060 ▪ Ponds and other water bodies: 0.030 ▪ Newly built/resurfaced road: 0.018 ▪ Industrial: 0.070 ▪ Roads: 0.022 ▪ Creek permanent water: 0.040 ▪ Vegetation: 0.100 ▪ Vegetated creek: 0.080 ▪ Railway: 0.060 ▪ select 1D cross section (crooked creek): 0.060	▪ Pasture: 0.045 ▪ 1D cross-section elements: 0.040 ▪ Lots: 0.060 ▪ Ponds and other water bodies: 0.030 ▪ Newly built/resurfaced road: 0.018 ▪ Industrial: 0.070 ▪ Roads: 0.022 ▪ Creek permanent water: 0.040 ▪ Vegetation: 0.100 ▪ Vegetated creek: 0.080 ▪ Railway: 0.060 ▪ select 1D cross section (crooked creek): 0.060 ▪ Design Channel: 0.035 Note: Some roughness areas in the site (the rail line) were refined
Design Events	PMF, 0.2% AEP, 0.5% AEP, 1% AEP, 2% AEP, 5% AEP, 10% AEP, 0.2 EY	PMF, 1% AEP + Climate Change, 1%AEP, 2% AEP, 5% AEP, 10% AEP

4.2.1.1 GDA 2020 conversion

The conversion to the Geocentric Datum of Australia 2020 (GDA2020) represents a crucial update to modernise and align the model with the latest geodetic standards and reference systems and to meet project requirements on the CRS. The model layers and the rasters were converted into GDA2020 Map Grid of Australia (MGA) 55 from GDA94 MGA 55.

4.2.1.2 TUFLOW model version and grid size

The initial 5-meter grid size and TUFLOW 2018-03-AC HPC was adopted in the MOFFS 2021 TUFLOW model. However, the 5m grid was found to be insufficient to model the detailed specific requirements of the study area. Consequently, a more refined grid size is required. The application of a finer grid to the whole model extent is not cost-effective in terms of the computation time as the site areas are limited compared with the model extent. As such, the approach of applying quadtree (only available in versions from 2020 onwards) with 1.25m to the site area is favoured.

2023-03-AC is the most up-to-date TUFLOW version at the time when the modelling was carried out. However, when running the model using the 2023-03-AC HPC, inconsistencies were noted near the site area, particularly at Area 1 and Area 2 (refer to Figure 7), in comparison to the results obtained from the 2018-03-AC HPC. Area 1, which is located near Pearson Street Bridge, experienced an increase of around 0.1m in flood level, while Area 2 (upstream of Wagga Yard) experienced an increase of around 0.5m in flood level.

Following a series of tests, it was found that version 2020-10-AF HPC (the latest release prior to 2023) yielded results most similar to the results produced by the MOFFS 2021 model (2018-03-AC HPC), which Wagga Wagga City Council used (refer to Section 5 for more details). In Areas 1 and 2, the flood levels were increased by around 0.02m and 0.15m.

Therefore, TUFLOW 2020-10-AF HPC with a quadtree of 1.25m was adopted for this study which closely reproduces the model results utilised by WWCC. (Refer to Figure 8) for the adopted quadtree extent).

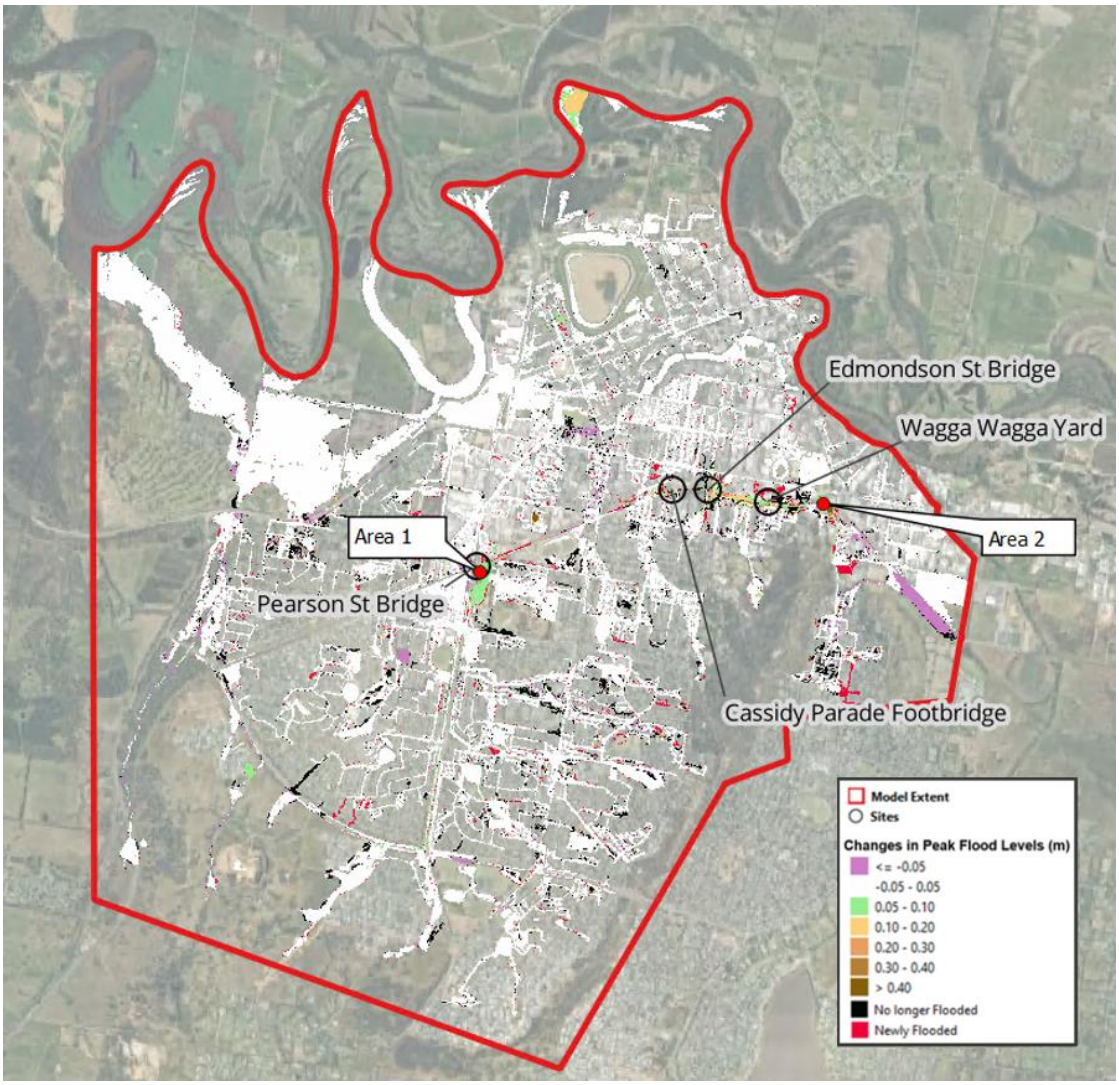


Figure 7: Discrepancies Between 2023-03-AC and 2018-03-AC TUFLOW Version Flood Levels Results



Figure 8: Quadtree Extent - Wagga Wagga Yard

4.2.1.3 Topography

The model topography was updated by incorporating the 2020 LiDAR and the site survey for both the existing case and the proposed design surfaces. This update was performed to enhance the accuracy of the model, ensuring a proper representation of the most recent topography within the study area. Figure 9 shows the 2020 LiDAR extent.



Figure 9: 2020 LiDAR Extent

4.2.1.4 Drainage Network

Existing condition drainage elements were based on the data received from the DJV drainage team (Item 11 in Table 3). For the design conditions, the drainage design composed of pipes and headwalls was incorporated into the model in addition to the proposed drainage channel implemented to the south of the slewed Main Line.

4.2.2 Design Model Update

The design model was updated from the existing condition by incorporating the Inland Rail Project Works as part of the DDR stage, including:

- Civil design – The civil design for Rail ballast and capping was incorporated into the model (item 11 in Table 3). Refer to Figure 10 for changes in topography between the existing and design conditions.
- Top of rail representation – The top of the rail strings was represented as break lines to reinforce the rail level (item 12 in Table 3),
- Proposed drainage networks were incorporated into the model. The layout and pipe sizes of the design drainage system were adopted from the drainage plan (item 10 in Table 3)

This inclusion did not result in any alterations to the sub-catchment topography (Figure 12 of Wagga Wagga Major Overland Flow Flood Study, WMAwater, 2011). Thus, the inflow locations remain consistent with the existing model.

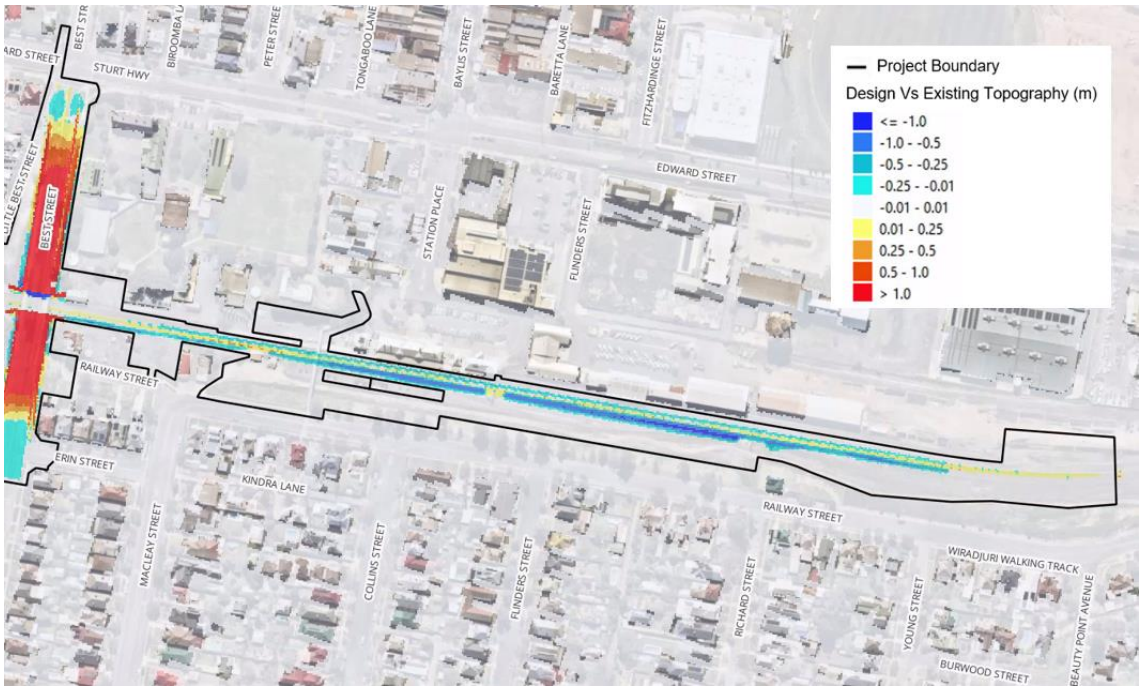


Figure 10: Changes in Topography (Design vs Existing)

4.2.3 Design Events

The storm durations of 10min, 15min, 20min, 25min, 30min, 45min, 60min, 90min, 120min, 180min, 270min, 360min, 540min and 720min were modelled. An ensemble of 11 temporal patterns for PMF and 10 temporal patterns for other events was run for each duration as recommended in ARR2019. The critical durations were determined based on the maximum envelope method across the selected durations.

As per CoA E39, the document listed in Condition A1 (EIS report) should be carried out. In the EIS report, the smallest modelled event is 5% AEP. However, to be consistent with the previous stage (SDR and PDR) of flood design report. 10% AEP is selected as the smallest design event.

The model was run for the design events of 10%, 5%, 2%, 1%, 1% AEP with climate change and PMF. The critical duration and temporal patterns determined and elaborated below in Table 13 summarise the information of the design events.

Table 13: Summary of Events and Critical Durations Run in TUFLOW – Wagga Wagga Yard

Design Events	Master Design Critical Duration	Temporal Pattern
10% AEP	30 minutes, 60 minutes, 120 minutes	All 10 temporal patterns for each duration
5% AEP	30 minutes, 90 minutes, 120 minutes	
2% AEP	30 minutes, 45 minutes, 60 minutes, 90 minutes	
1% AEP & 1% AEP + Climate Change	30 minutes, 45 minutes, 60 minutes	
PMF	30 minutes, 45 minutes, 60 minutes	All 11 temporal patterns for each duration

4.2.3.1 Climate change

There are no design criteria for flood impact on climate change. Therefore, a sensitivity assessment was conducted to evaluate the influence of climate change on flooding to anticipate future climate change flood risk. The existing WBNM model was employed to generate hydrographs for the TUFLOW model for the 1% AEP with climate change. As per the EIS report (Section 3.3.5 of Albury to Illabo Environmental Impact Statement Technical Paper 11), Year 2090 RCP8.5 interim climate change factor sourced from the ARR Data Hub (https://data.arr-software.org/) was adopted.

As per the EIS report (Section 3.3.5 of Albury to Illabo Environmental Impact Statement Technical Paper 11), Year 2090 RCP8.5 interim climate change factor sourced from the ARR Data Hub (Refer to Appendix B) and the associated 20.2% increase in rainfall was adopted.

5 HYDRAULIC MODEL COMPARISON

The comparison in this section involved the results from the updated DDR model existing condition against the results from the MOFFS TUFLOW model for the 1% AEP design event storm duration of 120 minutes and TP3935.

Generally, this comparison revealed a high degree of consistency in flood levels between the two sets of results, with variations typically falling within the range of +/- 50 mm (refer to Figure 11). In some localised areas, larger differences were found, ranging around from 0.05 to 0.3 meters. The possible reasons are listed below:

- It was initially expected that transitioning to a newer version of TUFLOW, which incorporates the quadtree method, might lead to minor changes in flood levels. The quadtree method could alter the model running timestep compared to the original model, potentially contributing to an increase in flood levels of up to 0.2m at the northern downstream boundary. However, since this area is distant from the sites, any such changes in flood levels would not impact the site.
- The changes in flood levels around the sites primarily stem from the integration of the 2020 LiDAR data and the comprehensive site survey.
- The existing drainage networks were updated (as data by the DJV Drainage team) based on the latest survey, which involved modification in terms of pipe location, pipe size and inverts to reflect the existing site conditions accurately.
- Modifications to the SA inflow polygons were made following proof engineer review, to achieve a better alignment between the physical asset capacity and the modelled asset usage.

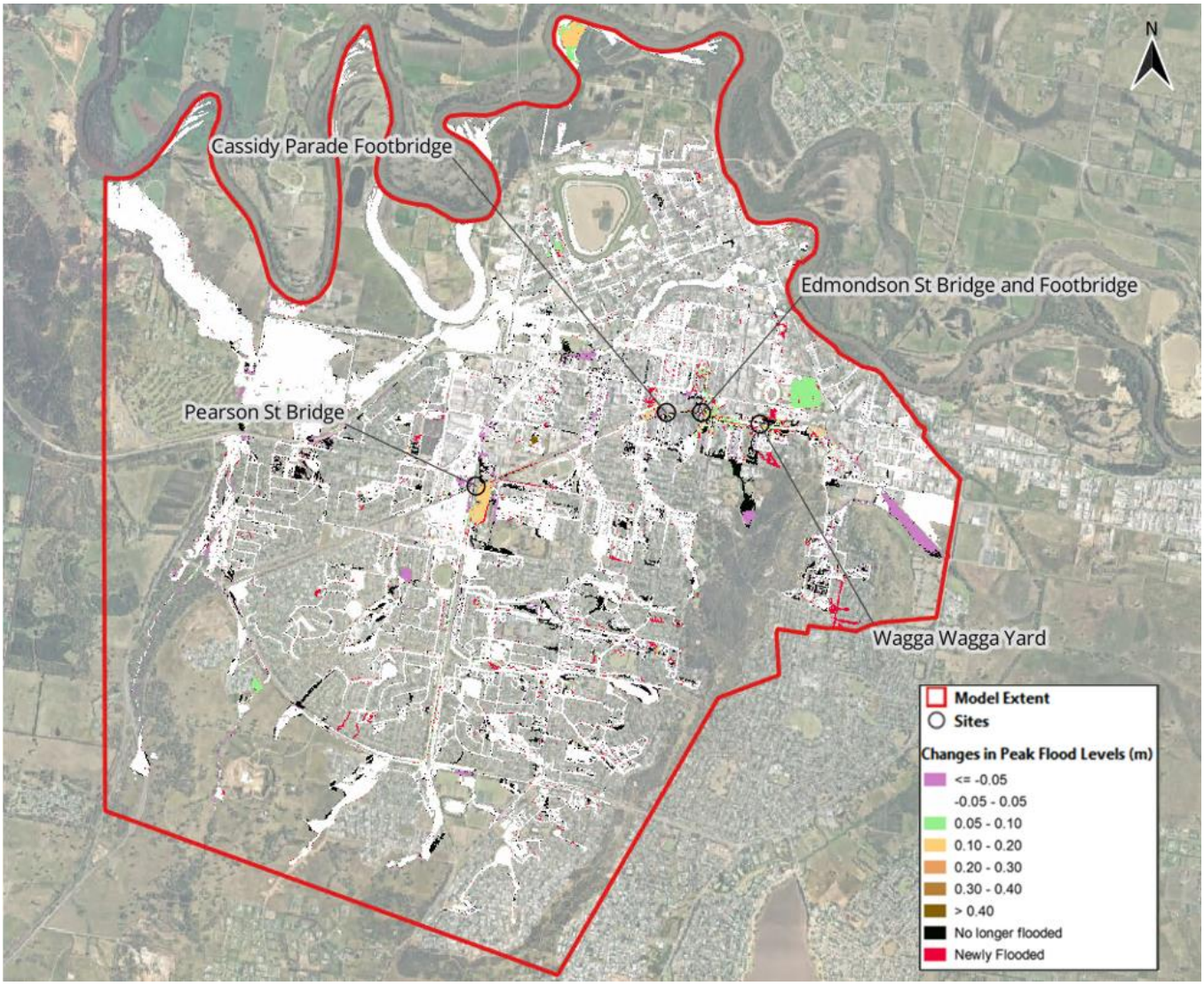


Figure 11: Comparison - Changes in Peak Flood Levels (Updated TUFLOW Model vs MOFFS 2021 TUFLOW Model)

6 FLOOD ASSESSMENT

6.1 Existing Condition

Existing flood maps, including peak flood depth and levels, peak flood velocity, and peak flood hazard for the modelled events, are provided in Appendix A.

In the existing scenario, the floodwaters generally flow from the upper part of the catchment in the south towards the railway line on the site (Refer to Figure 12). During a 1% AEP event, the water diverges approximately at CH520.850km (near Point 5), flowing both eastwards and westwards. The water that flows west continues until CH521.250km and then to CH521.350km, after which it travels northwards. A gully pit near Point 4 drains water from the railway corridor, which is then directed through a culvert to the north into an open channel at Point 6. This channel connects to an existing culvert downstream of Point 6. During more intense storm events, floodwater overtops both the channel and the culvert, flowing further north. Under existing conditions, the railway is overtopped during the 10% AEP, at CH521.250km to CH521.500km.

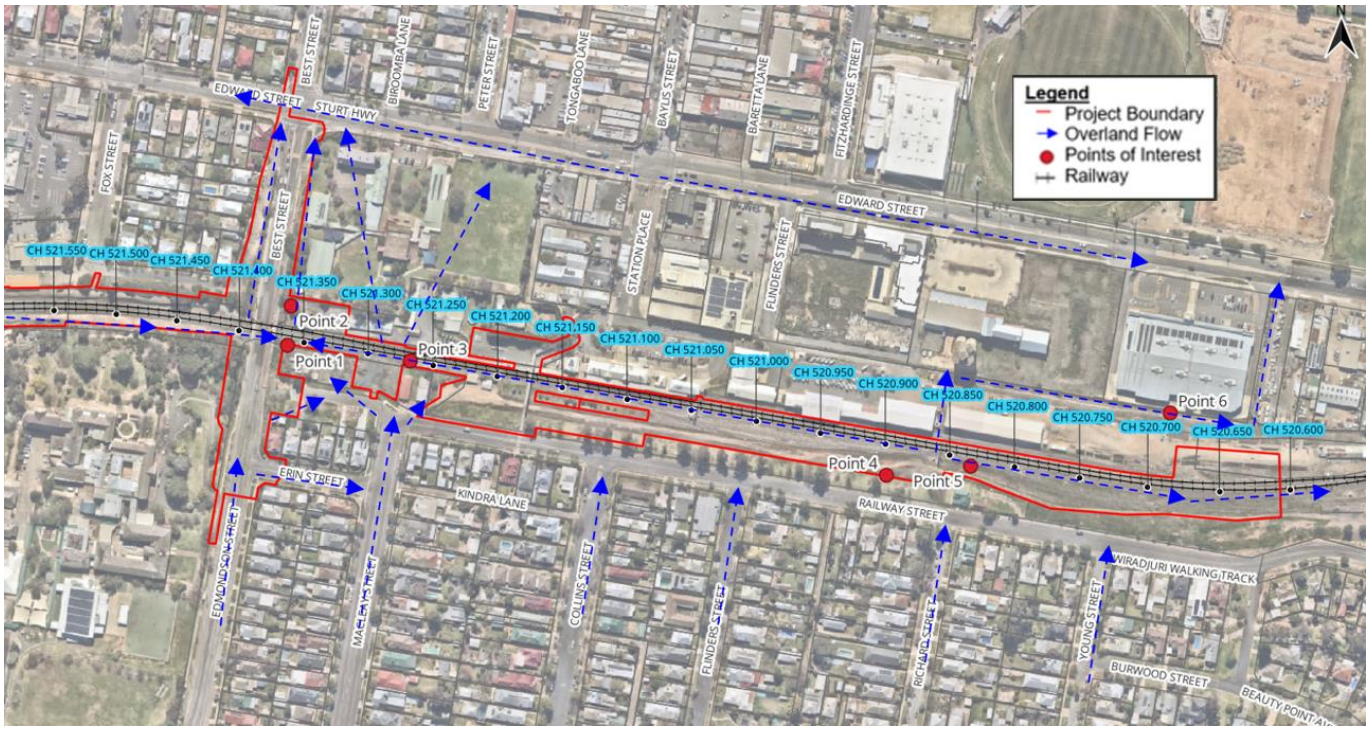


Figure 12: 1% AEP Existing Flow path

Figure 12 above shows various points of interest that have been used for the analysis below. The existing condition flood behaviour is discussed in the tables below.

Table 14: Peak Flood Levels – Existing Condition

Design Events	Flood Levels
10% AEP	▪ The flood waters overtop the top of rail between CH 521.500km and CH 521.250km generally with a depth less than 30mm. ▪ Refer to Table 6-2 below, which shows the reduced levels (RLs) at the points of interest in the existing condition.
5% AEP	▪ The flood waters overtop the top of rail between CH 521.500km and CH 521.100km generally with a depth less than 100mm. ▪ Refer to Table 6-2 below, which shows the reduced levels (RLs) at the points of interest in the existing condition.
2% AEP	▪ The flood waters overtop the top of rail between CH 521.500km and CH 521.050km generally with a depth less than 120mm. ▪ Refer to Table 6-2 below, which shows the reduced levels (RLs) at the points of interest in the existing condition.

Design Events	Flood Levels
1% AEP	▪ The flood waters overtop the top of rail between CH 521.500km and CH 521.000km generally with a depth less than 180mm. ▪ Refer to Table 6-2 below, which shows the reduced levels (RLs) at the points of interest in the existing condition.
1% AEP + Climate change	▪ The flood waters overtop the top of rail between CH 521.500km and CH 520.750km generally with a depth less than 250mm. ▪ Refer to Table 6-2 below, which shows the reduced levels (RLs) at the points of interest in the existing condition.
PMF	▪ The flood waters overtop the top of rail at all areas within the site boundary generally with a depth less than 900mm. ▪ Refer to Table 6-2 below, which shows the reduced levels (RLs) at the points of interest in the existing condition.

The table below shows the reduced levels (RLs) at the points of interest in the existing condition.

Table 15: Points of Interest Data – Peak Flood Levels (mAHD) – Existing Condition

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Point 1	184.01	184.14	184.19	184.21	184.24	184.65
Point 2	183.68	183.70	183.70	183.71	183.75	184.17
Point 3	184.13	184.16	184.18	184.20	184.24	184.79
Point 4	184.25	184.31	184.37	184.43	184.50	185.24
Point 5	184.22	184.28	184.35	184.41	184.49	184.98
Point 6	181.16	181.17	181.19	181.20	181.21	182.23

The table below summarises the peak flood velocity results for existing conditions in Wagga Yard.

Table 16: Peak Flood Velocity – Existing Condition

Design Events	Flood Velocity
10% AEP	▪ The peak velocity on the site is generally below 1m/s. The peak velocity is generally below 1.5m/s at downstream of culverts (Points 1 and 2) and within open channels (Point 6). ▪ Refer to Table 17 for flood velocity comparison based on points of interest.
5% AEP	
2% AEP	
1% AEP	
1% AEP + Climate Change	
PMF	▪ The peak velocity on the site is generally below 1.5m/s. The peak velocity is generally below 2 m/s at downstream of culverts (Points 1 and 2) and within open channels (Point 6). ▪ Refer to Table 17 for flood velocity comparison based on points of interest.

The table below shows the peak flood velocities at the points of interest in the existing condition.

Table 17: Points of Interest Data – Peak Flood Velocity (m/s) – Existing Condition

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Point 1	1.2	1.3	1.3	1.3	1.3	1.4
Point 2	1.2	1.3	1.4	1.4	1.5	1.8
Point 3	0.3	0.4	0.4	0.5	0.5	0.9
Point 4	0.2	0.2	0.2	0.2	0.2	0.3
Point 5	0.1	0.1	0.2	0.2	0.2	1.0
Point 6	1.2	1.2	1.3	1.3	1.3	2.0

The flood hazard assessment is based on the general flood hazard classification set by the Australian Institute for Disaster Resilience in Australian Disaster Resilience Handbook Collection - Flood Hazard, 2017. The Figure 13 and tables below describe the hazards.

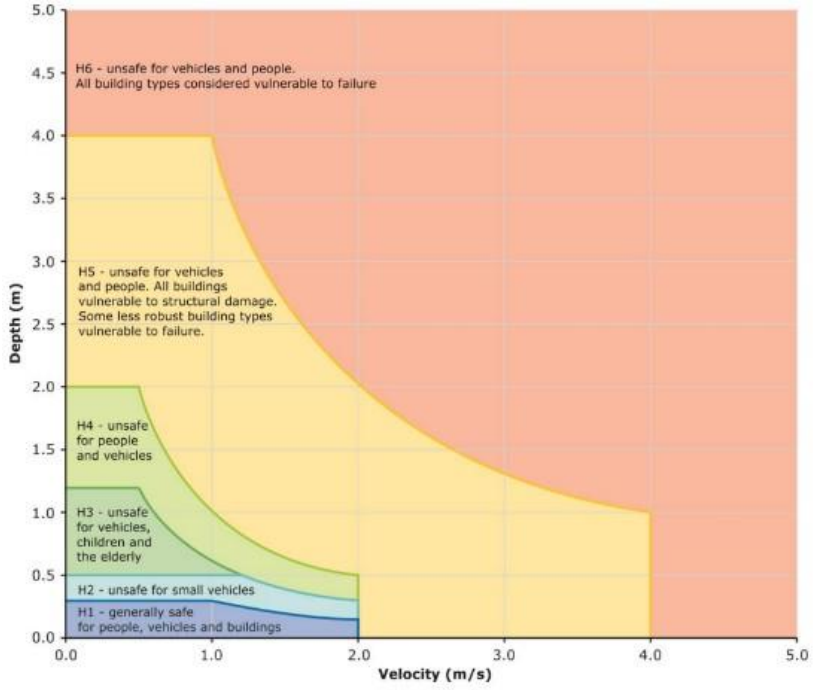


Figure 13: Hazard Category Classification

The table below presents the flood hazards at the site for the existing condition. Maps are included in Appendix A.

Table 18: Flood Hazard – Existing Condition

Design Events	Flood Hazard
10% AEP	▪ The peak hazard along the site is generally H1 to H2. ▪ Refer to Table 19 for flood hazard comparison based on points of interest.
5% AEP 2% AEP	▪ The peak hazard along the site is generally H1 to H3. ▪ Refer to Table 19 for flood hazard comparison based on points of interest.
1% AEP 1% AEP + Climate Change	▪ The peak hazard along the site is generally H2 to H3. ▪ Refer to Table 19 for flood hazard comparison based on points of interest.
PMF	▪ The peak hazard along the site is generally H3 to H4. ▪ Refer to Table 19 for flood hazard comparison based on points of interest.

The table below shows the hazard category at the points of interest in the existing condition.

Table 19: Points of Interest Data – Peak Flood Hazard – Existing Condition

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate change	PMF
Point 1	H3	H3	H4	H4	H4	H4
Point 2	H4	H4	H4	H4	H4	H5
Point 3	H3	H3	H3	H3	H3	H5
Point 4	H3	H3	H3	H3	H3	H4
Point 5	H3	H3	H3	H3	H3	H5
Point 6	H3	H3	H3	H3	H4	H5

6.2 Design Conditions

The general flooding behaviour is similar to the existing conditions, with a redistribution of flows south of the rail caused by the proposed design and channel running south of the rail line (Refer to Figure 14). The proposed channel, which runs south of the rail, distributes more floodwaters towards both the eastern and the western end of the rail line while providing additional storage for the site (generally up to 0.5m depth). This reduces the floodwater levels south of the railway. The reduction in water level in the south leads to a reduction in the flood water overtopping the rail to the north and flowing west towards the industrial area.

Additionally, two design culverts drain the site via an inspection pit located at approximately CH 520.880km, improving the flood conditions at the site during the proposed condition. This results in a reduction of flood levels at the site.

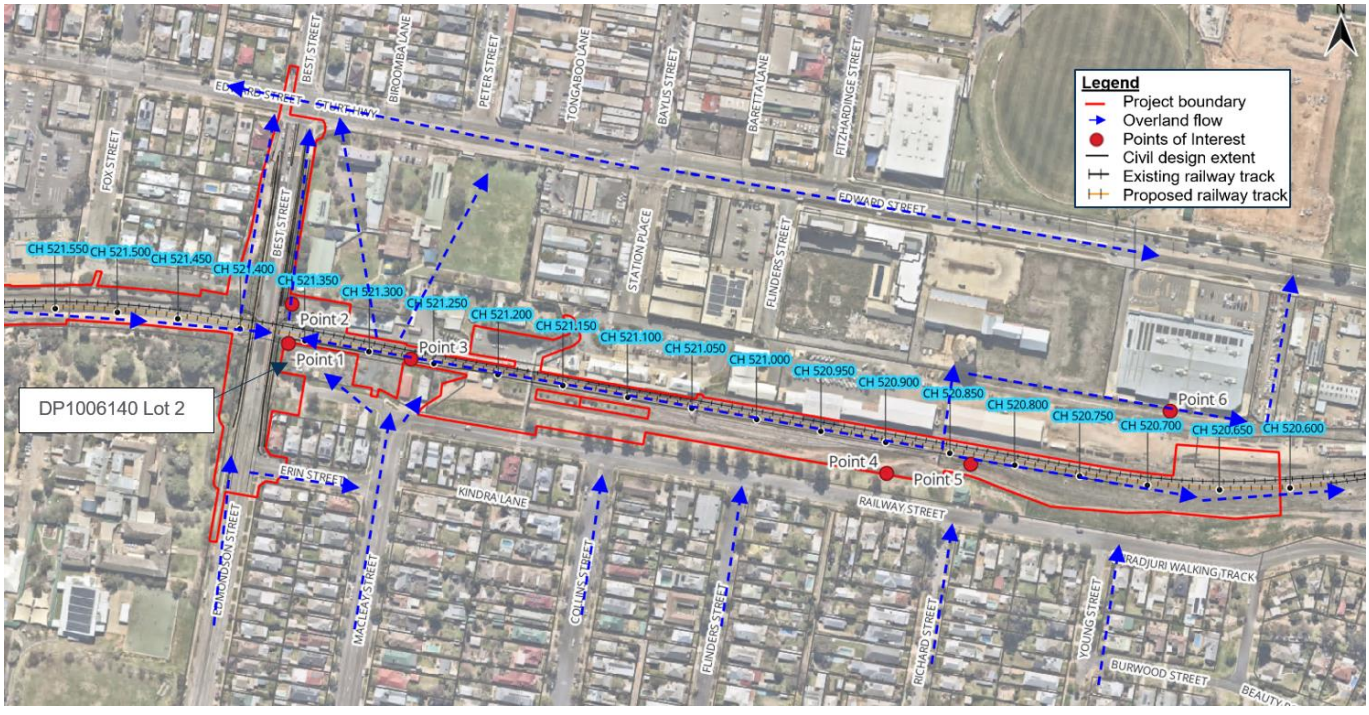


Figure 14: 1% AEP Proposed Condition Flow Path

The design condition peak flood levels are discussed below in Table 20.

Table 20: Peak Flood Levels – Design Condition

Design Events	Flood Levels
10% AEP	▪ The flood waters overtop the top of rail levels only at CH 521.500km generally with a depth less than 10mm. ▪ Table 21 shows the reduced levels (RLs) at the points of interest in the design conditions

Design Events	Flood Levels
5% AEP	▪ The flood waters overtop the top of rail levels between CH 521.500km and CH 521.250km generally with a depth less than 50mm. ▪ Refer to Table 21 for flood level based on points of interest.
2% AEP	▪ The flood waters overtop the top of rail levels between CH 521.500km and CH 521.150km generally with a depth less than 100mm. ▪ Refer to Table 21 for flood level based on points of interest.
1% AEP	▪ The flood waters overtop the top of rail levels between CH 521.500km and CH 521.050km generally with a depth less than 150mm. ▪ Refer to Table 21 for flood level based on points of interest.
1% AEP + Climate Change	▪ The flood waters overtop the top of rail levels between CH 521.500km and CH 520.900km generally with a depth less than 200mm. ▪ Refer to Table 21 for flood level based on points of interest.
PMF	▪ The flood waters overtop the top of rail at all areas within the site boundary generally with a depth less than 870mm. ▪ Refer to Table 21 for flood level based on points of interest.

The table below shows the reduced levels (RLs) at the points of interest in the design condition.

Table 21: Points of Interest Data – Peak Flood Levels (mAHD) – Design Condition

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Point 1	184.12	184.18	184.23	184.26	184.29	184.67
Point 2	183.64	183.68	183.69	183.71	183.74	184.03
Point 3	184.08	184.17	184.19	184.21	184.25	184.79
Point 4	184.20	184.27	184.34	184.41	184.48	185.22
Point 5	184.20	184.27	184.34	184.40	184.48	184.99
Point 6	181.16	181.17	181.19	181.20	181.21	182.21

The table below summarises the peak flood velocity results at the site for the design condition.

Table 22: Peak Flood Velocity – Design Condition

Design Events	Flood Velocity
10% AEP 5% AEP 2% AEP 1% AEP 1% AEP + Climate Change	▪ The peak velocity on the site is generally below 1m/s. The peak velocity generally below 1.5m/s at downstream of culverts (Points 1 and 2) and within open channels (Point 6). ▪ Refer to Table 23 for velocity based on points of interest.
PMF	▪ The peak velocity on the site is generally below 1.5m/s. The peak velocity is generally below 2.1 m/s at downstream of culverts (Points 1 and 2) and within open channels (Point 6). ▪ Refer to Table 23 for velocity based on points of interest.

The table below shows the peak flood velocities in the design condition.

Table 23: Points of Interest Data – Peak Flood Velocities (m/s) – Design Condition

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Point 1	0.9	0.9	0.9	0.9	0.9	1.1
Point 2	1.1	1.1	1.1	1.1	1.2	1.3
Point 3	0.4	0.4	0.5	0.5	0.6	1.1
Point 4	0.2	0.2	0.2	0.2	0.2	0.3
Point 5	0.3	0.4	0.5	0.5	0.5	1.1
Point 6	1.2	1.2	1.3	1.3	1.3	2.1

In the design scenario, the proposed channel within the site experiences higher hazards. The table below presents the flood hazards at each event under design conditions. Maps are also included in Appendix A.

Table 24: Flood Hazard – Design Condition

Design Events	Flood Hazard
10% AEP	▪ The peak hazard along the site is generally H1 to H2. Proposed channel experiences flood hazard up to H4. ▪ Refer to Table 25 for hazard based on points of interest.
5% AEP 2% AEP	▪ The peak hazard along the site is generally H1 to H3. Proposed channel experiences flood hazard up to H4. ▪ Refer to Table 25 for hazard based on points of interest.
1% AEP 1% AEP + Climate Change	▪ The peak hazard along the site is generally H2 to H3. Proposed channel experiences flood hazard up to H4. ▪ Refer to Table 25 for hazard based on points of interest.
PMF	▪ The peak hazard along the site is generally H3 to H4. Proposed channel experiences flood hazard up to H5. ▪ Refer to Table 25 for hazard based on points of interest.

The table below shows the hazard category at the points of interest in the design condition.

Table 25: Points of Interest Data – Peak Flood Hazard– Design Condition

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP + Climate Change	PMF
Point 1	H3	H3	H3	H3	H3	H4
Point 2	H4	H4	H4	H4	H4	H4
Point 3	H3	H3	H3	H3	H3	H5
Point 4	H3	H3	H3	H3	H3	H4
Point 5	H3	H3	H3	H3	H3	H5
Point 6	H3	H3	H3	H3	H4	H5

6.3 Flood Immunity and Scour Protection

During the existing scenario, the rail is overtopped in 10% AEP (smallest modelled event, refer to 4.2.3). In the design scenario, apart from a limited localised overtopping occurring at CH521.500 km during the 10% AEP, other areas

within the Wagga Yard site extents achieves flood immunity in 10% AEP. In the events of 5%, 2% and 1% AEPs, the existing immunity is also improved by showing reduced overtopping extent in the design scenario, which is attributed to the introduction of the proposed channel south of the Main Line. This complies with the criteria in PSRs and CoA. In order to have a better understanding of the flood risks and service reliability. The tables below show a summary of the flood immunity and top of formation level, top of rail level and simulated flood levels (existing and design) at CH521.250km, CH521.300km and CH521.500km.

Scour protection is applied on the ends of the proposed channels at the proposed culvert headwalls. The channels are also grass lined with jute-mesh which provides local scour protection to the channel (Refer to Drainage Design at Section 4.5 on Wagga Yard Design report (5-0052-210-PEN-W7-RP-0001)). The proposed design results in an improvement to the extent of the immunity of the rail in terms of overtopping, which complies with the criteria in PSRs and CoA.

Furthermore, in the design condition, the flood velocity along the proposed road design outside the project boundary complied with the CoA Scour/Erosion potential criteria (less than 10% increase or less than 0.5m/s change in velocity) (refer to Clause E42 (h) in Table 5) up to the 1% AEP storm event. Hence, there is no need for scour protection measures outside the project boundary.

Table 26: Comparison of Flood Immunity at Overtopping Locations

Overtopping Location	Existing Condition Overtopping AEP	Design Condition Overtopping AEP
CH521.250km	10% AEP event	5% AEP event
CH521.300km	10% AEP event	5% AEP event
CH521.500km	10% AEP event	10% AEP event

Table 27: Overtopping Details

Chainage	Top of the Rail Level (mAHD)		Top of the Formation Level (mAHD)		10% AEP Flood Level (mAHD)		5% AEP Flood Level (mAHD)	
	Existing	Design	Existing & Design		Existing	Design	Existing	Design
CH521.250km	184.15	184.18	183.48*	183.51*	184.16	184.08	184.19	184.18
CH521.300km	184.11	184.13	183.44*	183.47*	184.11	184.08	184.15	184.16
CH521.500km	184.74	184.75	184.07*	184.08*	184.75	184.75	184.77	184.77

*Note that the existing top of the formation level has been assumed to be 667mm below the existing top of the rail level

6.4 Flood Impact Assessment

The flood impact assessment was conducted, and results are summarised below for events up to and including the 1% AEP event. Generally, the implementation of the drainage channel south of the proposed rail line and two design culverts at the site improves the flooding conditions. This reduces the floodwater levels south of the railway. The reduction in water level in the south, leads to a reduction in the flood water overtopping the rail to the north and flowing west towards the industrial area. The flood water overflows to the west near Edmondson Street Bridge, where an increase in flood water level and a new wet area can be observed within the project boundary. The flood level increase outside the project boundary is less than 10mm.

6.4.1 Changes in Peak Flood Level

The impacts seen below are due to the implementation of the design surface for the rail line as well as the design drainage at the Wagga Wagga Yard.

Table 28: Flood Level Impact Assessment

Design Events	Changes in Peak Flood Levels
10% AEP	▪ The changes in flood level outside the project boundary are less than 0.05m and no residential, commercial or industrial properties are impacted (Refer to Figure A37 in Appendix A).

Design Events	Changes in Peak Flood Levels
	▪ The industrial area near the Railway Street (located east of the enhancement site) is not impacted due to Wagga Yard's proposed conditions and the changes in flood level are less than 0.05m. Refer to Section 6.4.6. ▪ No third party private road has been impacted. ▪ The Corner lot (DP1006140 Lot 2) (Refer to Figure 14) upstream of the railway corridor between Edmondson Street and Railway Street experiences afflux up to 110mm due to the Eastern wing wall of Edmondson Street bridge Design. Even though lot is outside the boundary, It is an ARTC land. Hence this afflux is considered compliant. ▪ Newly wet area water depth created outside the project boundary is less than 0.01m.
5% AEP	▪ The changes in flood level outside the project boundary are less than 0.05m and no residential, commercial or industrial properties are impacted (Refer to Figure A38 in Appendix A). ▪ The industrial area near the Railway Street (located east of the enhancement site) is not impacted due to Wagga Yard's proposed conditions and the changes in flood level are less than 0.05m. Refer to Section 6.4.6. ▪ No third party private road has been impacted. ▪ The Corner lot (DP1006140 Lot 2) upstream of the railway corridor between Edmondson Street and Railway Street experiences afflux up to 50mm due to the Eastern wing wall of Edmondson Street bridge Design. Even though the lot is outside the boundary, it is ARTC land. Hence this afflux is considered compliant. ▪ Newly wet area water depth created outside the project boundary is less than 0.01m.
2% AEP	▪ The changes in flood level outside the project boundary are less than 0.05m and no residential, commercial or industrial properties are impacted (Refer to Figure A39 in Appendix A). ▪ The industrial area near the Railway Street (located east of the enhancement site) is not impacted due to Wagga Yard's proposed conditions and the changes in flood level are less than 0.05m. Refer to Section 6.4.6. ▪ No third party private road has been impacted. ▪ The Corner lot (DP1006140 Lot 2) upstream of the railway corridor between Edmondson Street and Railway Street experiences afflux up to 50mm due to the Eastern wing wall of Edmondson Street bridge Design. Even though the lot is outside the boundary, It is an ARTC land. Hence this afflux is considered compliant. ▪ Newly wet area water depth created outside the project boundary is less than 0.01m.
1% AEP	▪ The changes in flood level outside the project boundary are less than 0.01m (Refer to Figure A40 in Appendix A). ▪ The industrial area near the Railway Street (located east of the enhancement site) is not impacted due to Wagga Yard's proposed conditions and the changes in flood level are less than 0.05m. Refer to Section 6.4.6. ▪ No third party private road has been impacted. ▪ The Corner lot (DP1006140 Lot 2) upstream of the railway corridor between Edmondson Street and Railway Street experiences afflux up to 50mm due to the Eastern wing wall of Edmondson Street bridge Design. Even though the lot is outside the boundary, It is an ARTC land. Hence this afflux is considered compliant. ▪ Newly wet area water depth created outside the project boundary is less than 0.01m.

Table 29: Points of Interest Data – Change in Flood Level (m)

Locations	10% AEP	5% AEP	2% AEP	1% AEP	1% AEP CC
Point 1	0.11	0.04	0.04	0.05	0.05
Point 2	-0.03	-0.03	-0.01	0.00	-0.01

Point 3	-0.05	0.01	0.02	0.01	0.01
Point 4	-0.05	-0.04	-0.03	-0.02	-0.02
Point 5	-0.02	-0.01	-0.01	-0.01	-0.01
Point 6	Negligible impacts	Negligible impacts	Negligible impacts	Negligible impacts	Negligible impacts

The changes in flood level outside the project boundary comply with the PSR and CoA project requirements.

6.4.2 Changes in Peak Flood Velocity

Table 30: Flood Velocity Impact Assessment

Design Events	Changes in Peak Flood Velocity
10% AEP	▪ The changes in velocity outside the site is less than 0.5m/s. (Refer to Figure A42 in Appendix A). ▪ Newly wet area created outside the project boundary has a velocity less than 0.5m/s.
5% AEP	▪ The changes in velocity outside the site is less than 0.5m/s. (Refer to Figure A43 in Appendix A). ▪ Newly wet area created outside the project boundary has a velocity less than 0.5m/s.
2% AEP	▪ The changes in velocity outside the site is less than 0.5m/s. (Refer to Figure A44 in Appendix A). ▪ Newly wet area created outside the project boundary has a velocity less than 0.5m/s.
1% AEP	▪ The changes in velocity outside the site is less than 0.5m/s. (Refer to Figure A45 in Appendix A). ▪ Newly wet area created outside the project boundary has a velocity less than 0.5m/s.

The changes in flood velocity outside the project boundary comply with the PSR and CoA project requirements.

6.4.3 Changes in Peak Flood Hazard

Table 31: Flood Hazard Impact Assessment

Design Events	Changes in Peak Flood Hazard
10% AEP	▪ There is no increase in flood hazard outside the project boundary. (Refer to Figure A47 in Appendix A). ▪ The Corner lot (DP1006140 Lot 2) upstream of the railway corridor between Edmondson Street and Railway Street experiences an increase in Hazard by one category due to additional flow from the culvert from the Edmondson Street bridge transverse pipe. Even though this lot is outside the project boundary, it is an ARTC land. Hence this afflux is considered compliant. ▪ Newly created wet area outside the project boundary experiences H1 Hazard which is generally safe for people vehicles and buildings.
5% AEP	▪ There is no increase in flood hazard outside the project boundary (Refer to Figure A48 in Appendix A). ▪ The Corner lot (DP1006140 Lot 2) upstream of the railway corridor between Edmondson Street and Railway Street experiences an increase in Hazard by one category due to additional flow from the culvert from the Edmondson Street bridge transverse pipe. Even though this lot is outside the project boundary, it is an ARTC land. Hence this afflux is considered compliant. ▪ Newly created wet area outside the project boundary experiences H1 Hazard which is generally safe for people vehicles and buildings.

Design Events	Changes in Peak Flood Hazard
2% AEP	▪ There is no increase in flood hazard outside the project boundary (Refer to Figure A49 in Appendix A). ▪ The Corner lot upstream (DP1006140 Lot 2) of the railway corridor between Edmondson Street and Railway Street experiences an increase in Hazard by one category due to additional flow from the culvert from the Edmondson Street bridge transverse pipe. Even though this lot is outside the project boundary, it is an ARTC land. Hence this afflux is considered compliant. ▪ Newly created wet area outside the project boundary experiences H1 Hazard which is generally safe for people vehicles and buildings.
1% AEP	▪ There is no increase in flood hazard outside the project boundary (Refer to Figure A50 in Appendix A). ▪ The Corner lot upstream (DP1006140 Lot 2) of the railway corridor between Edmondson Street and Railway Street experiences an increase in Hazard by one category due to additional flow from the culvert from the Edmondson Street bridge transverse pipe. Even though this lot is outside the project boundary, it is an ARTC land. Hence this afflux is considered compliant. (Refer to Figure A50 in Appendix A). ▪ Newly created wet area outside the project boundary experiences H1 Hazard which is generally safe for people vehicles and buildings.

The changes in flood hazard outside the project boundary comply with the PSR and CoA project requirements.

6.4.4 Changes in Duration of Inundation

The analysis around the changes in the duration of inundation was undertaken by comparing the existing and design flood level vs time in selected locations. The locations adopted for the comparison are shown in Figure 15. Figure 16 and Figure 17 which show the comparison of flow level vs time for Reporting Locations 1 and 2, respectively. Both the existing and design flood level vs time is mostly similar. These demonstrate that the design will not create an extra duration of inundation upstream and downstream outside the project boundary. Consequently, the changes in the duration of inundation comply with the CoA E42(a).



Figure 15: Reporting Locations for the Changes in Duration of Inundation

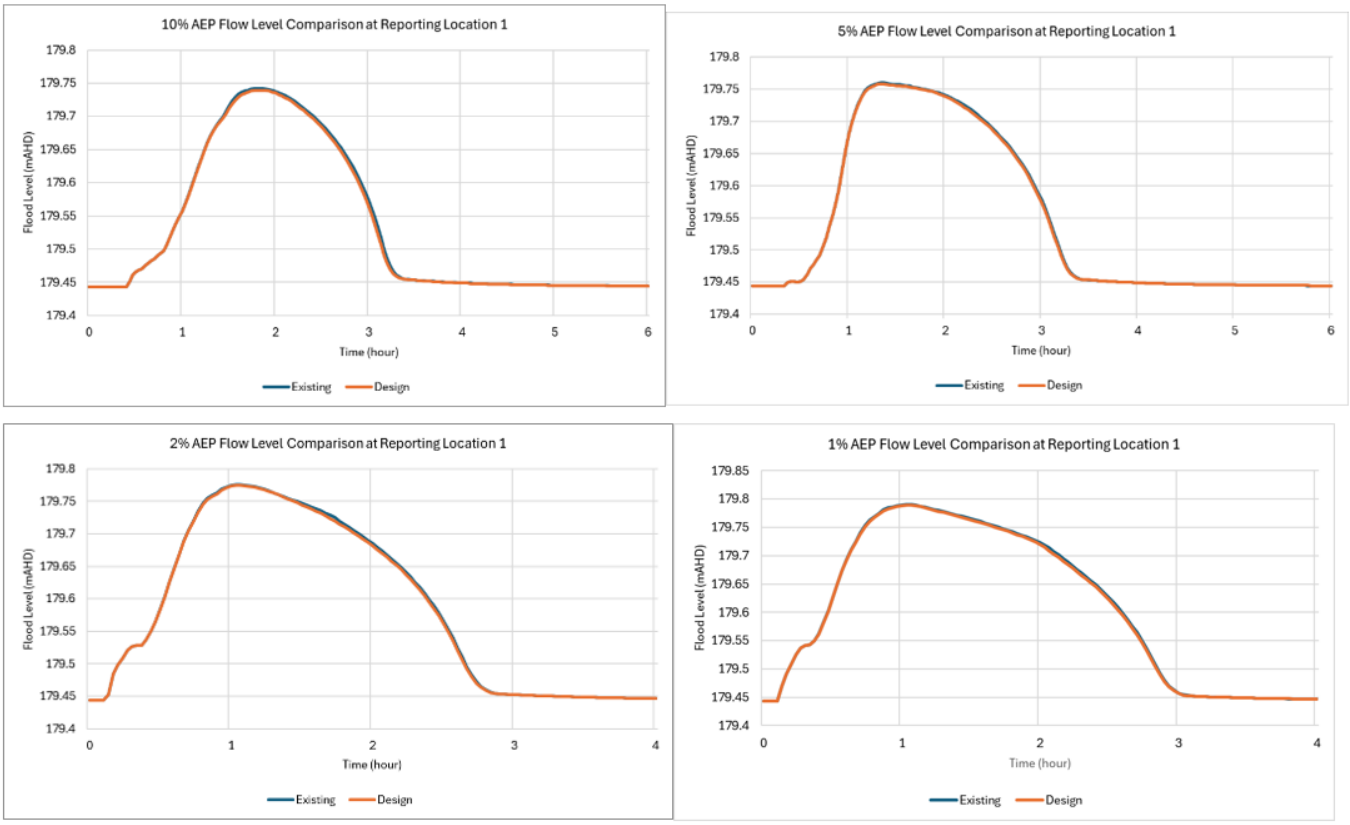


Figure 16: Comparison of Existing and Design Flood Level vs. Time at Reporting Location 1

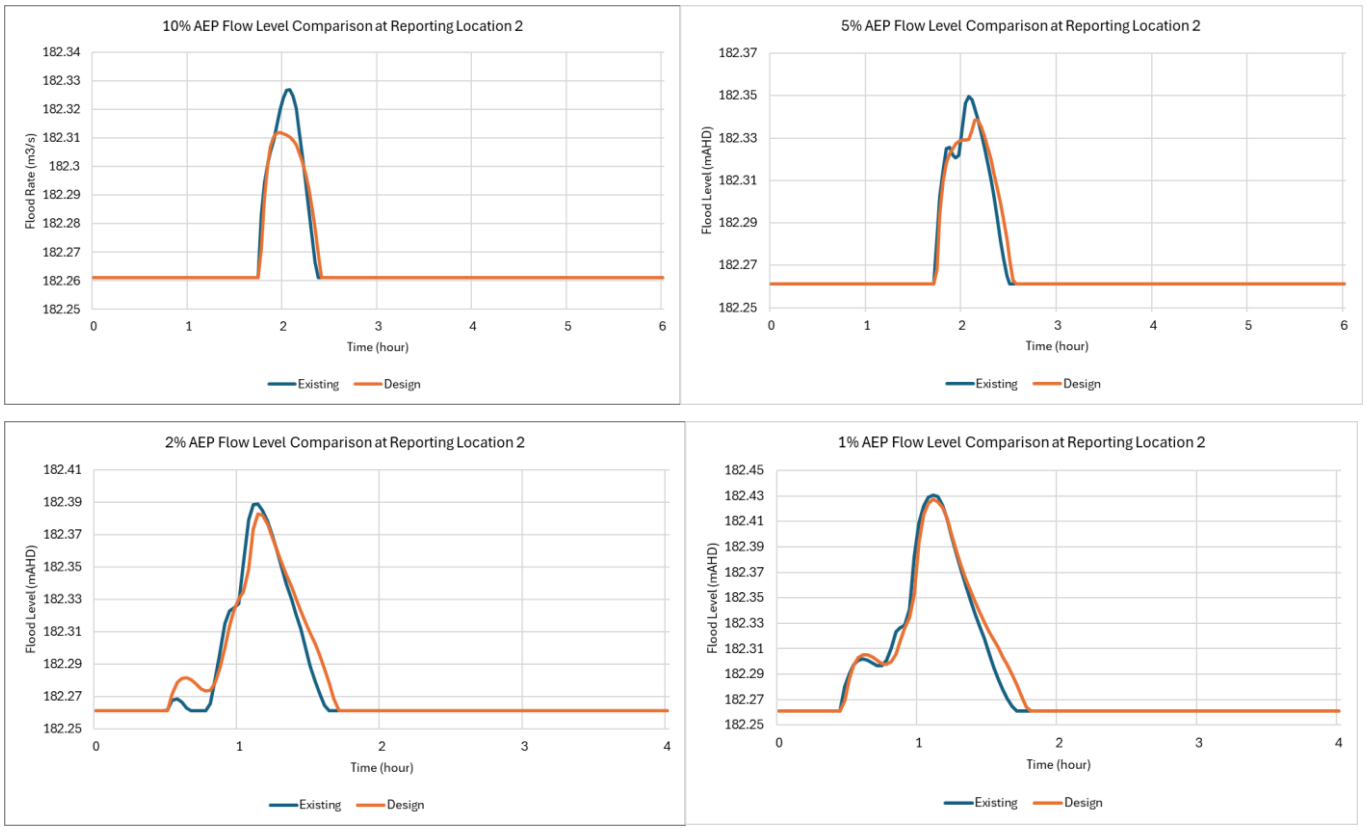


Figure 17: Comparison of Existing and Design Flood Level vs. Time at Reporting Location 2

6.4.5 Cumulative Impact

6.4.5.1 Edmondson Street Bridge and Cassidy Parade

As stated in Section 4 under "Modelling Methodology", the master design condition incorporated the Wagga Wagga Yard design, Cassidy Parade (5-0052-210-IHY-W4-RP-0001), Edmondson Street bridge and footbridge designs (5-0052-210-IHY-W5-RP-0001) to understand an overall cumulative impact on the site. Those cumulative impacts have been reflected from Section 6.4.1 to Section 6.4.4, indicating that there are no impacts on Wagga Wagga Yard caused by the Cassidy Parade footbridge and Edmondson Street bridge and footbridge design for all events up to 1% AEP.

6.4.6 Industrial Properties Impact

The Albury to Illabo Environmental Impact Statement (EIS) Technical Paper 11 – Hydrology, flooding and water quality (July 2022) (currently under planning assessment) stated that *"In the 1 per cent AEP flood event the model results show afflux up to 20mm in the area between the track and Railway Street and afflux up to 30mm in the industrial area located 400m at the east of the enhancement site*". The flood impact due to the design is assessed during this DDR stage. The industrial area is located east downstream (approximately 400m) from the Wagga Wagga yard site.

The implementation of a drainage channel south of the proposed rail line, along with two designed culverts on the site, has improved flooding conditions. The depth of the proposed channel (generally 0.5m) offers additional flood storage, while the additional culverts at chainage Ch520.850 km effectively drain the site, significantly contributing to the enhancement of flooding conditions. This resulted in lesser flood water flowing eastern downstream, resulting in improved flooding conditions at the industrial area (approximately by 0.02 m) compared to the existing condition in 1% AEP (refer to Figure 18 for changes in water level for 1% AEP). Hence the industrial area is not impacted due to Wagga Yard's proposed conditions. Refer to Maps A37 to A51 in Appendix A for changes in flood level, velocity and hazard for all events up to 1% AEP with climate change in the industrial area. This complies with condition E40 of CoA and HFWQ4 of Updated Mitigation Measures (UMM) (refer to Table 5 and Table 6)

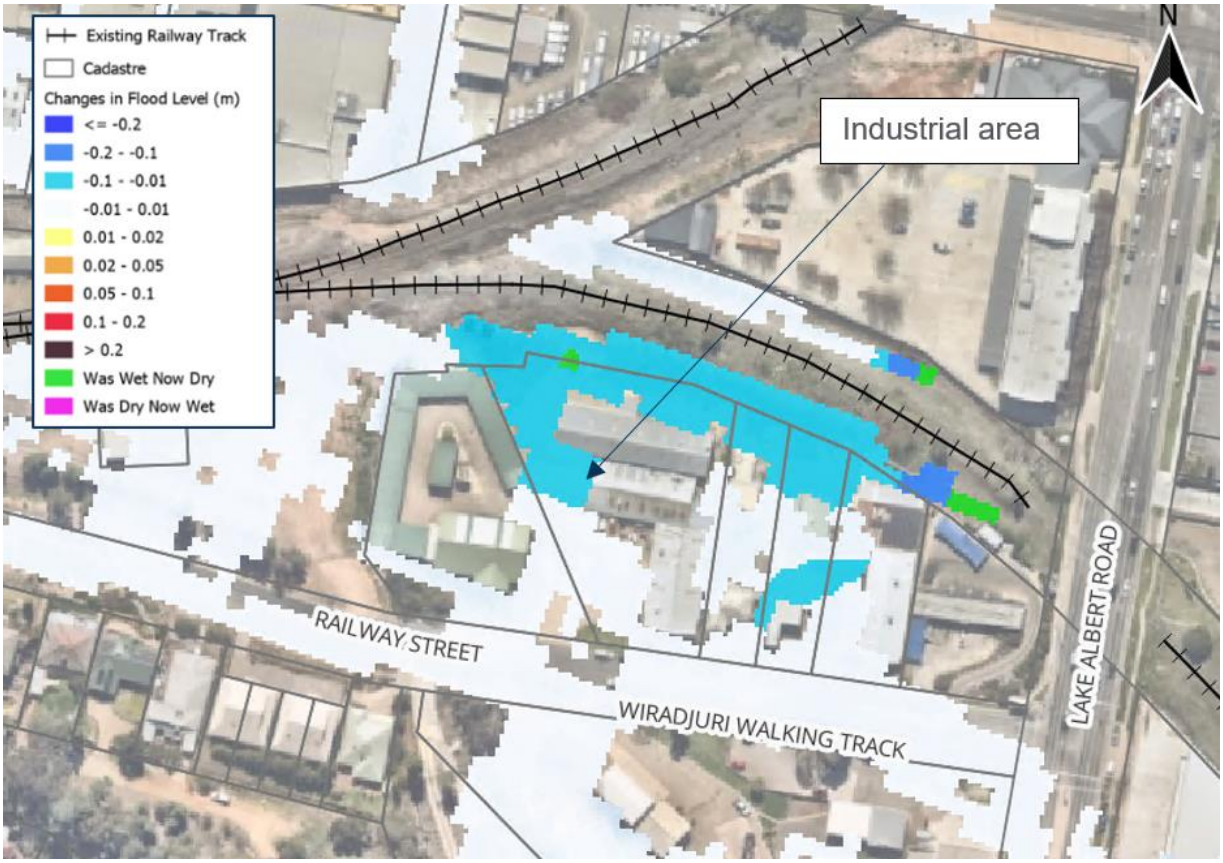


Figure 18: 1% AEP Changes in Flood Level at The Industrial Area

During 10% AEP due to a minor model noise, the few pixels of results data show an increase in water level with a new wet area (Refer to Figure 19). However, upon checking the water depth, it is less than 0.001m. It is understood that due to shallow water depth, the model results in a localised modelling noise, which is shown as an impact. This is not a real impact due to the proposed conditions but a modelling noise.

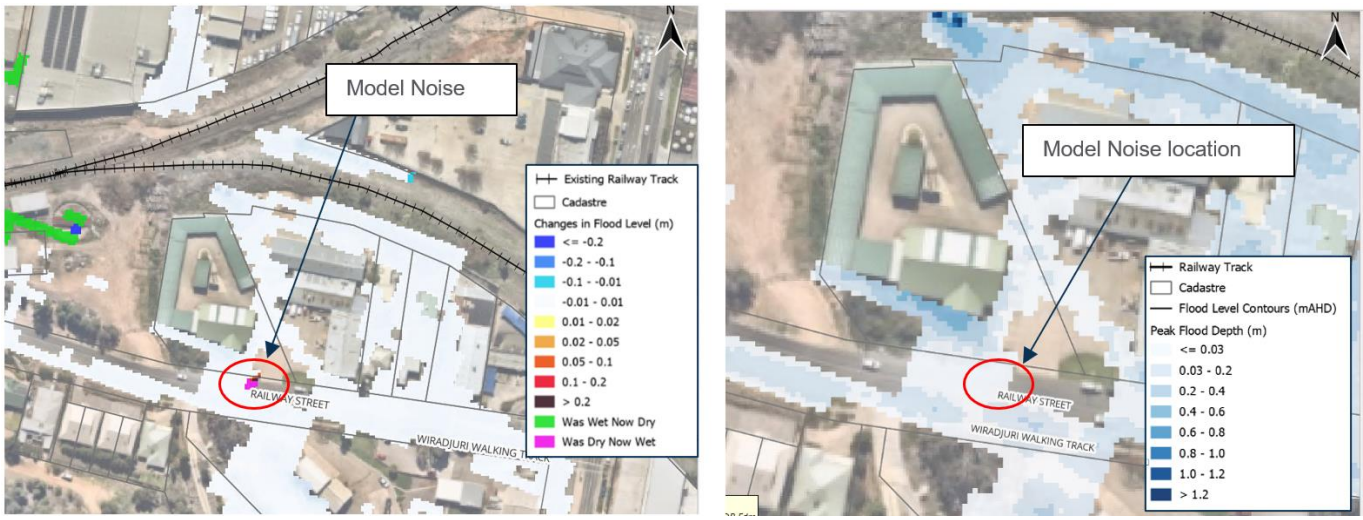


Figure 19: 10% AEP Changes in Flood Level at the Industrial Area and 10% AEP Proposed Water Depth

6.5 Sensitivity Test

6.5.1 Blockage Assessment

A hydraulic blockage assessment was carried out for the 1% AEP design scenario as per the guidance set out in ARR2019. The assessment involved assessing the site area for debris availability, mobility and transportability and this, in conjunction with culvert size was used to determine the relevant blockage factors shown (refer to Table 32 and Table 33) below 20% blockage was adopted for all the other culverts, pits and pipes outside the project boundary (refer to Table 32) (Refer to Figure 20 and Figure 21).

A flood level comparison between the blockage scenario and design is shown in Figure 22. Although the Culvert NP1049 and the Edmondson Street wing wall penetration within the project boundary do not have any blockage, the overall flood behaviour is subject to the blockage of the downstream drainage system. A general water level increase of up to 0.035 m is mainly found at the site.

Table 32: Culvert Blockage Percentage

Culvert	Blockage Percentage (1% AEP)	Comments
Wagga Yard site		
W7_P1_01 (1 cell 0.225m in diameter)	25%	Inside the project boundary
W7_P2_01 (1 cell 0.225m in diameter)	25%	Inside the project boundary
W7_P3_01to02 (1 cell 0.300m in diameter)	25%	Inside the project boundary
W7_P4_01 to02 (1 cell 0.200m in diameter)	25%	Inside the project boundary
Edmondson Street site		
W5_E02_01t02 (1 cell 0.600m in diameter)	25%	Inside the project boundary
NP1064 (1 cell 0.9m Width x 0.6m Height)	25%	Inside the project boundary
NP1049 (1 cell 1.8m Width x 0.6m Height)	0%	Inside the project boundary
Eastern bridge wing walls penetration (1 cell 2.0m Width x 0.65m Height)	0%	Inside the project boundary
Western bridge wing walls penetration (1 cell 1.2m Width x 1.0m Height)	0%	Inside the project boundary
W5_E04_01t02 (1 cell 0.600m in diameter)	25%	Inside the project boundary
P06_01_02 (1 cell 0.900m in diameter)	25%	Inside the project boundary
All other pipes (Stormwater pipes)	25%	Inside the project boundary
All others (culvert, pit and pipe)	20%	Outside of the project boundary

Table 33: Culvert Blockage Parameters

Culvert	Debris Availability	Debris Mobility	Debris Transportability	AEP Adjusted Debris Potential
Wagga Yard				
W7_P1_01	Low	Medium	Low	Low
W7_P2_01	Low	Medium	Low	Low
W7_P3_01	Low	Medium	Low	Low
W7_P4_01	Low	Medium	Low	Low
Edmondson Street site				
W5_E02_01t02	Low	Medium	Low	Low
NP1064	Low	Medium	Low	Low
NP1049	Low	Medium	Low	Low
Deflection walls	Low	Medium	Low	Low
W5_E04_01t02	Low	Medium	Low	Low
P06_01_02	Low	Medium	Low	Low

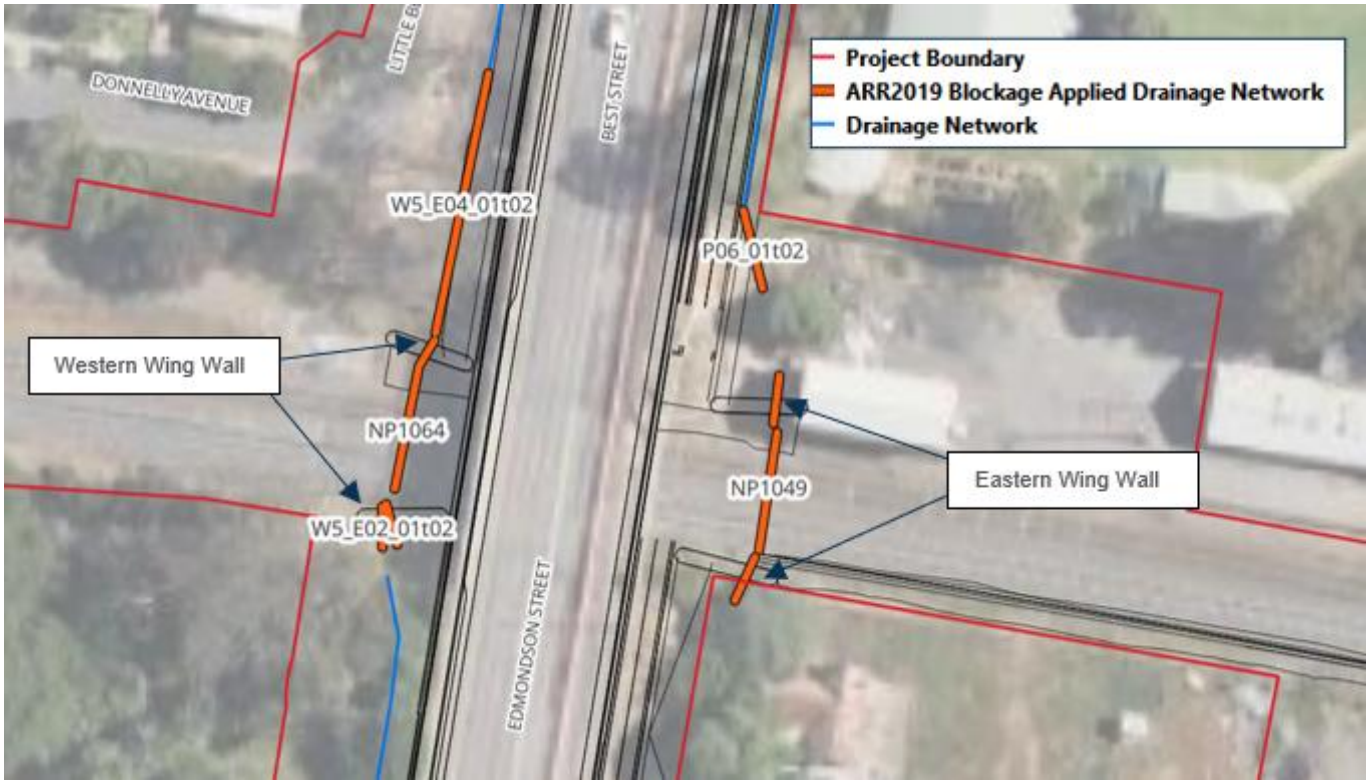


Figure 20: Culverts at Edmondson Street Bridge Site

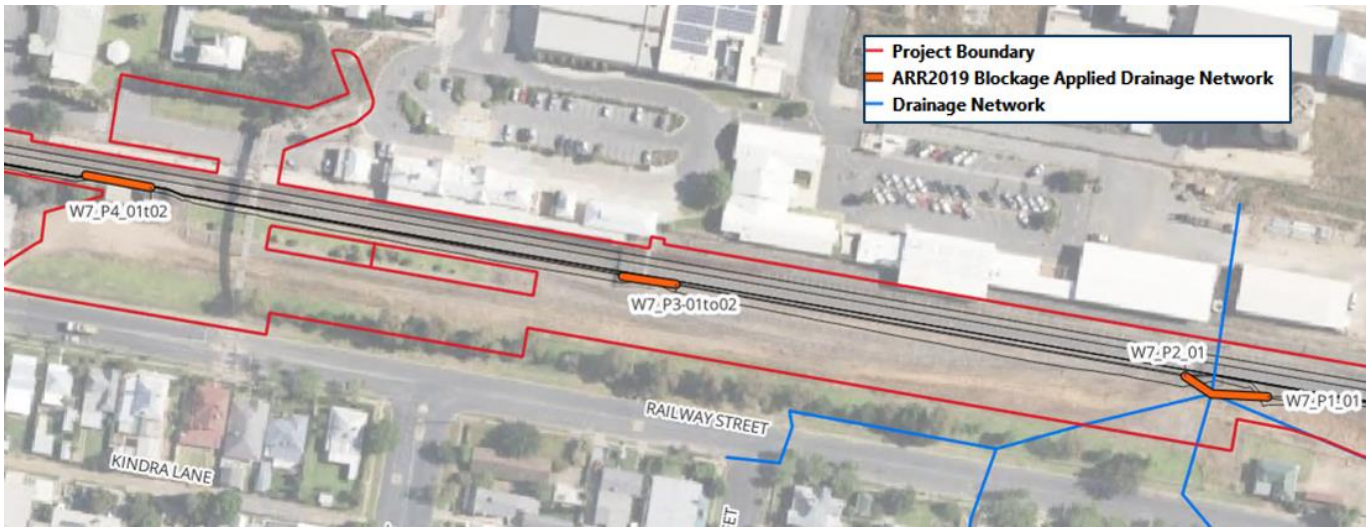


Figure 21: Culverts at Wagga Yard Site

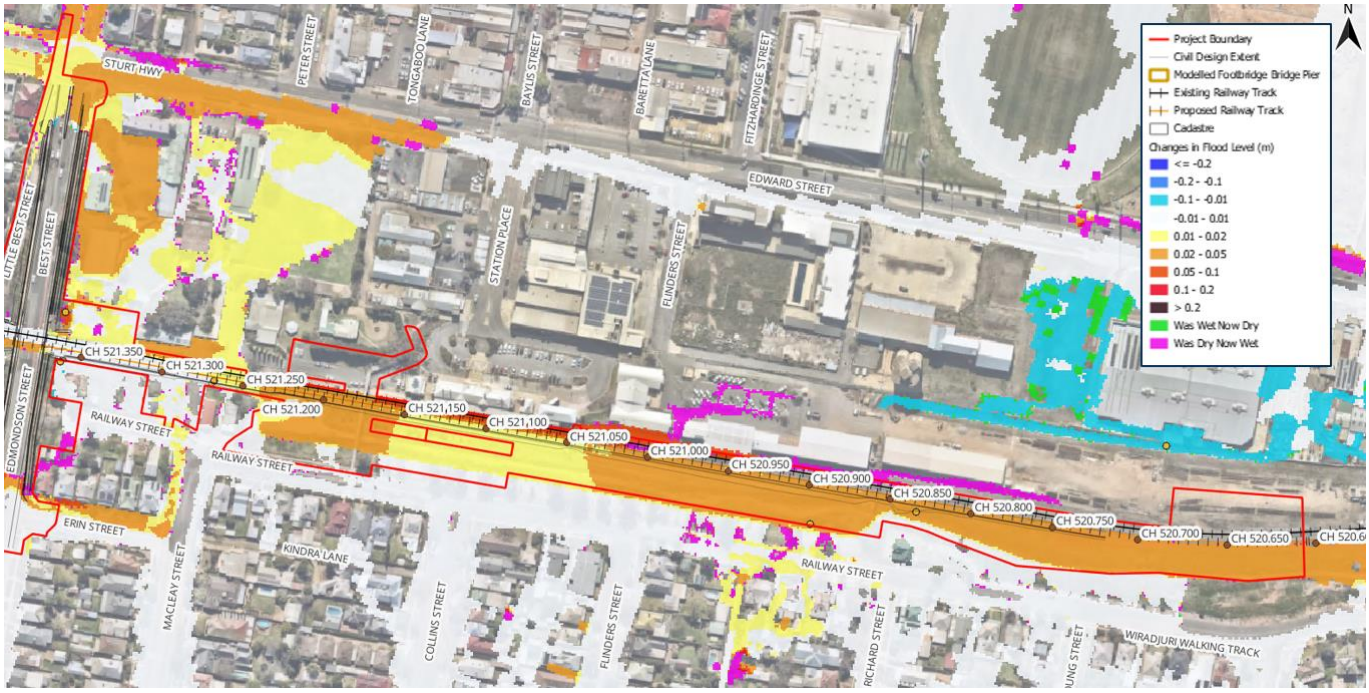


Figure 22: Flood Level Comparison for 1% AEP Design Condition – Blockage vs Design

6.5.2 Climate Change Risk Assessment

Climate change risk assessment was carried out by running the 1% AEP with 2090 RCP8.5 interim climate change factor (refer to Section 4.2.3.1 for details of the approach) and the results of flood depth, flood velocity and flood hazard can be found in Section 6.1 and Section 6.2 The corresponding flood maps can be found in Appendix A. The assessment is summarised below:

- Within the study area, the railway track is overtopped in the 1% AEP with Climate Change.
- Within the study area, the site generally experiences H3 flood hazard and the proposed channel experiences H4 flood hazard in the 1% AEP with Climate Change event.

7 MITIGATION MEASURES

No other instances of non-compliance in terms of flood impact were documented. Therefore, no additional mitigation measures are necessary unless the design changes.

8 RECOMMENDATIONS AND NEXT STAGE

This is the IFC stage of the report, and the following are finalised:

- No instances of non-compliance have been identified through the assessment.
- All comments raised by relevant parties have been resolved (refer to Appendices C, D and E)

Consequently, there are no further recommendations and the report is finalised.

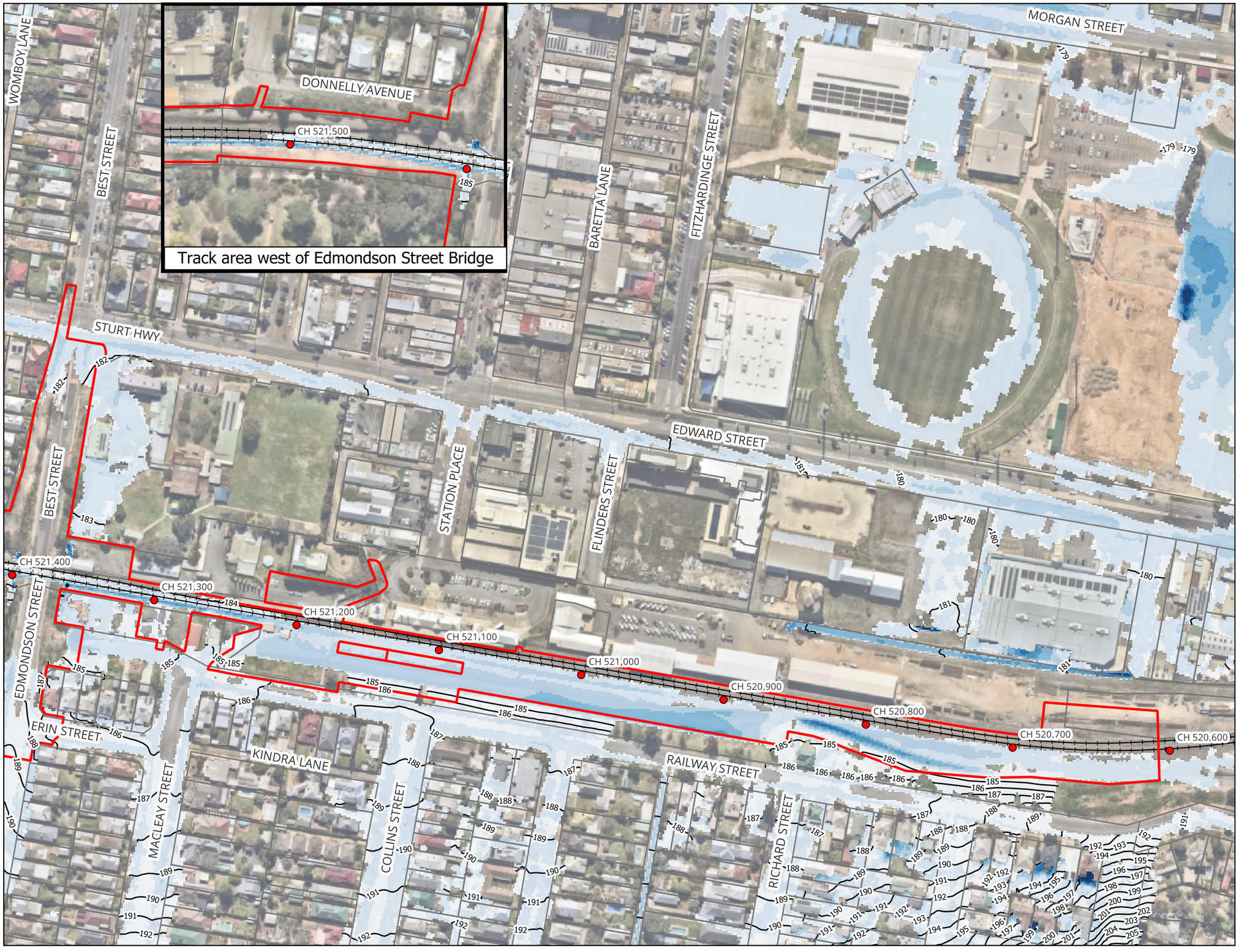
APPENDIX A

Flood Maps



Map ID	Map description
Figure A01	10% AEP Peak Flood Depth and Levels - Existing Condition
Figure A02	5% AEP Peak Flood Depth and Levels - Existing Condition
Figure A03	2% AEP Peak Flood Depth and Levels - Existing Condition
Figure A04	1% AEP Peak Flood Depth and Levels - Existing Condition
Figure A05	1% AEP Climate Changes Peak Flood Depth and Levels - Existing Condition
Figure A06	PMF Peak Flood Depth and Levels - Existing Condition
Figure A07	10% AEP Peak Flood Velocity - Existing Condition
Figure A08	5% AEP Peak Flood Velocity - Existing Condition
Figure A09	2% AEP Peak Flood Velocity - Existing Condition
Figure A10	1% AEP Peak Flood Velocity - Existing Condition
Figure A11	1% AEP Climate Changes Peak Flood Velocity - Existing Condition
Figure A12	PMF AEP Peak Flood Velocity - Existing Condition
Figure A13	10% AEP Peak Flood Hazard - Existing Condition
Figure A14	5% AEP Peak Flood Hazard - Existing Condition
Figure A15	2% AEP Peak Flood Hazard - Existing Condition
Figure A16	1% AEP Peak Flood Hazard - Existing Condition
Figure A17	1% AEP Climate Changes Peak Flood Hazard - Existing Condition
Figure A18	PMF AEP Peak Flood Hazard - Existing Condition
Figure A19	10% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A20	5% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A21	2% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A22	1% AEP Peak Flood Depth and Levels - Master Design Condition
Figure A23	1% AEP Climate Changes Peak Flood Depth and Levels - Master Design Condition
Figure A24	PMF Peak Flood Depth and Levels - Master Design Condition
Figure A25	10% AEP Peak Flood Velocity - Master Design Condition
Figure A26	5% AEP Peak Flood Velocity - Master Design Condition
Figure A27	2% AEP Peak Flood Velocity - Master Design Condition
Figure A28	1% AEP Peak Flood Velocity - Master Design Condition
Figure A29	1% AEP Climate Changes Peak Flood Velocity - Master Design Condition
Figure A30	PMF Peak Flood Velocity - Master Design Condition
Figure A31	10% AEP Peak Flood Hazard - Master Design Condition
Figure A32	5% AEP Peak Flood Hazard - Master Design Condition
Figure A33	2% AEP Peak Flood Hazard - Master Design Condition
Figure A34	1% AEP Peak Flood Hazard - Master Design Condition
Figure A35	1% AEP Climate Changes Peak Flood Hazard - Master Design Condition
Figure A36	PMF Peak Flood Hazard - Master Design Condition
Figure A37	Changes in Peak Flood Levels for 10% AEP - Master Design Condition vs Existing Condition
Figure A38	Changes in Peak Flood Levels for 5% AEP - Master Design Condition vs Existing Condition
Figure A39	Changes in Peak Flood Levels for 2% AEP - Master Design Condition vs Existing Condition
Figure A40	Changes in Peak Flood Levels for 1% AEP - Master Design Condition vs Existing Condition

Map ID	Map description
Figure A41	Changes in Peak Flood Levels for 1% AEP Climate Changes - Master Design Condition vs Existing Condition
Figure A42	Changes in Peak Flood Velocity for 10% AEP - Master Design Condition vs Existing Condition
Figure A43	Changes in Peak Flood Velocity for 5% AEP - Master Design Condition vs Existing Condition
Figure A44	Changes in Peak Flood Velocity for 2% AEP - Master Design Condition vs Existing Condition
Figure A45	Changes in Peak Flood Velocity for 1% AEP - Master Design Condition vs Existing Condition
Figure A46	Changes in Peak Flood Velocity for 1% AEP Climate Changes - Master Design Condition vs Existing Condition
Figure A47	Changes in Peak Flood Hazard for 10% AEP - Master Design Condition vs Existing Condition
Figure A48	Changes in Peak Flood Hazard for 5% AEP - Master Design Condition vs Existing Condition
Figure A49	Changes in Peak Flood Hazard for 2% AEP - Master Design Condition vs Existing Condition
Figure A50	Changes in Peak Flood Hazard for 1% AEP - Master Design Condition vs Existing Condition
Figure A51	Changes in Peak Flood Hazard for 1% AEP Climate Changes - Master Design Condition vs Existing Condition
Figure A52	1% AEP Peak Flood Depth and Levels - Master Design Blockage Condition
Figure A53	1% AEP Peak Flood Velocity - Master Design Blockage Condition
Figure A54	1% AEP Peak Flood Hazard - Master Design Blockage Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

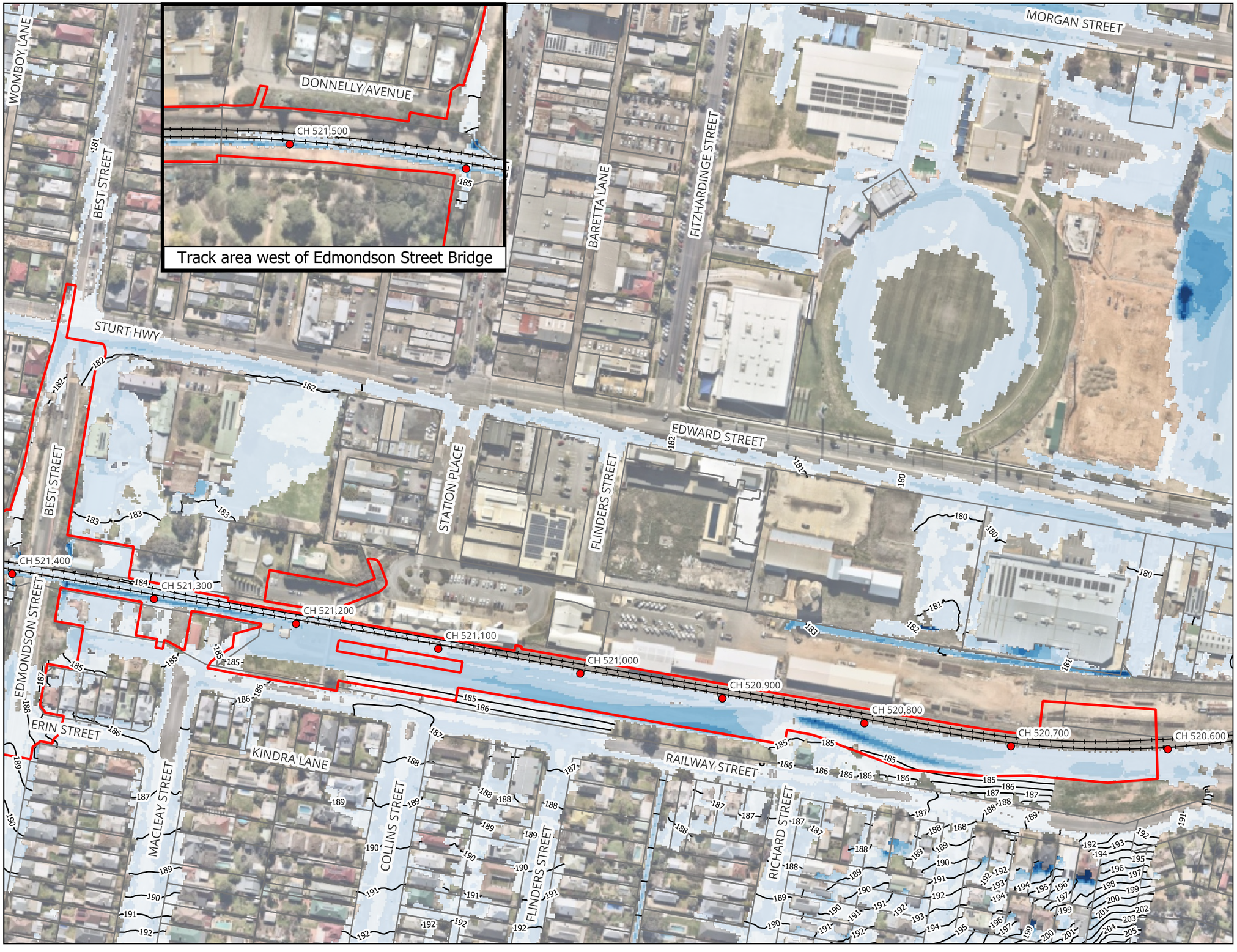
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A01 : 10% AEP Peak Flood Depth and Levels - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

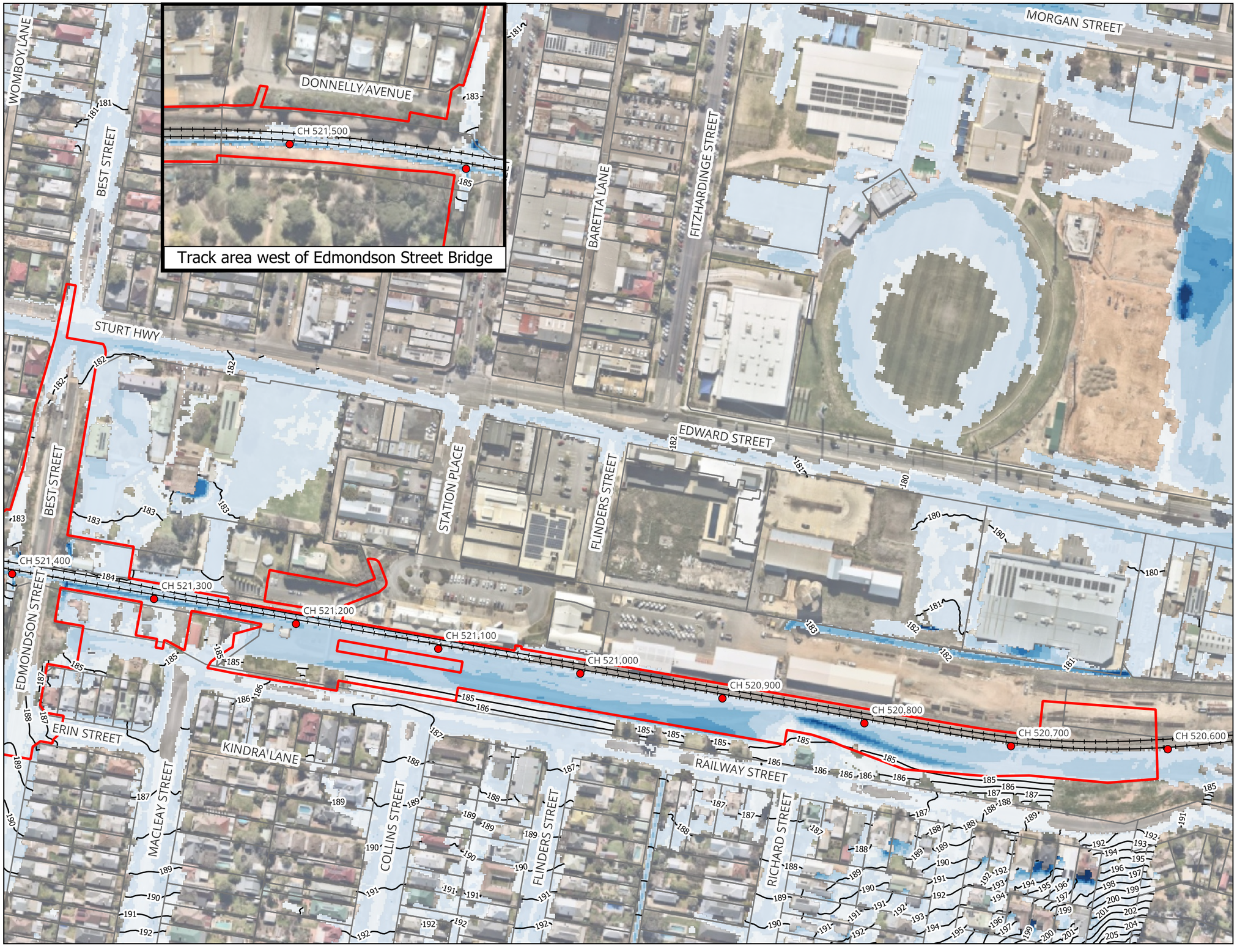
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A02 : 5% AEP Peak Flood Depth and Levels - Existing Condition



Map by: TT

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

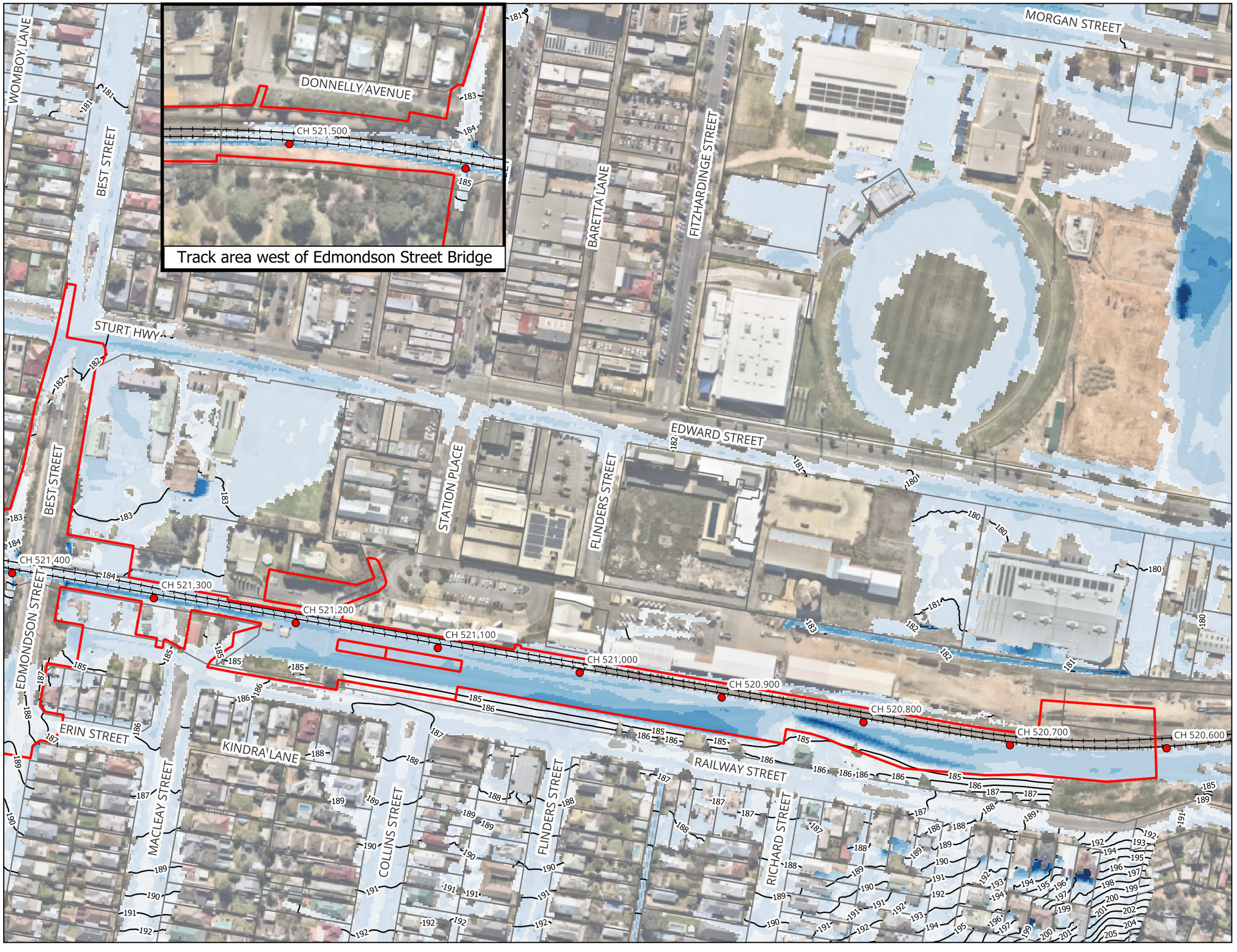
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A03 : 2% AEP Peak Flood Depth and Levels - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

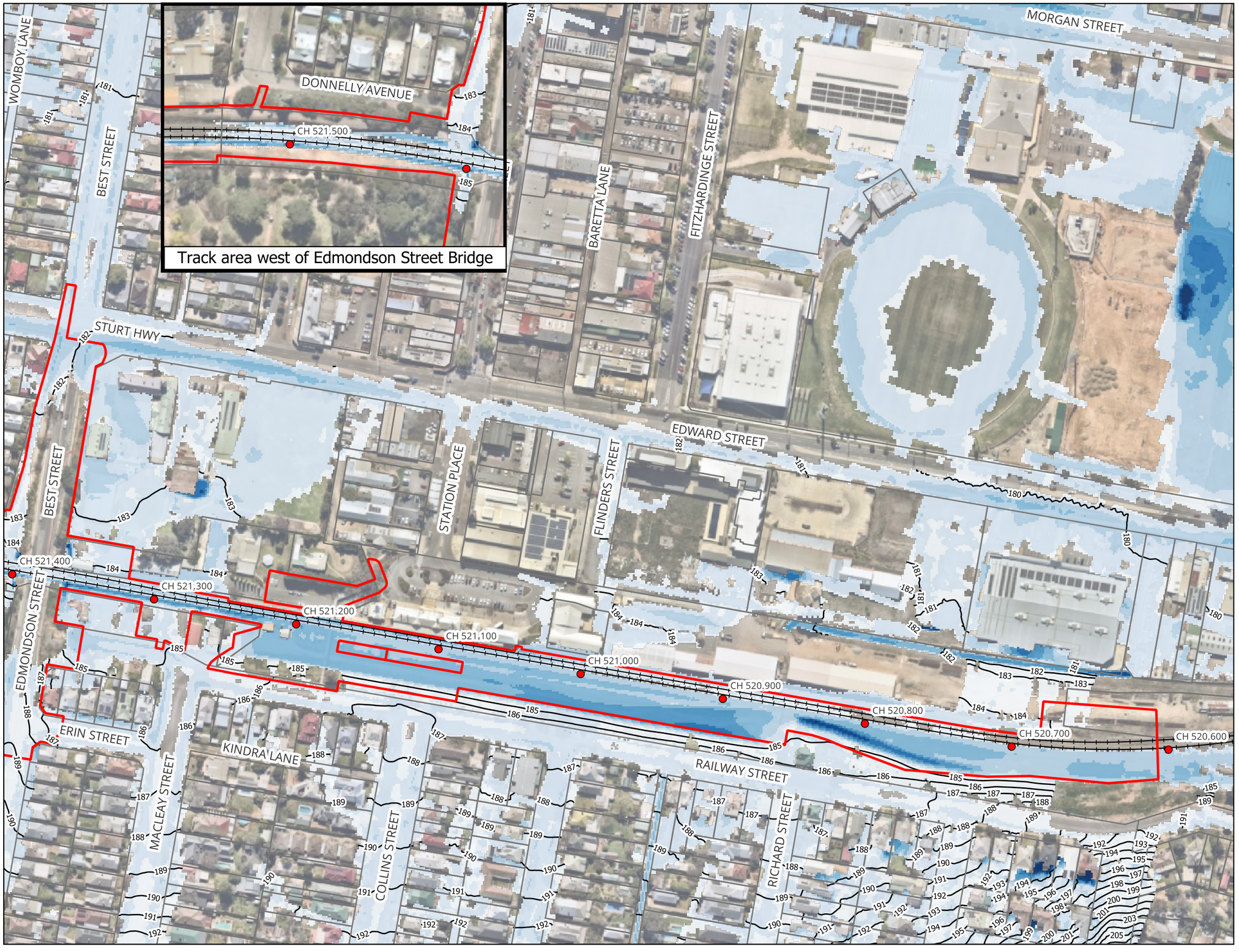
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A04 : 1% AEP Peak Flood Depth and Levels - Existing Condition



Map by: TT

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

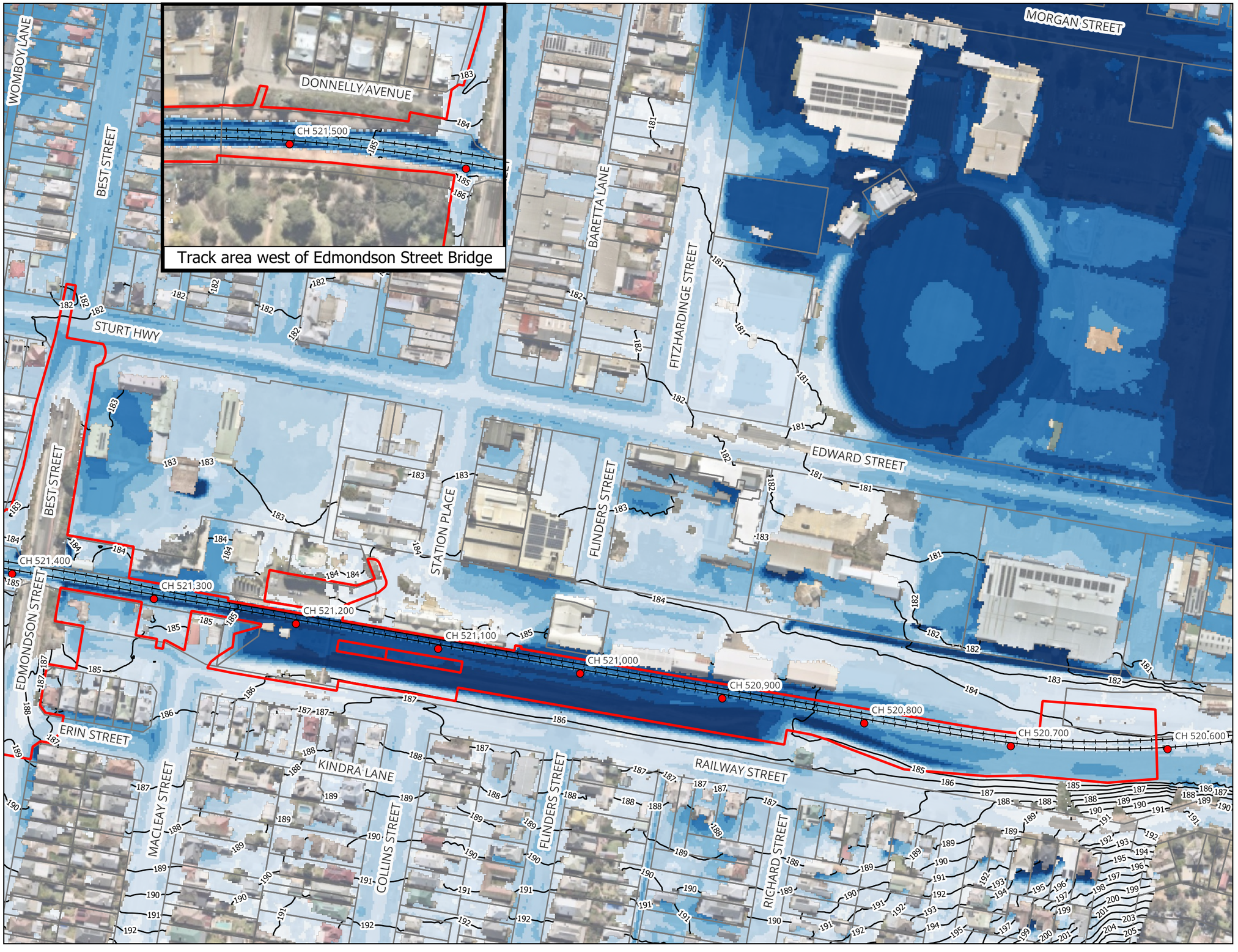
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A05 : 1% AEP Climate Changes Peak Flood Depth and Levels - Existing Condition



Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

MARTINUS aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A06 : PMF Peak Flood Depth and Levels - Existing Condition



MARTINUS

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Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A07 : 10% AEP Peak Flood Velocity - Existing Condition



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Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

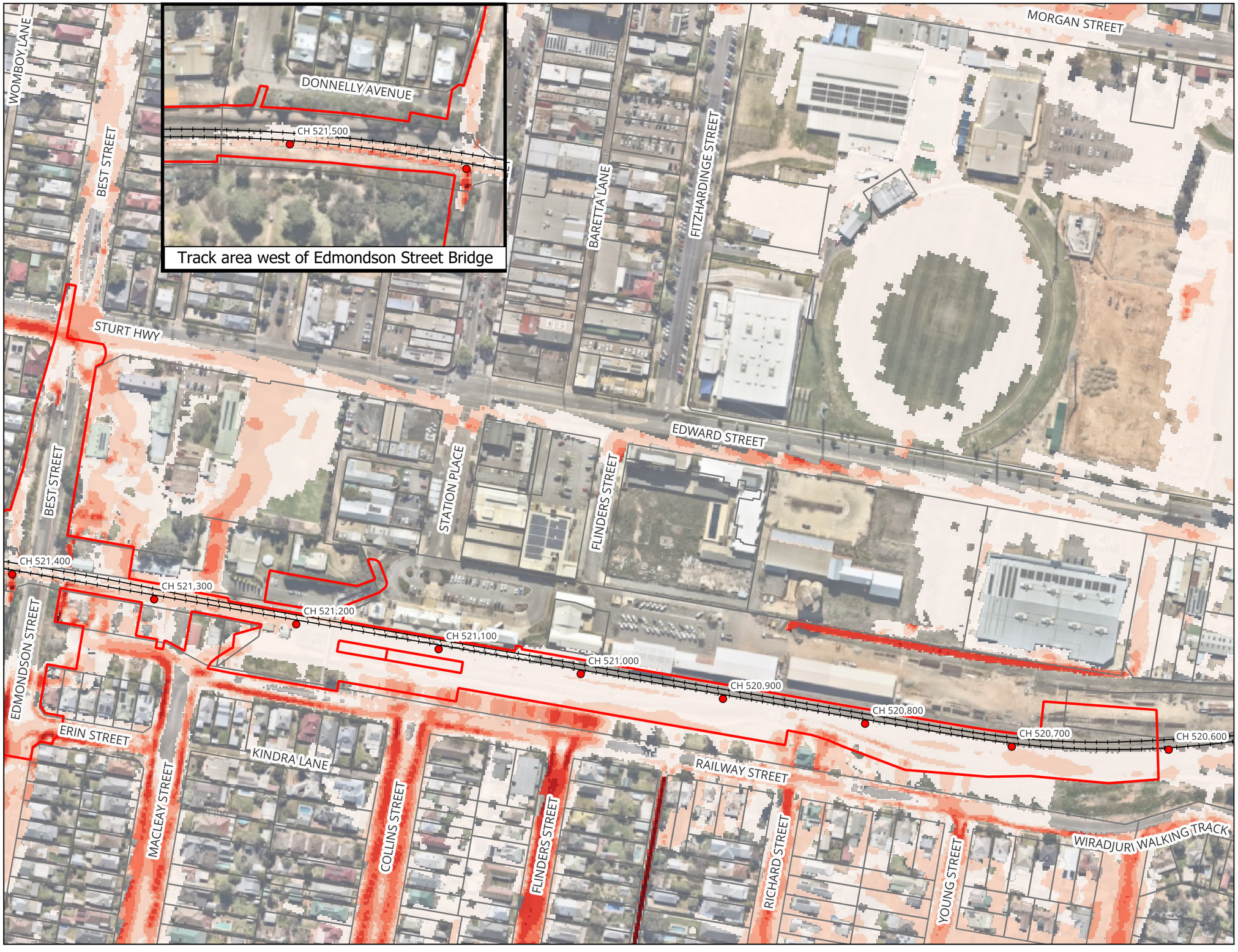
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A08 : 5% AEP Peak Flood Velocity - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A09 : 2% AEP Peak Flood Velocity - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A10 : 1% AEP Peak Flood Velocity - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

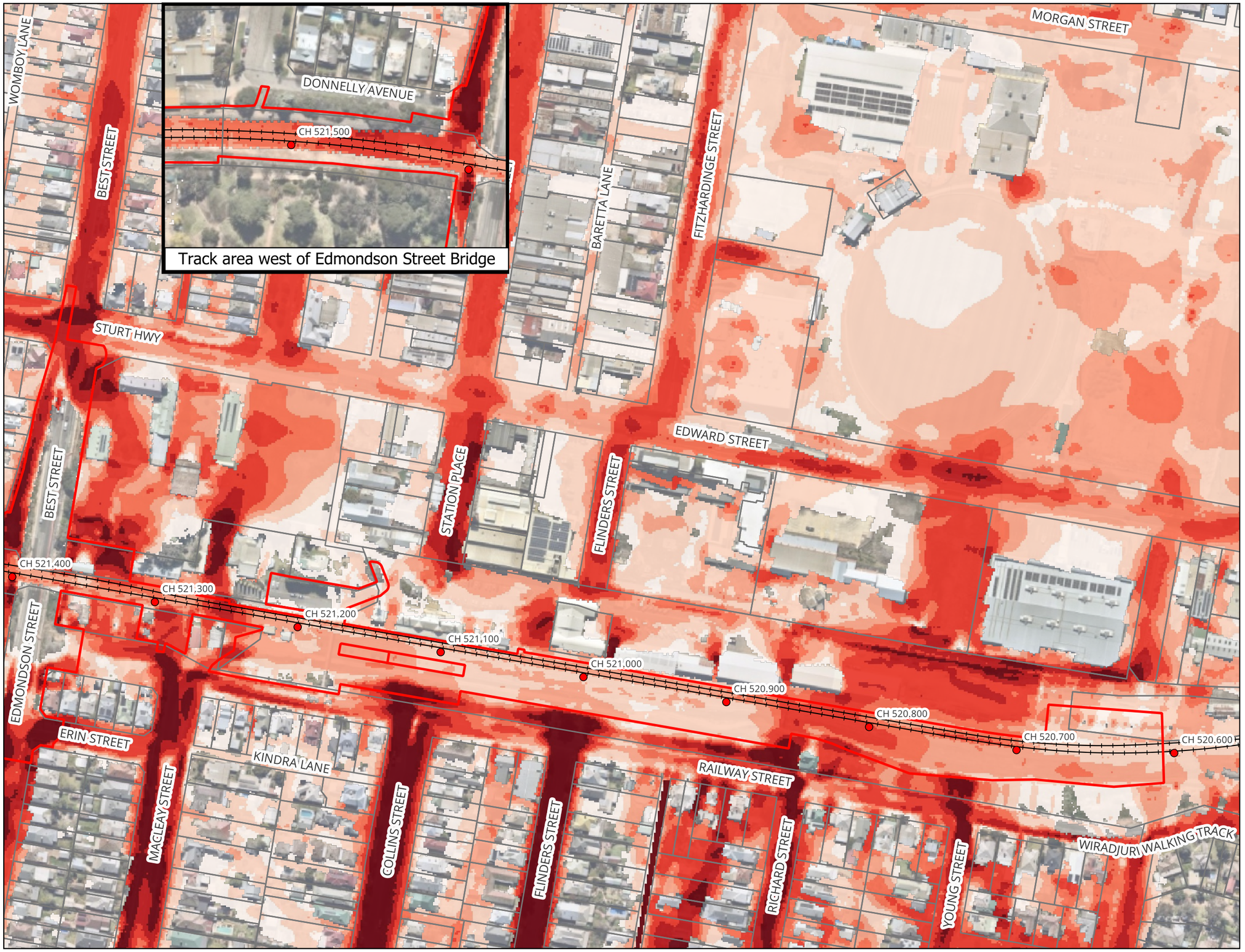
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A11 : 1% AEP Climate Changes Peak Flood Velocity - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

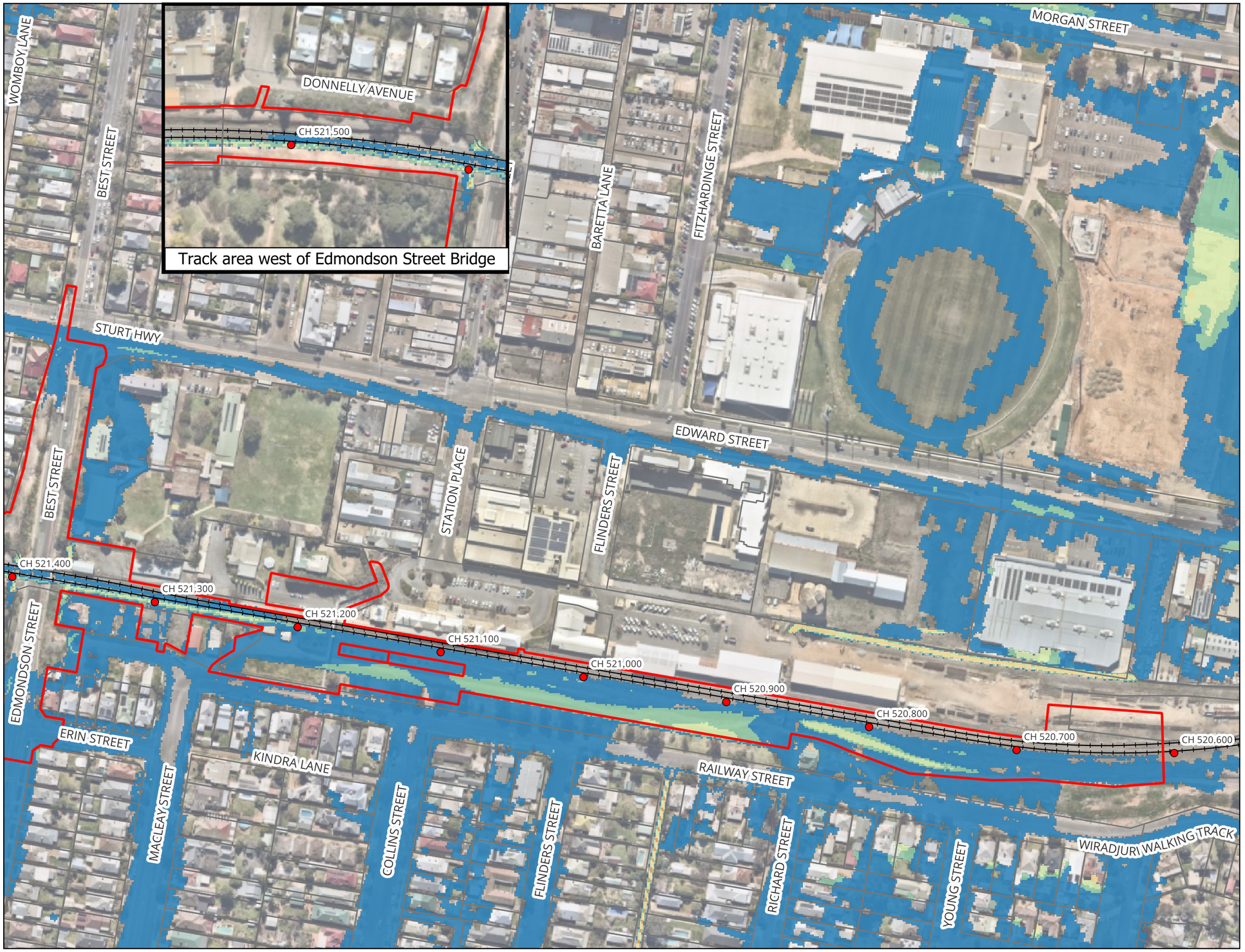
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A12 : PMF AEP Peak Flood Velocity - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

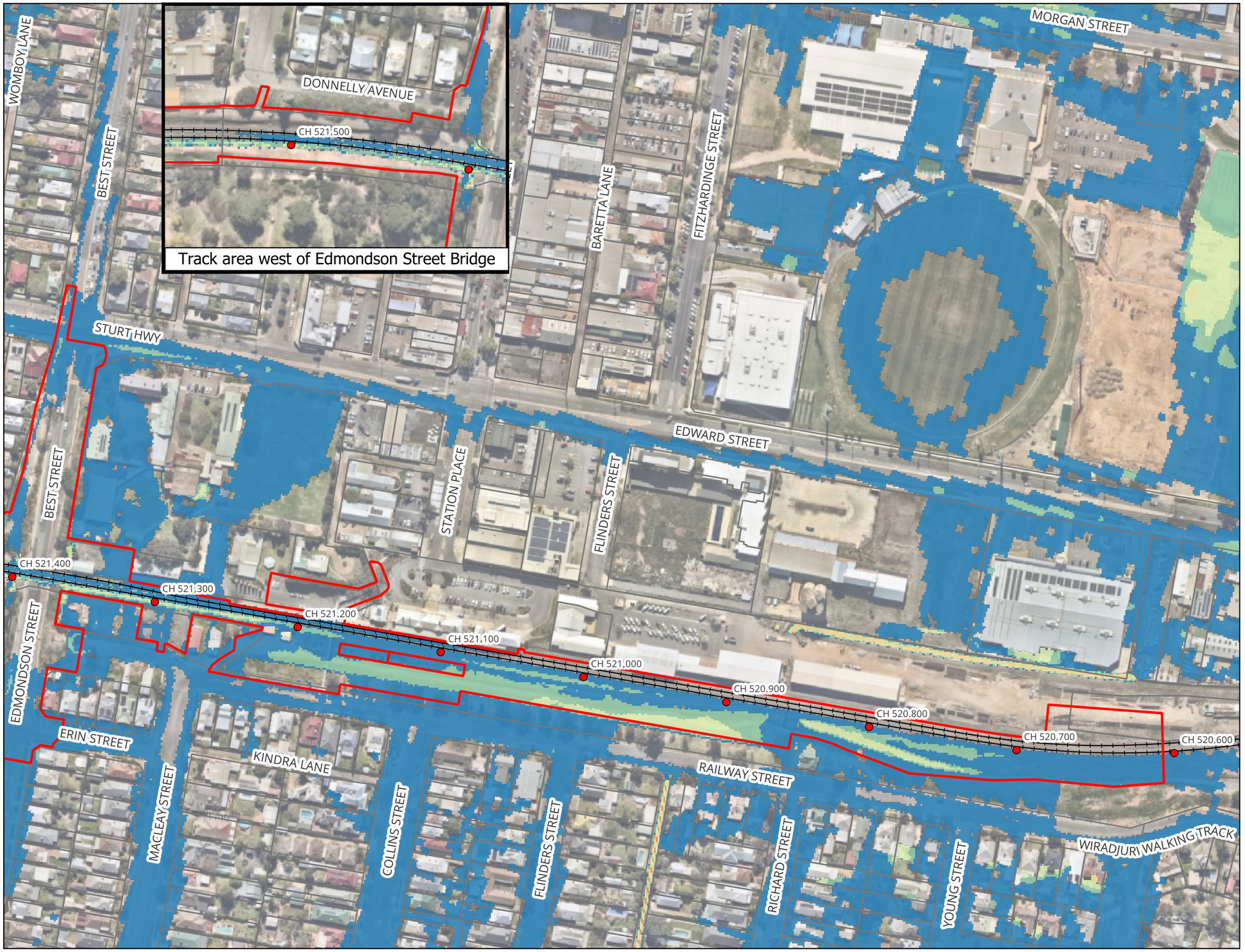
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A13 : 10% AEP Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

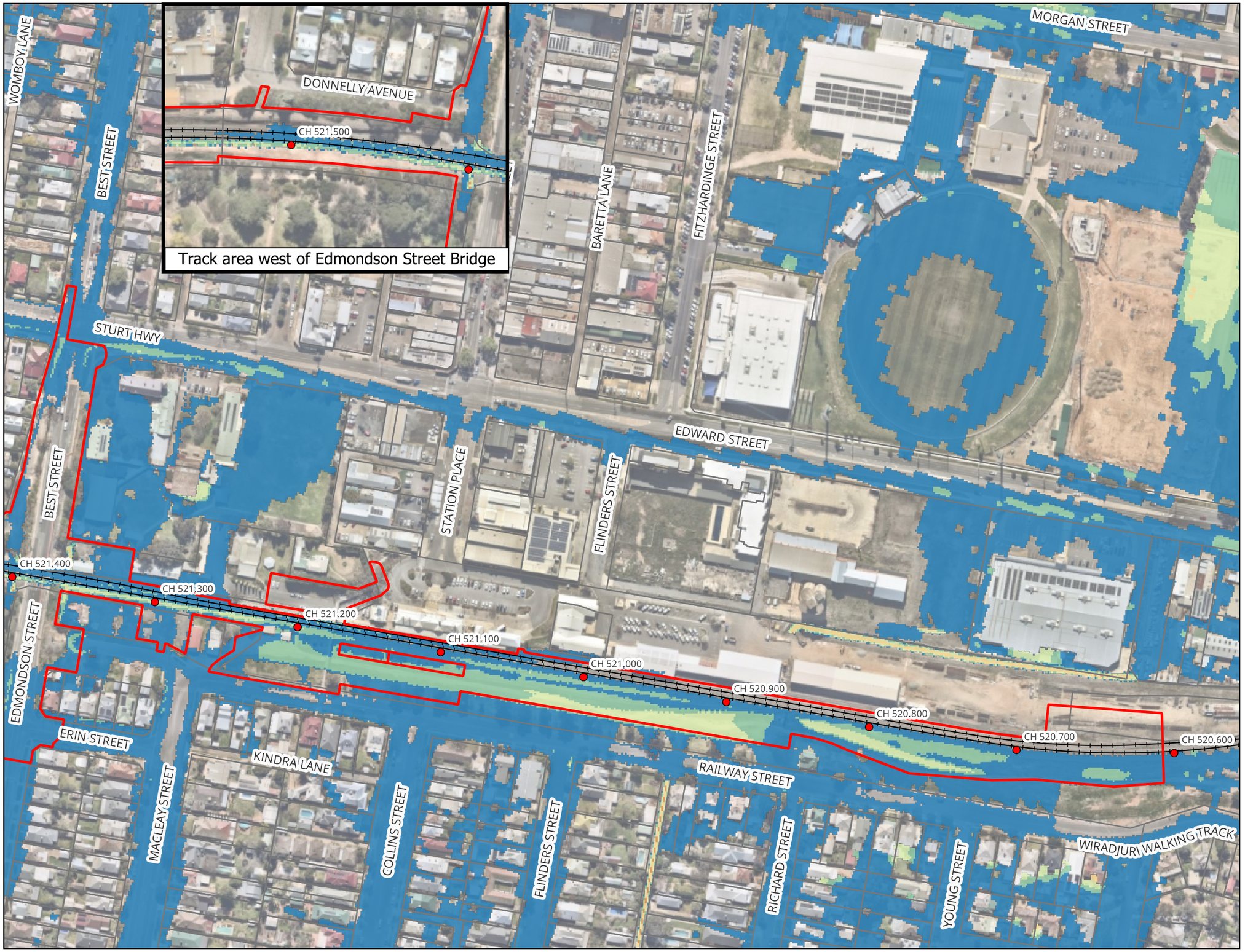
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A14 : 5% AEP Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A15 : 2% AEP Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A16 : 1% AEP Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A17 : 1% AEP Climate Changes Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Existing Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

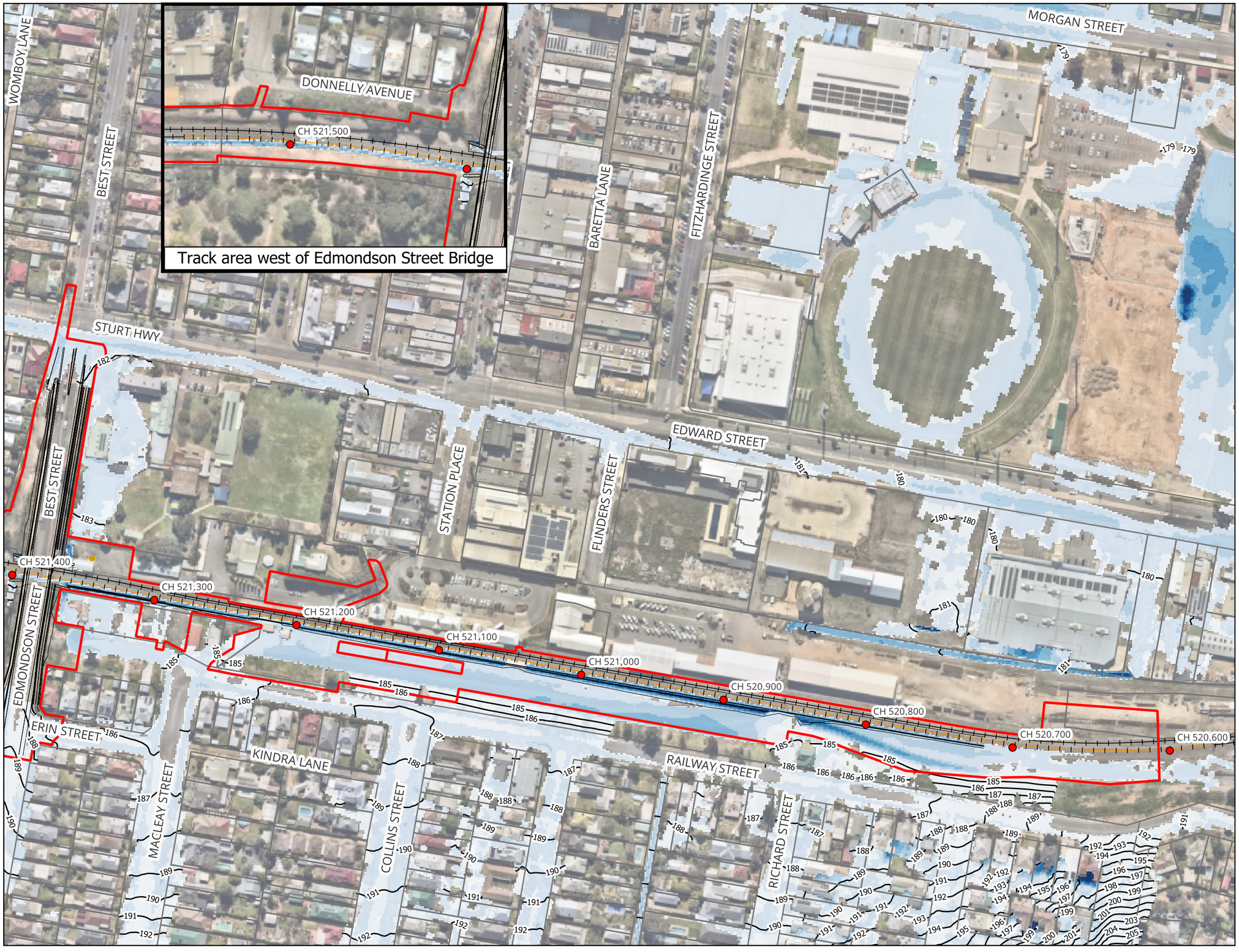
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A18 : PMF AEP Peak Flood Hazard - Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

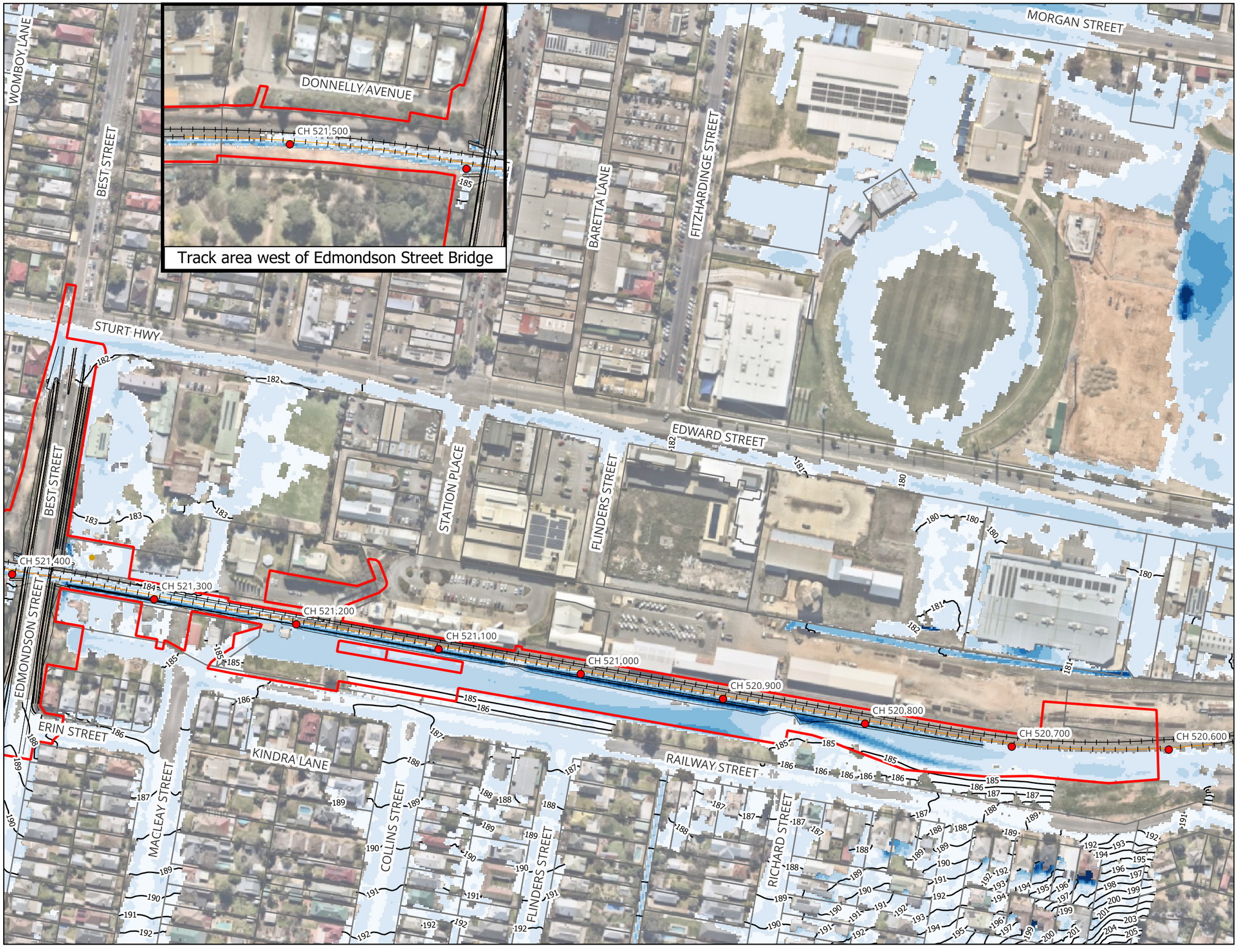
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A19 : 10% AEP Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

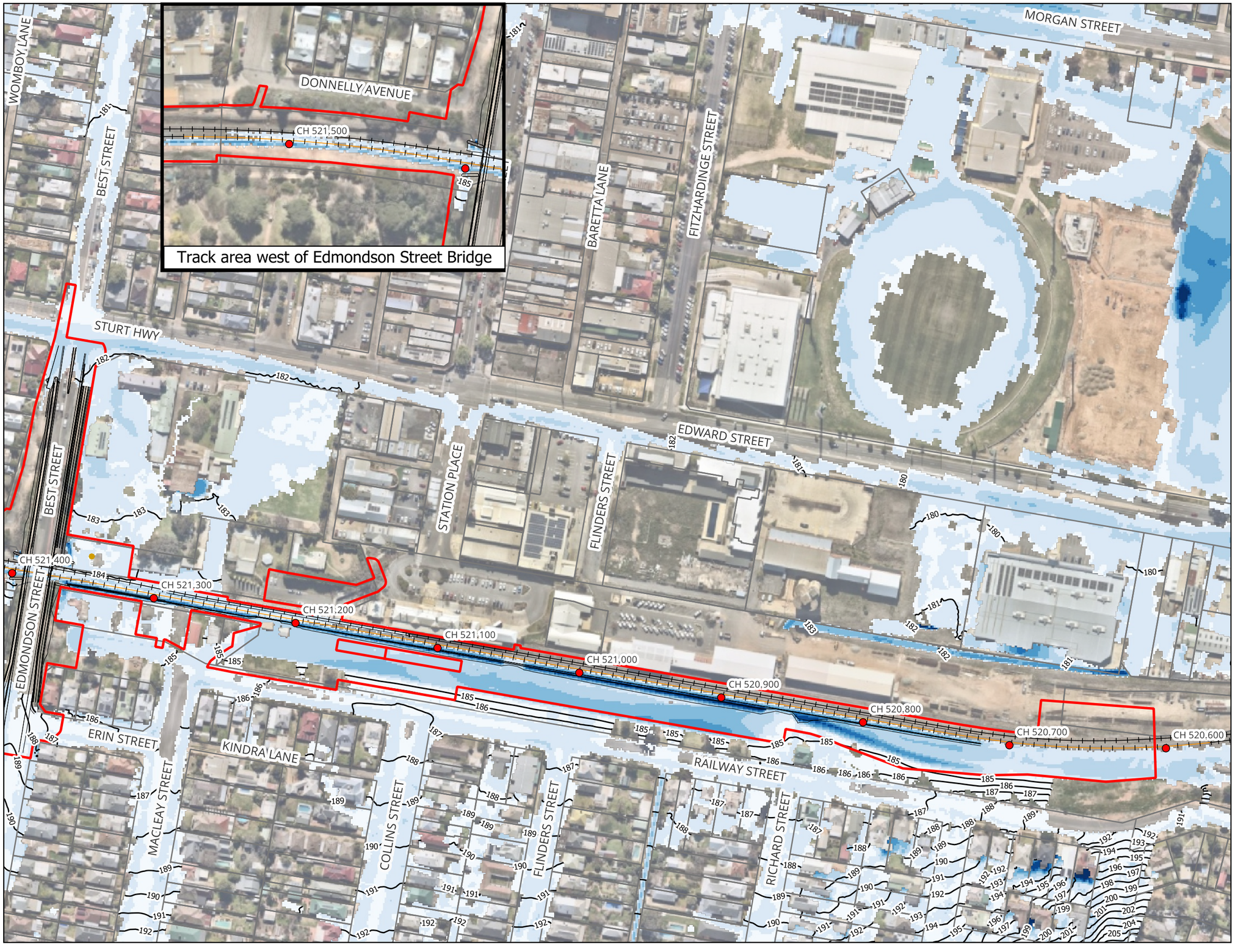
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A20 : 5% AEP Peak Flood Depth and Levels - Master Design Condition



Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

MARTINUS aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

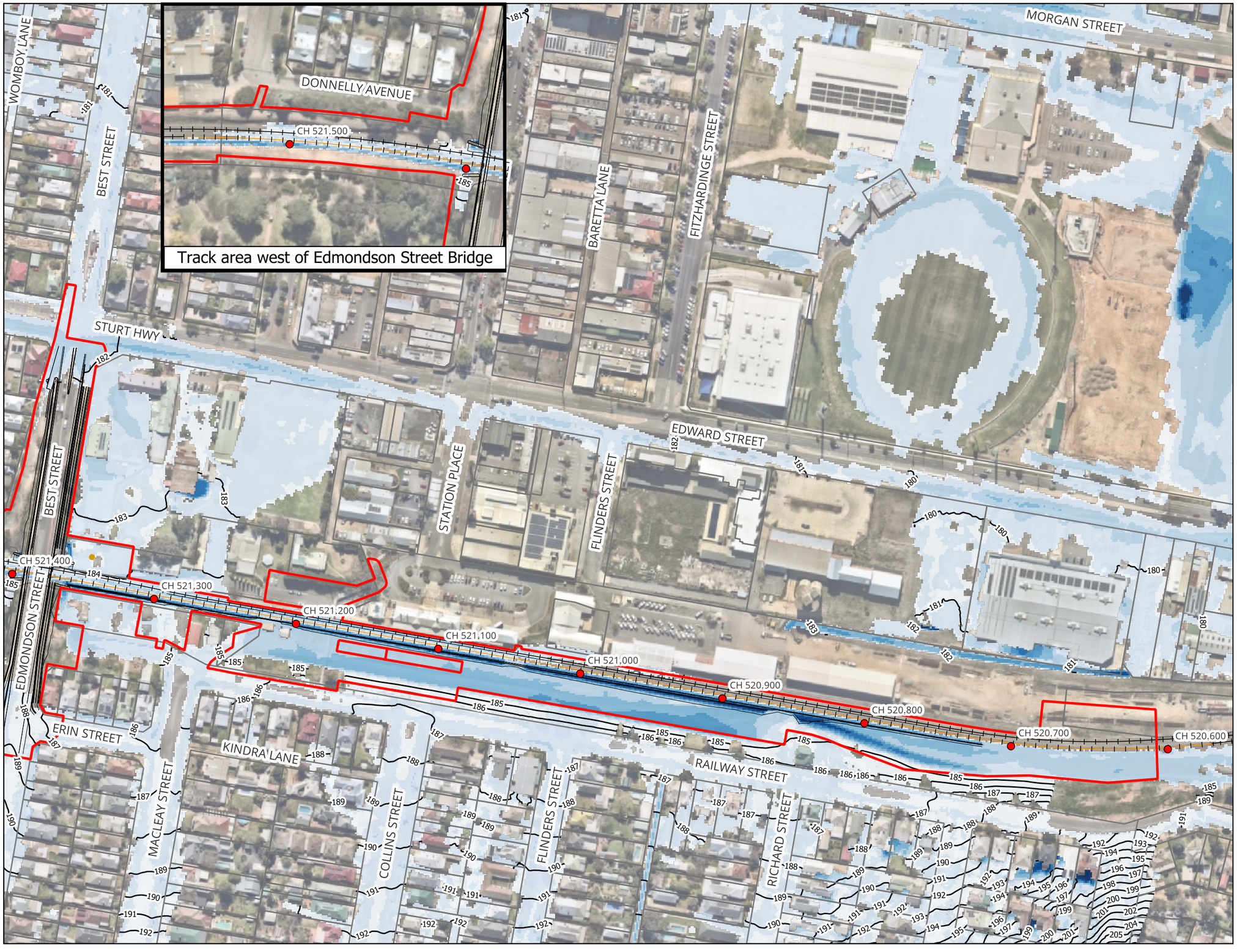
- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A21 : 2% AEP Peak Flood Depth and Levels - Master Design Condition



Map by: TT

MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

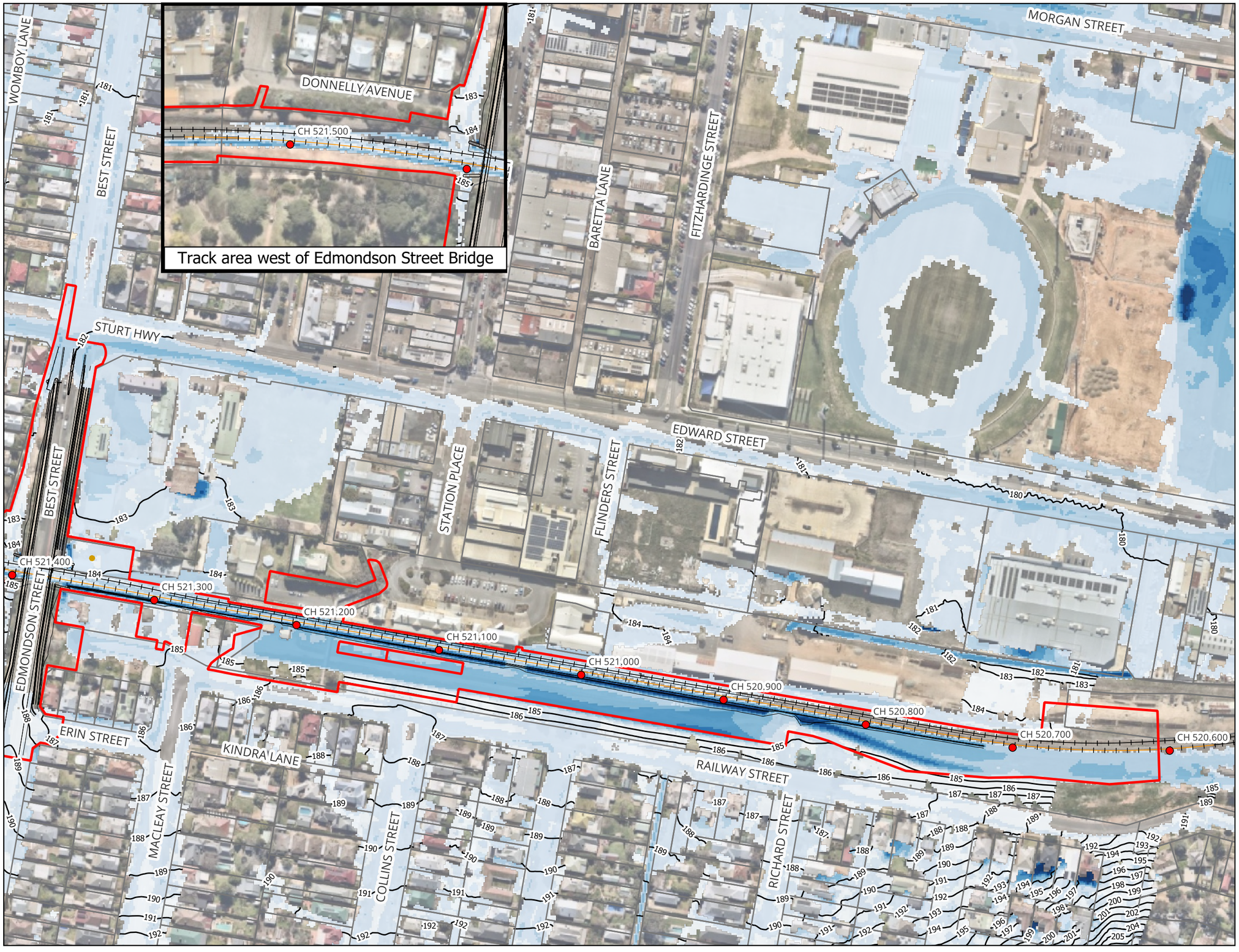
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A22 : 1% AEP Peak Flood Depth and Levels - Master Design Condition



Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

MARTINUS aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Depth (m)

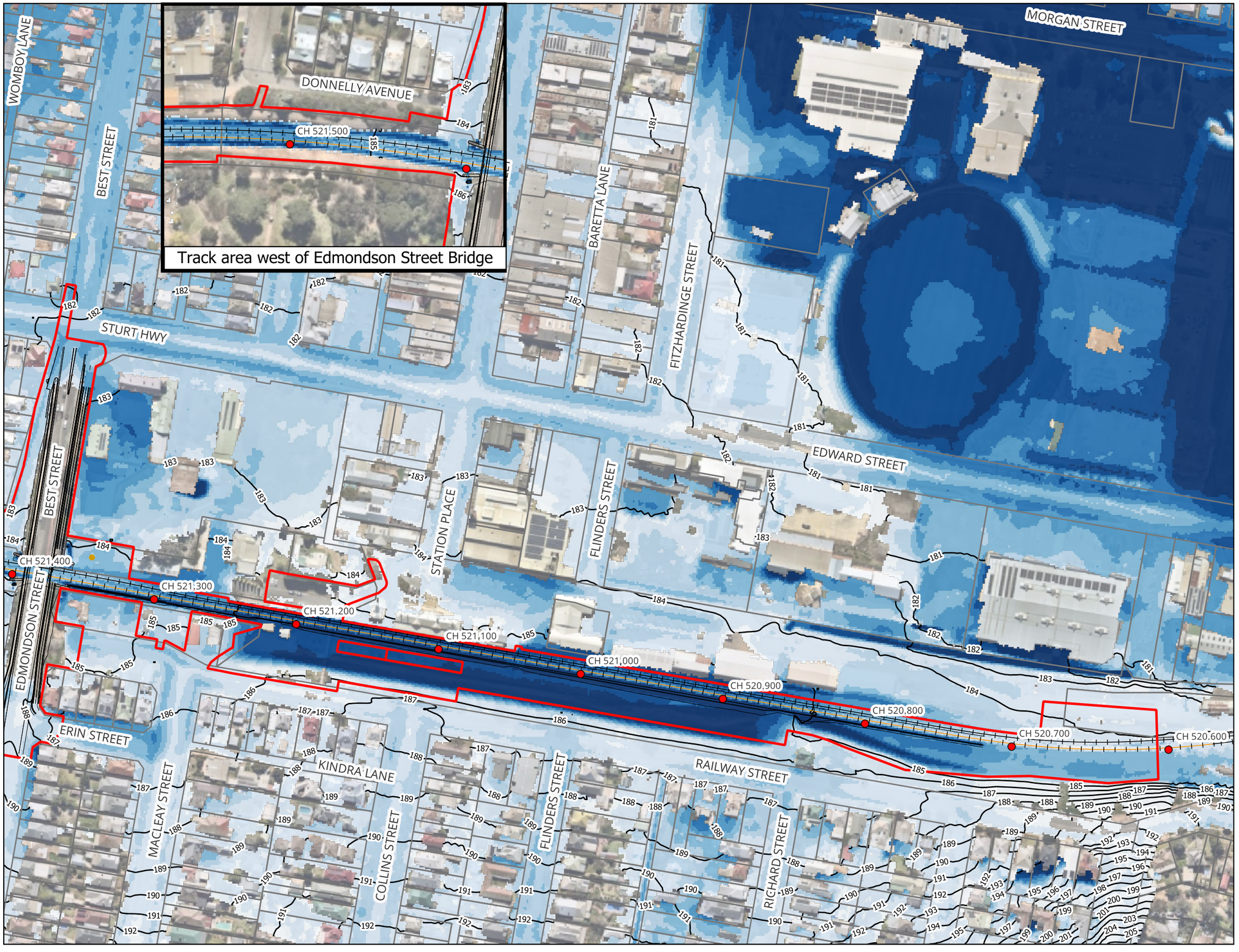
- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A23 : 1% AEP Climate Changes Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A24 : PMF Peak Flood Depth and Levels - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A25 : 10% AEP Peak Flood Velocity - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A26 : 5% AEP Peak Flood Velocity - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

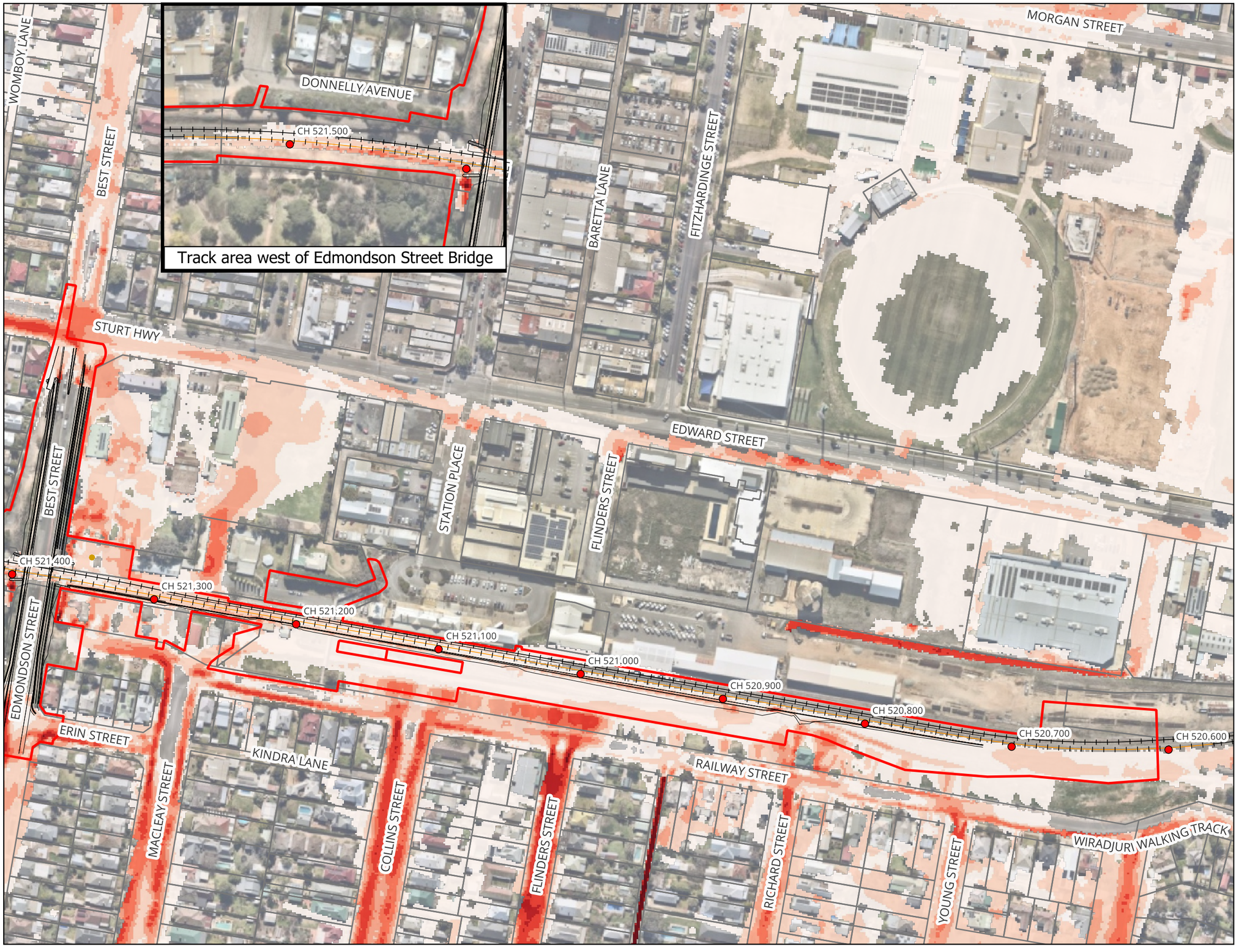
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A27 : 2% AEP Peak Flood Velocity - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A28 : 1% AEP Peak Flood Velocity - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

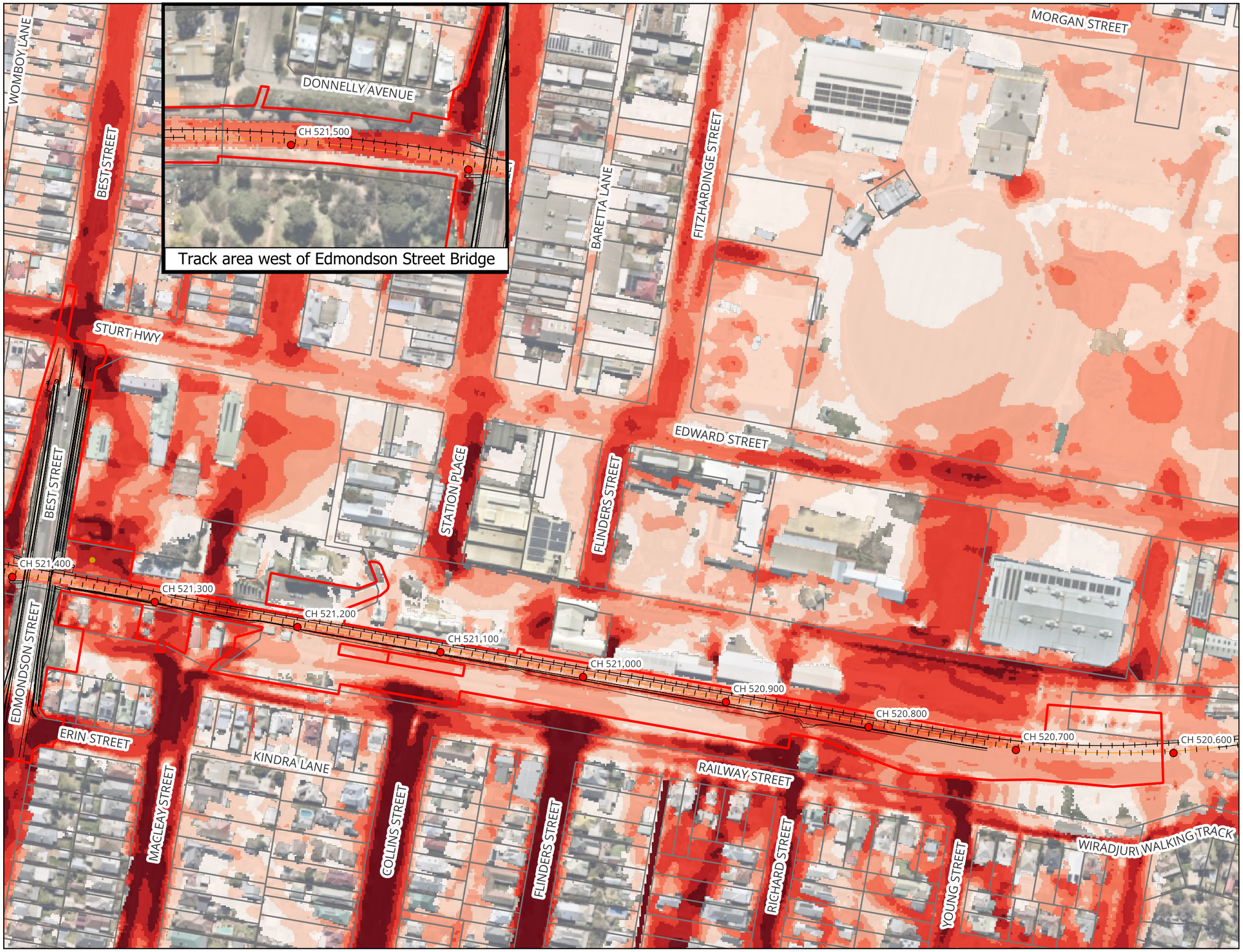
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A29 : 1% AEP Climate Changes Peak Flood Velocity - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

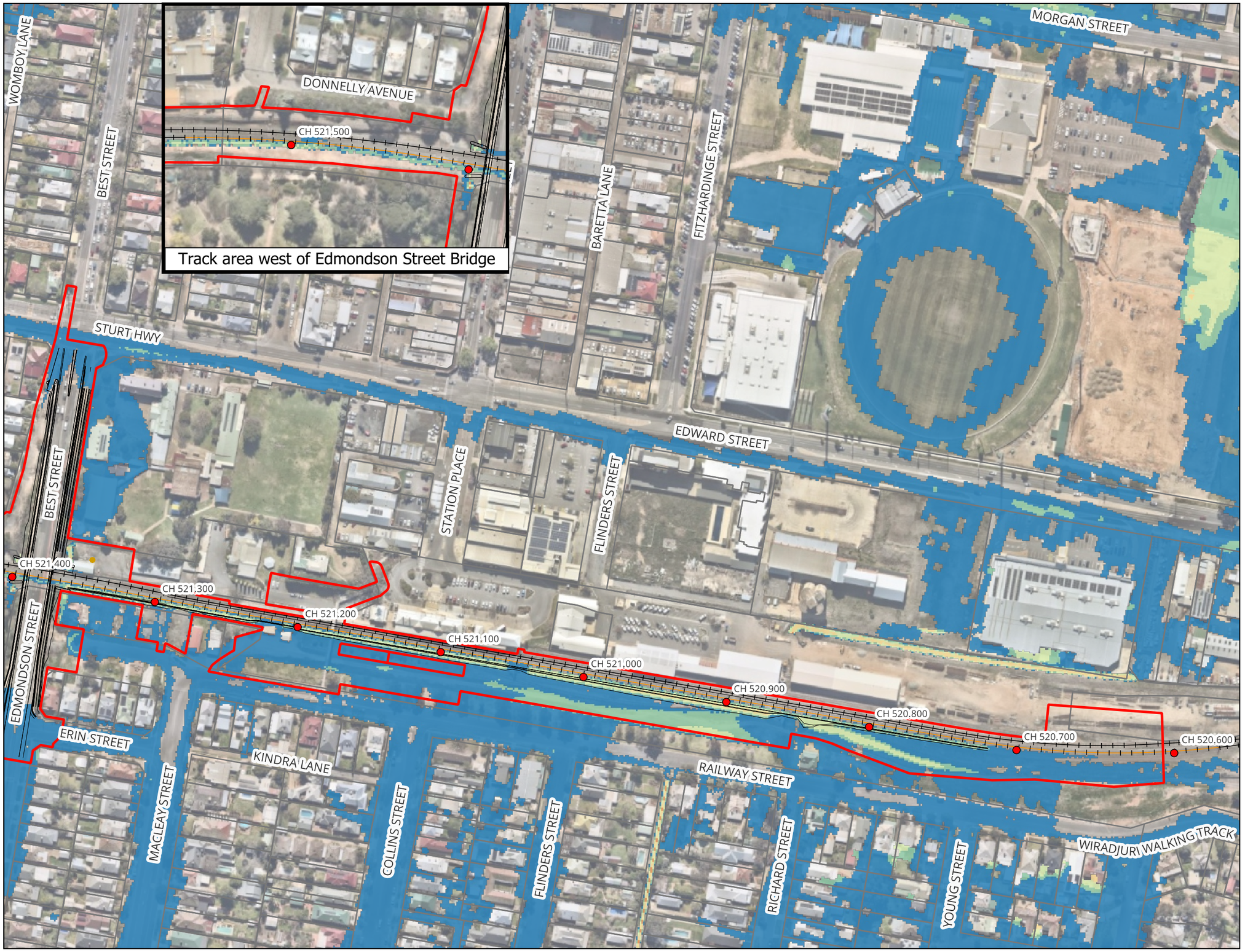
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A30 : PMF Peak Flood Velocity - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

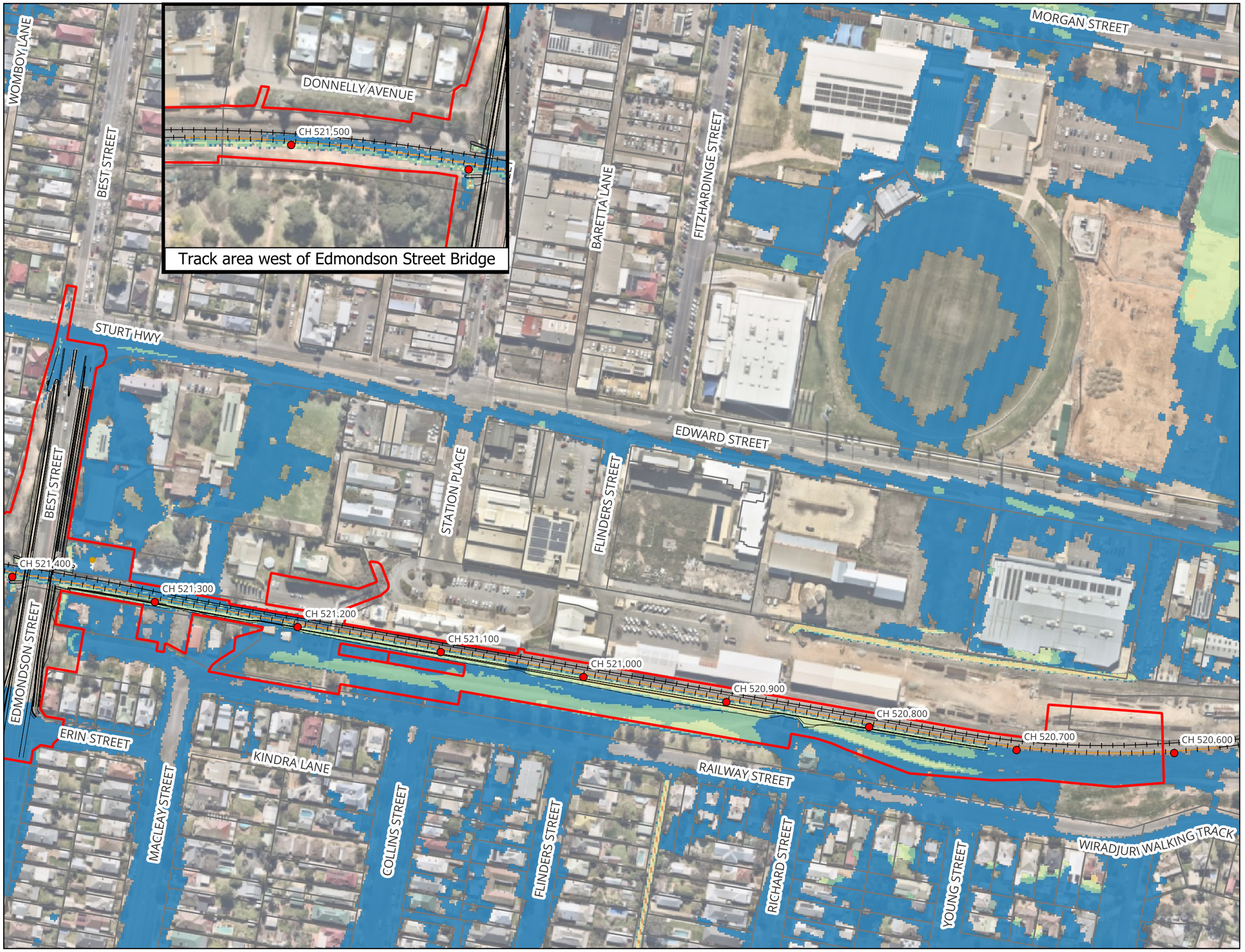
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A31 : 10% AEP Peak Flood Hazard - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

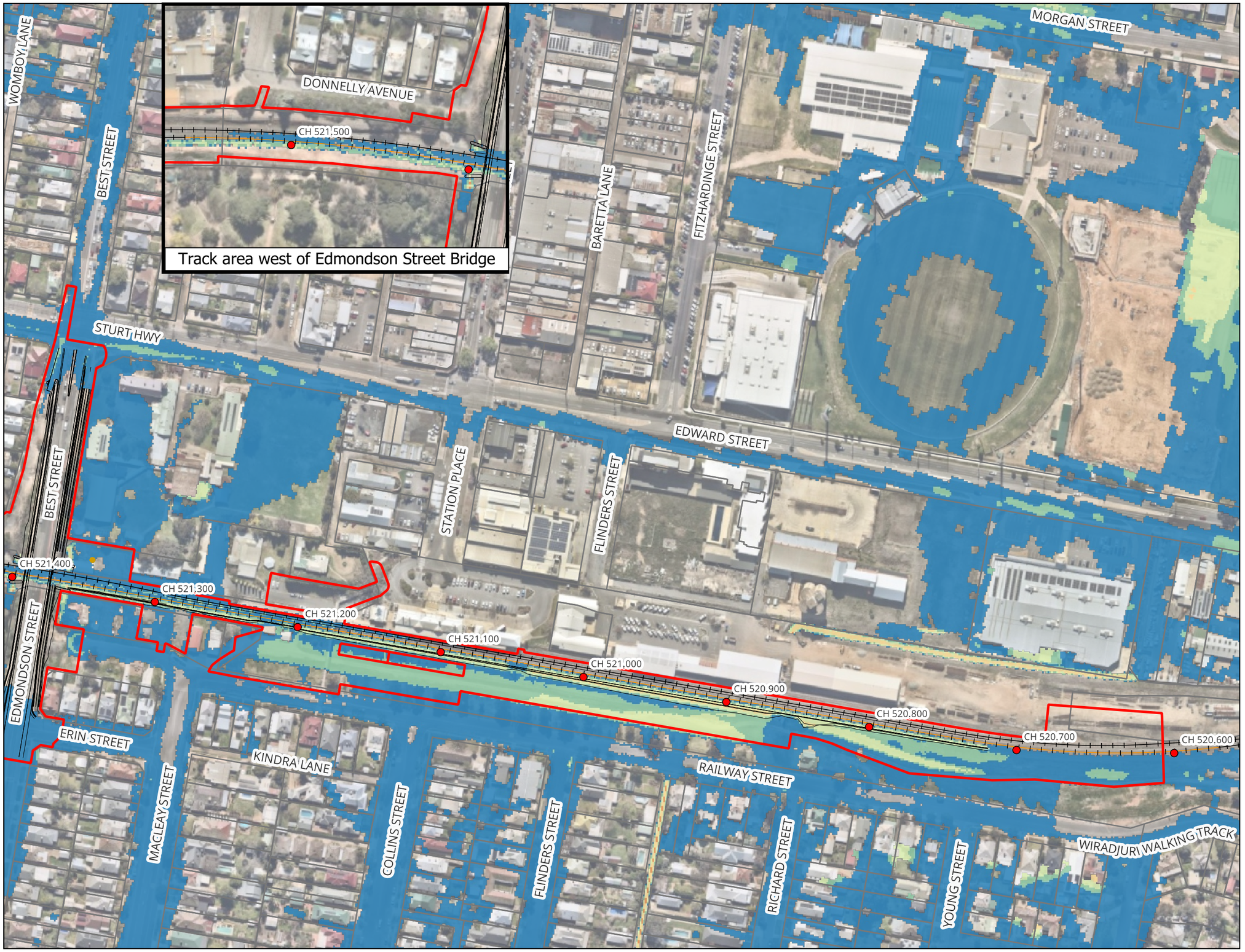
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A32 : 5% AEP Peak Flood Hazard - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

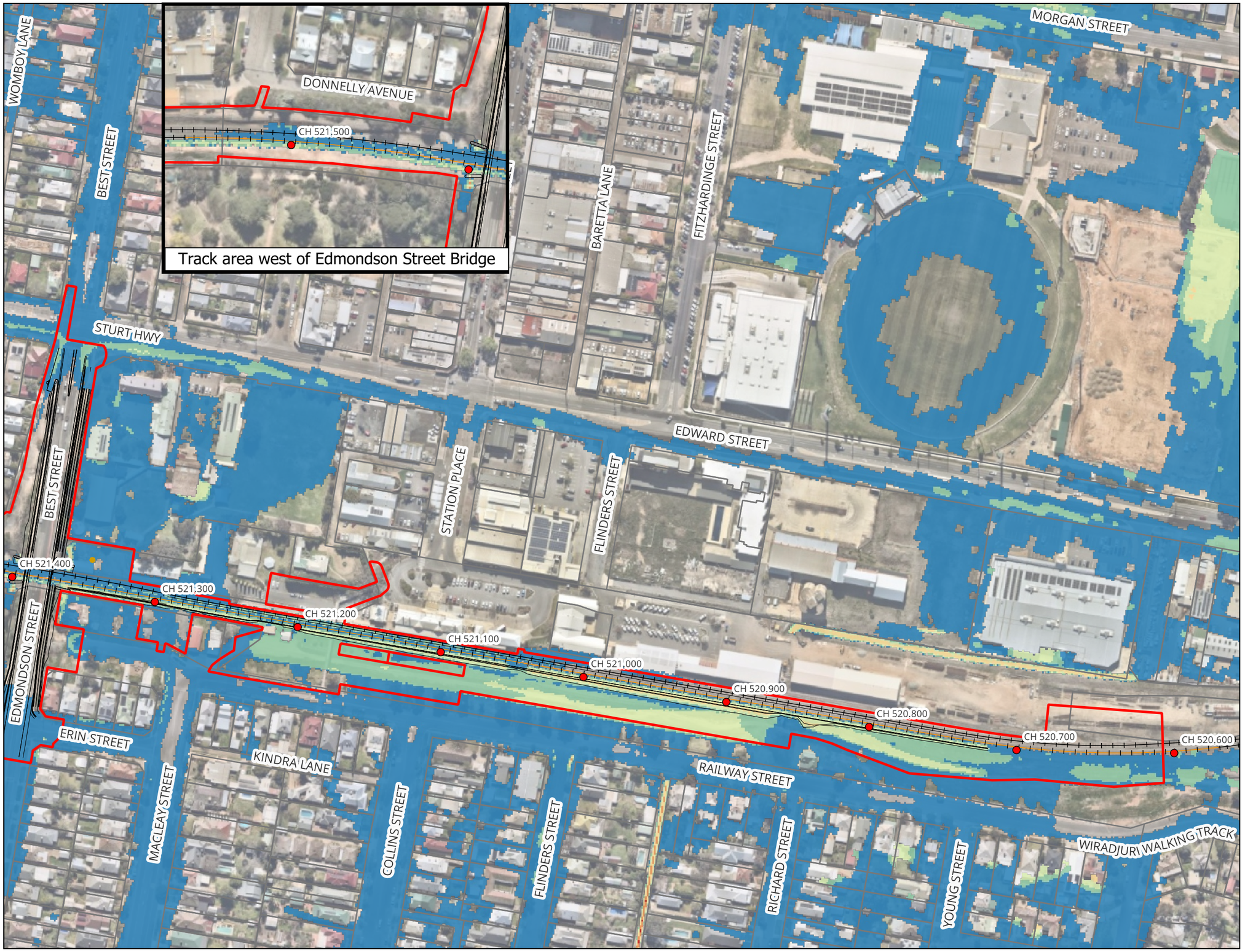
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A33 : 2% AEP Peak Flood Hazard - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A34 : 1% AEP Peak Flood Hazard - Master Design Condition



MARTINUS

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Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A35 : 1% AEP Climate Changes Peak Flood Hazard - Master Design Condition



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Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

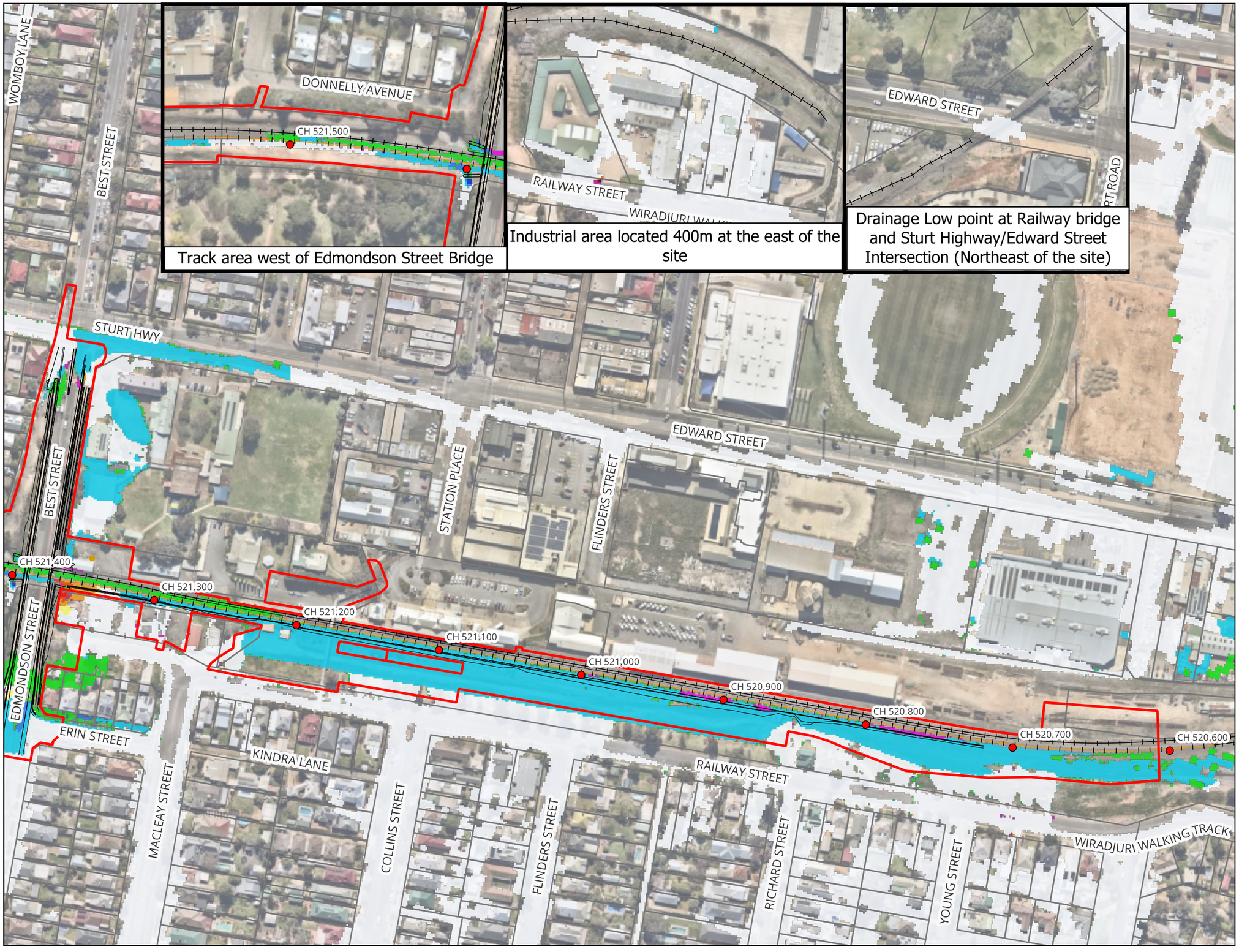
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A36 : PMF Peak Flood Hazard - Master Design Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

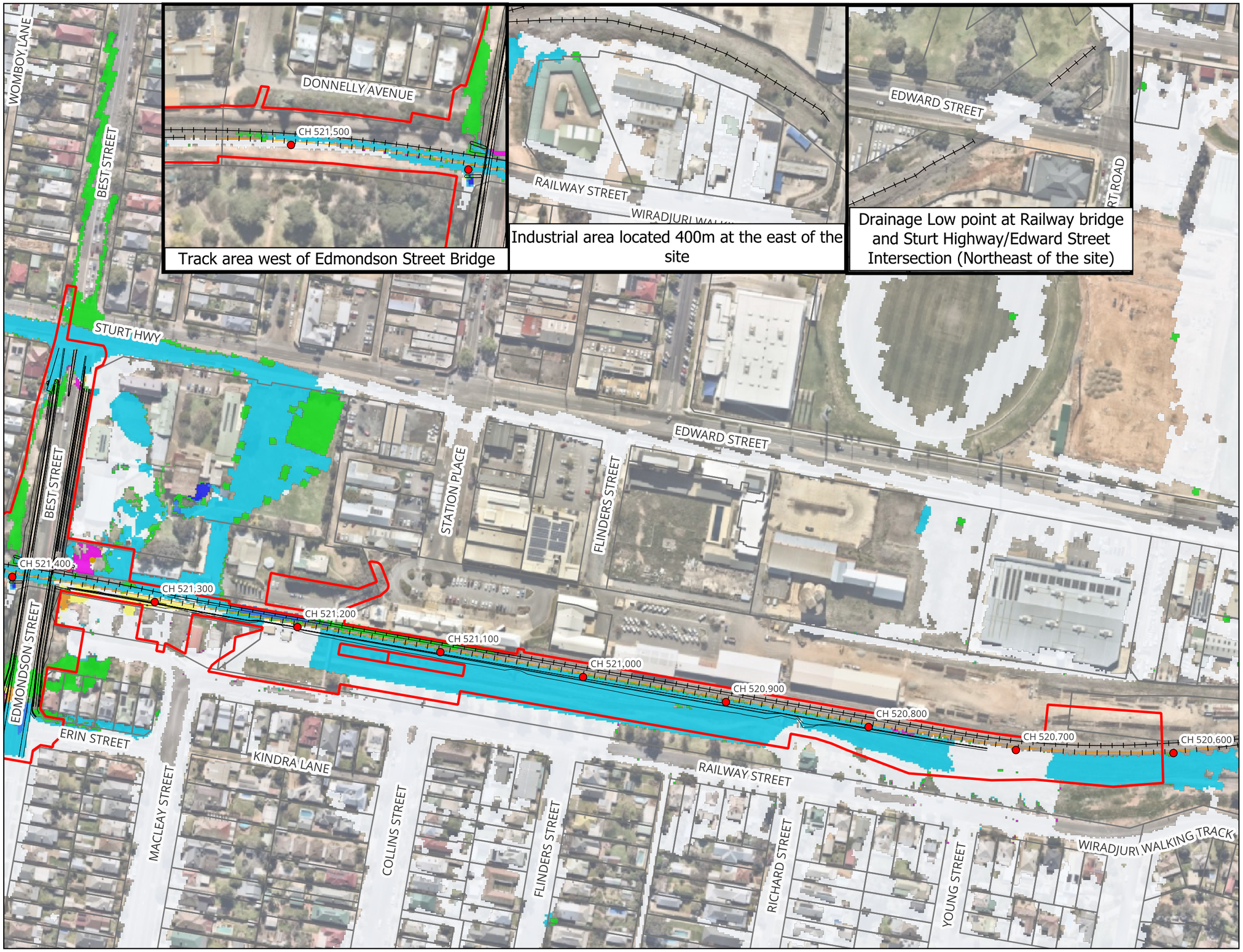
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A37 : Changes in Peak Flood Levels for 10% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

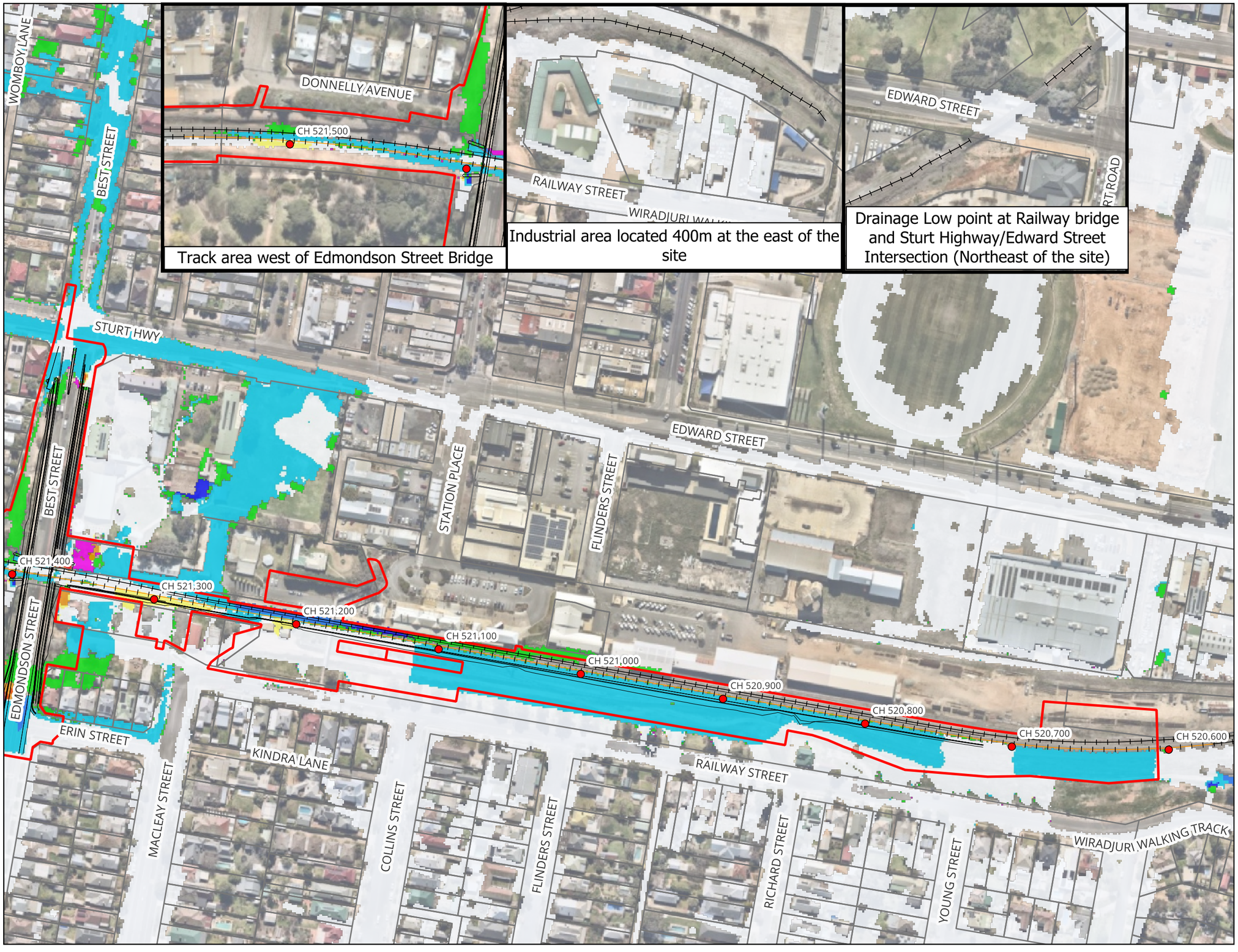
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A38 : Changes in Peak Flood Levels for 5% AEP - Master Design Condition vs Existing Condition



MARTINUS
aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

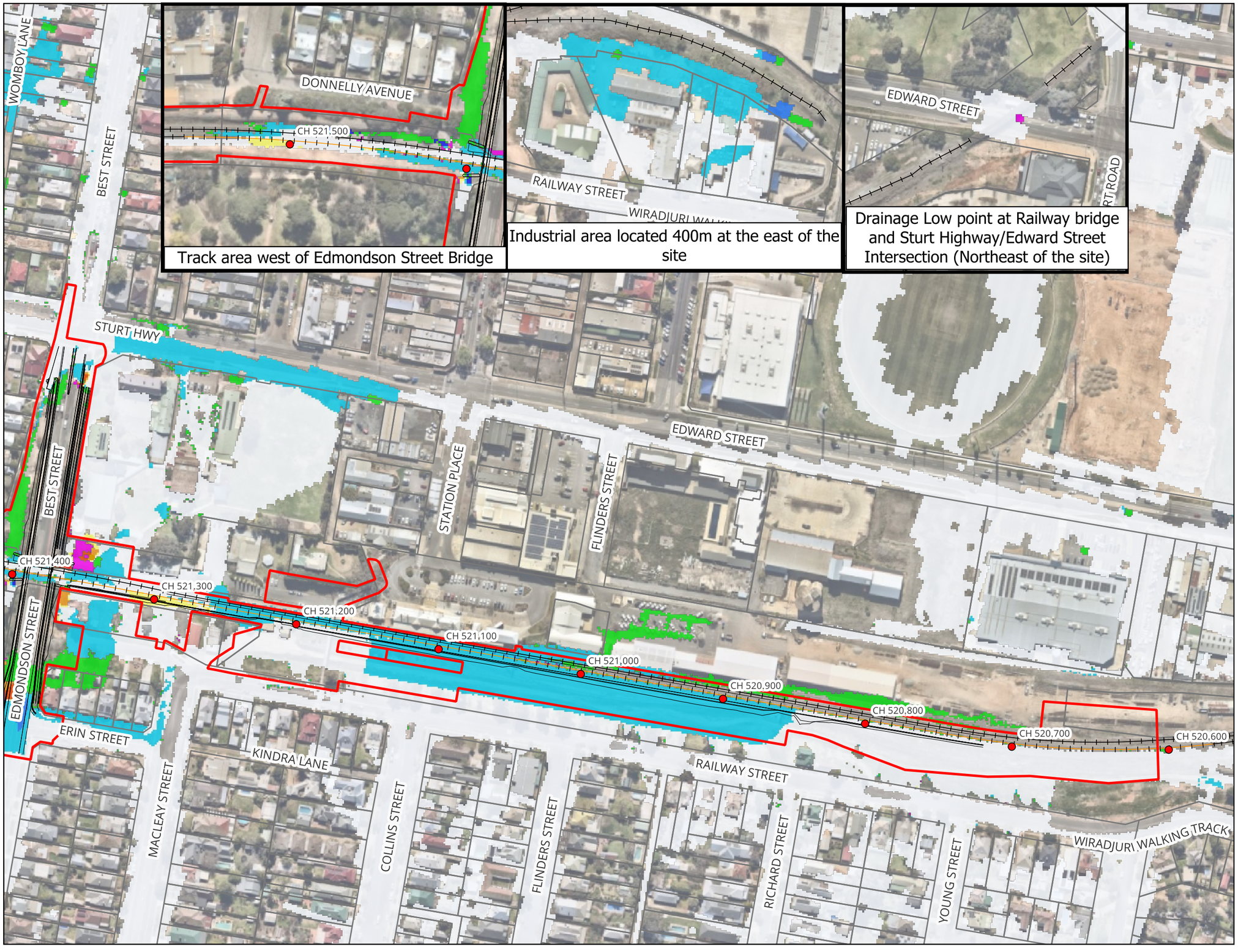
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A39 : Changes in Peak Flood Levels for 2% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

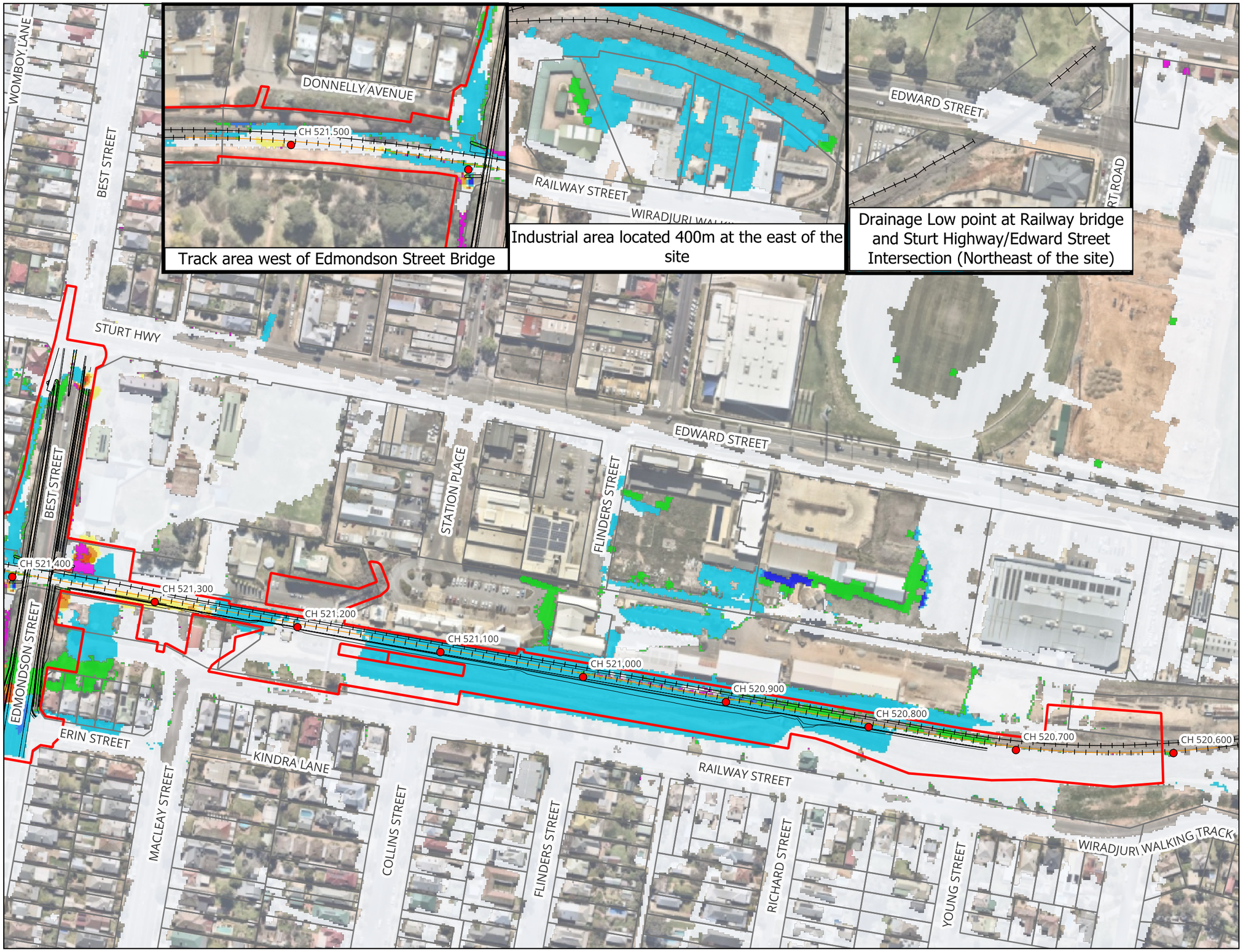
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A40 : Changes in Peak Flood Levels for 1% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Flood Level (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

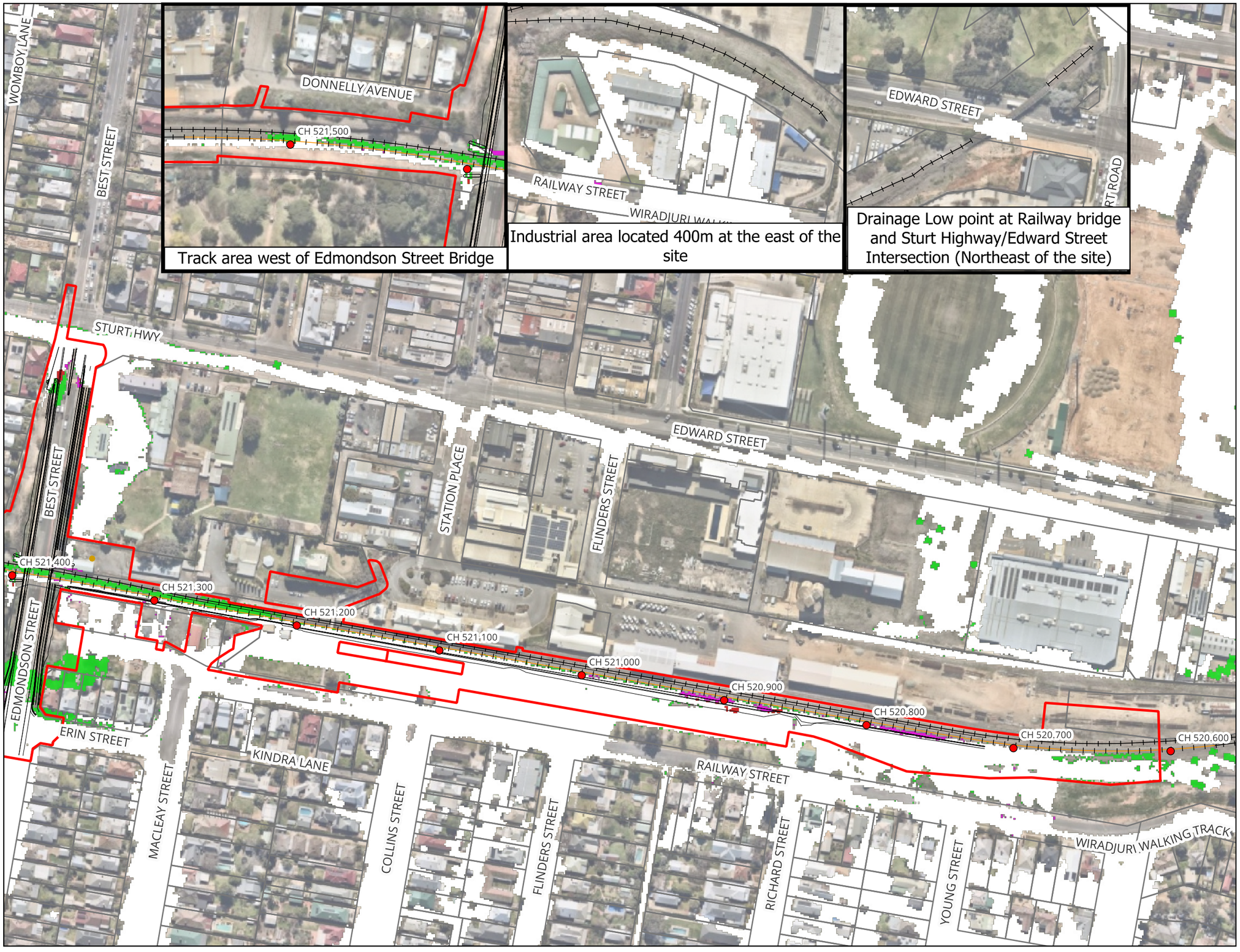
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A41 : Changes in Peak Flood Levels for 1% AEP Climate Changes - Master Design Condition vs Existing Condition



Map by: TT

0 100 200 m

A3 Scale: 1:2,600

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MARTINUS aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

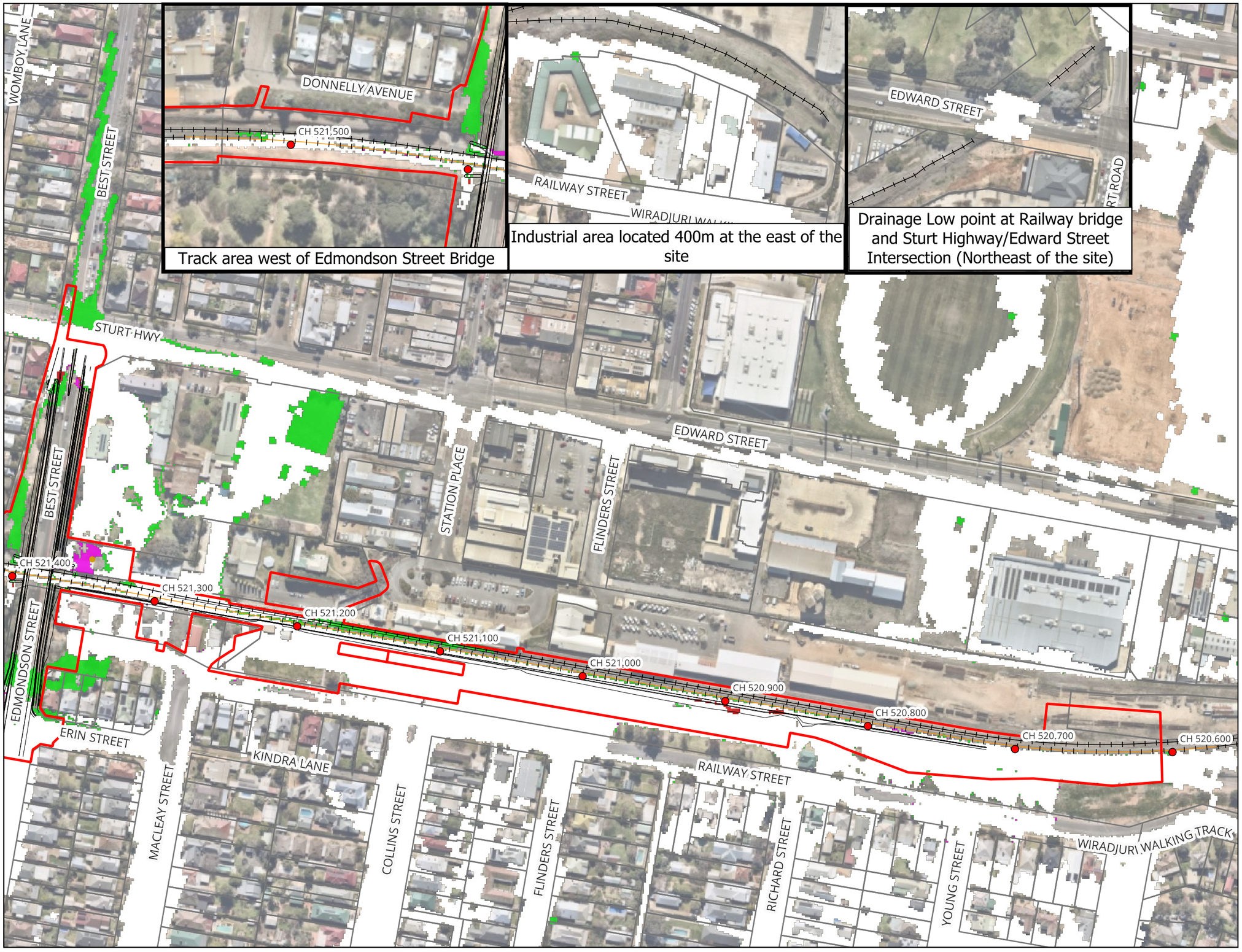
- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A42 : Changes in Peak Flood Velocity for 10% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Velocity (m/s)

<= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

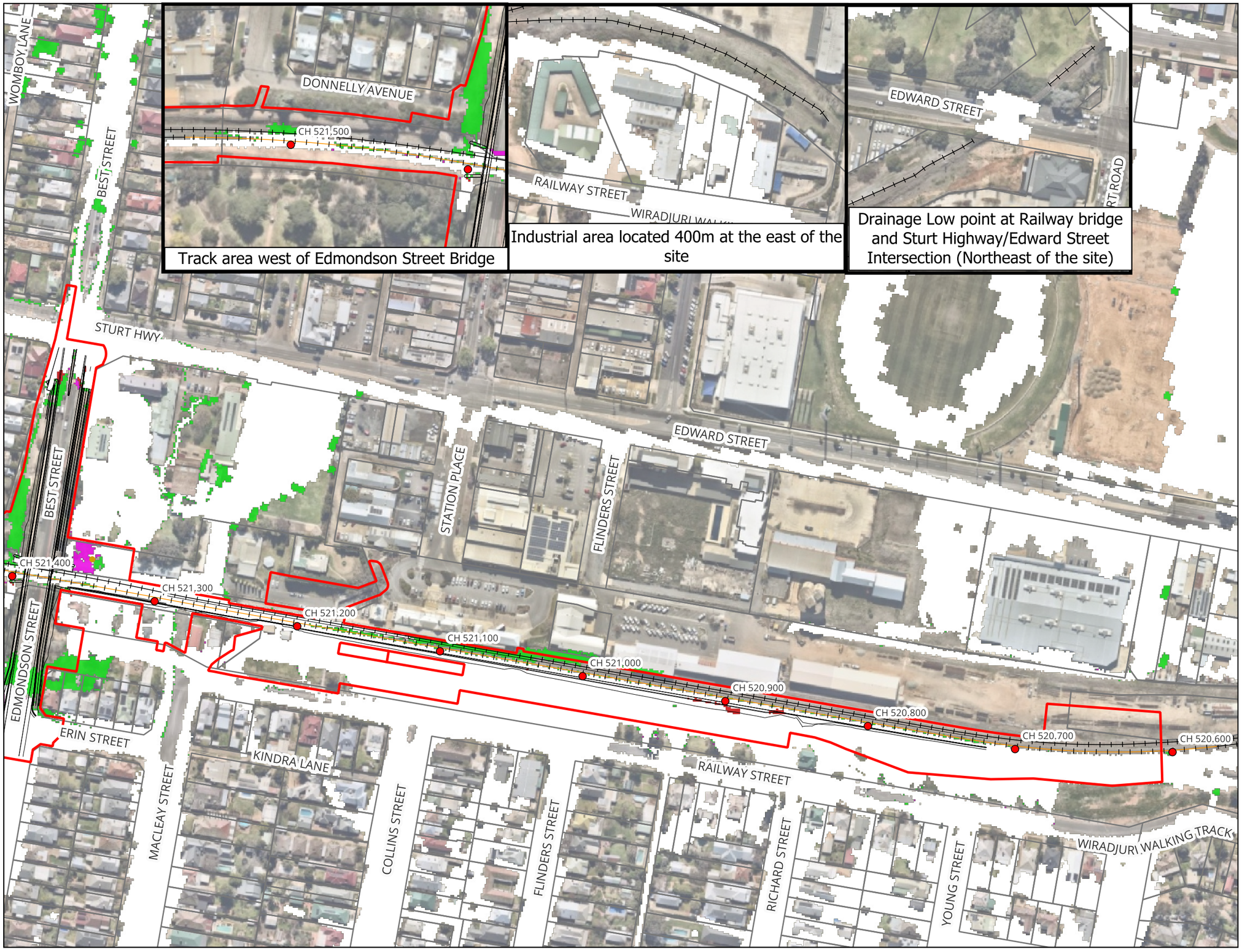
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A43 : Changes in Peak Flood Velocity for 5% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

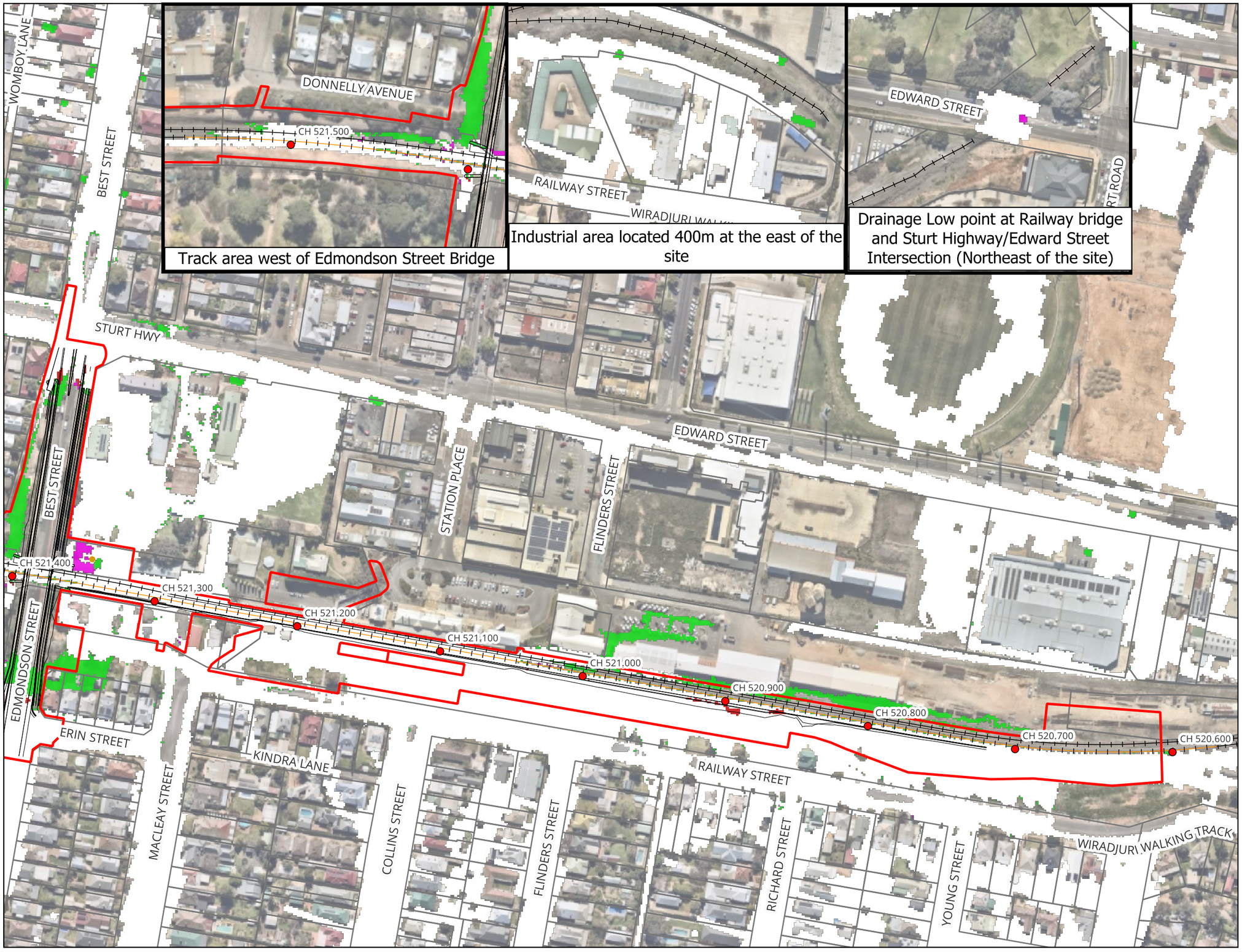
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A44 : Changes in Peak Flood Velocity for 2% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Velocity (m/s)

- <= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

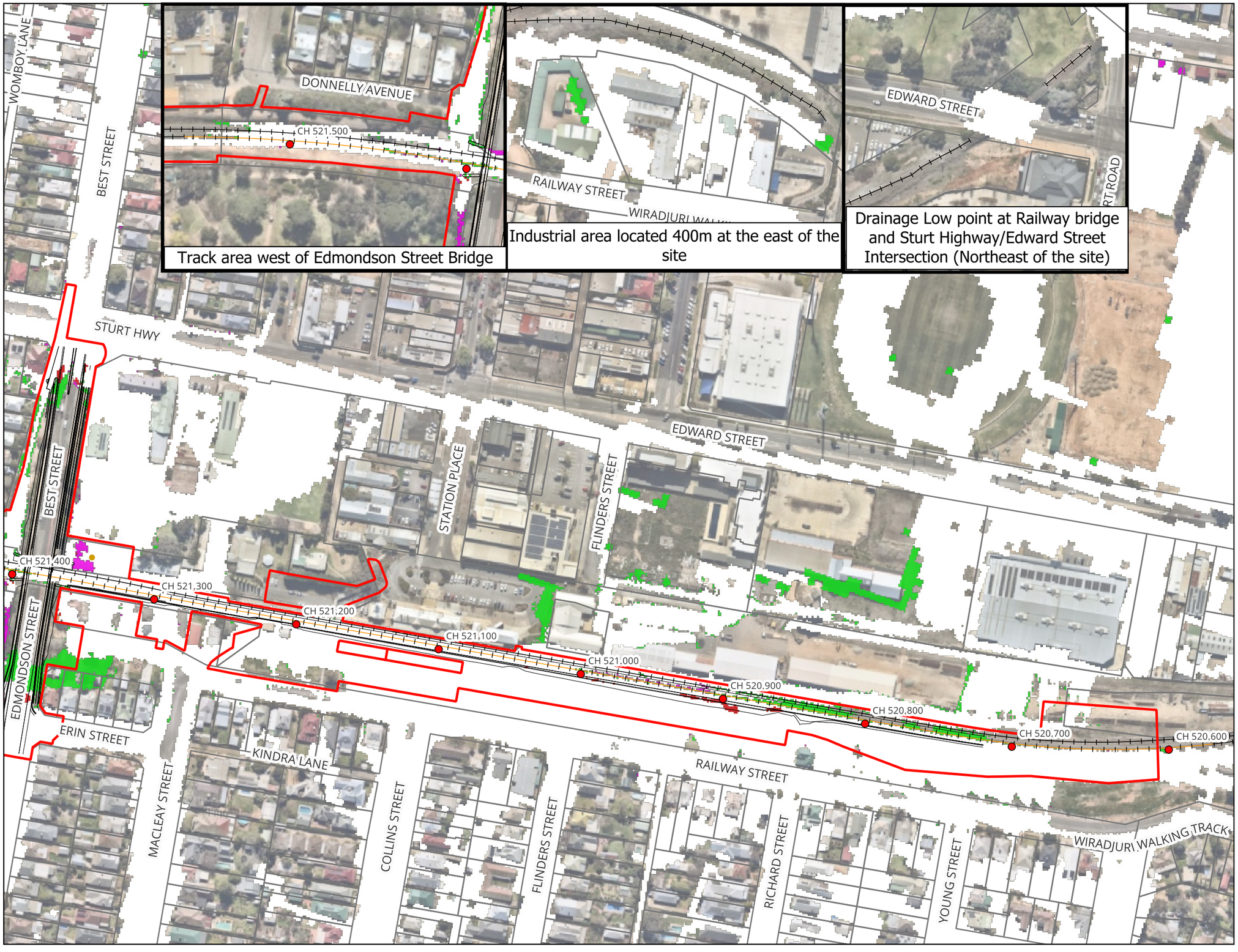
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A45 : Changes in Peak Flood Velocity for 1% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Velocity (m/s)

<= 0.50

Changes in Velocity (%)

- <= 10%
- 10% - 20%
- > 20%
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

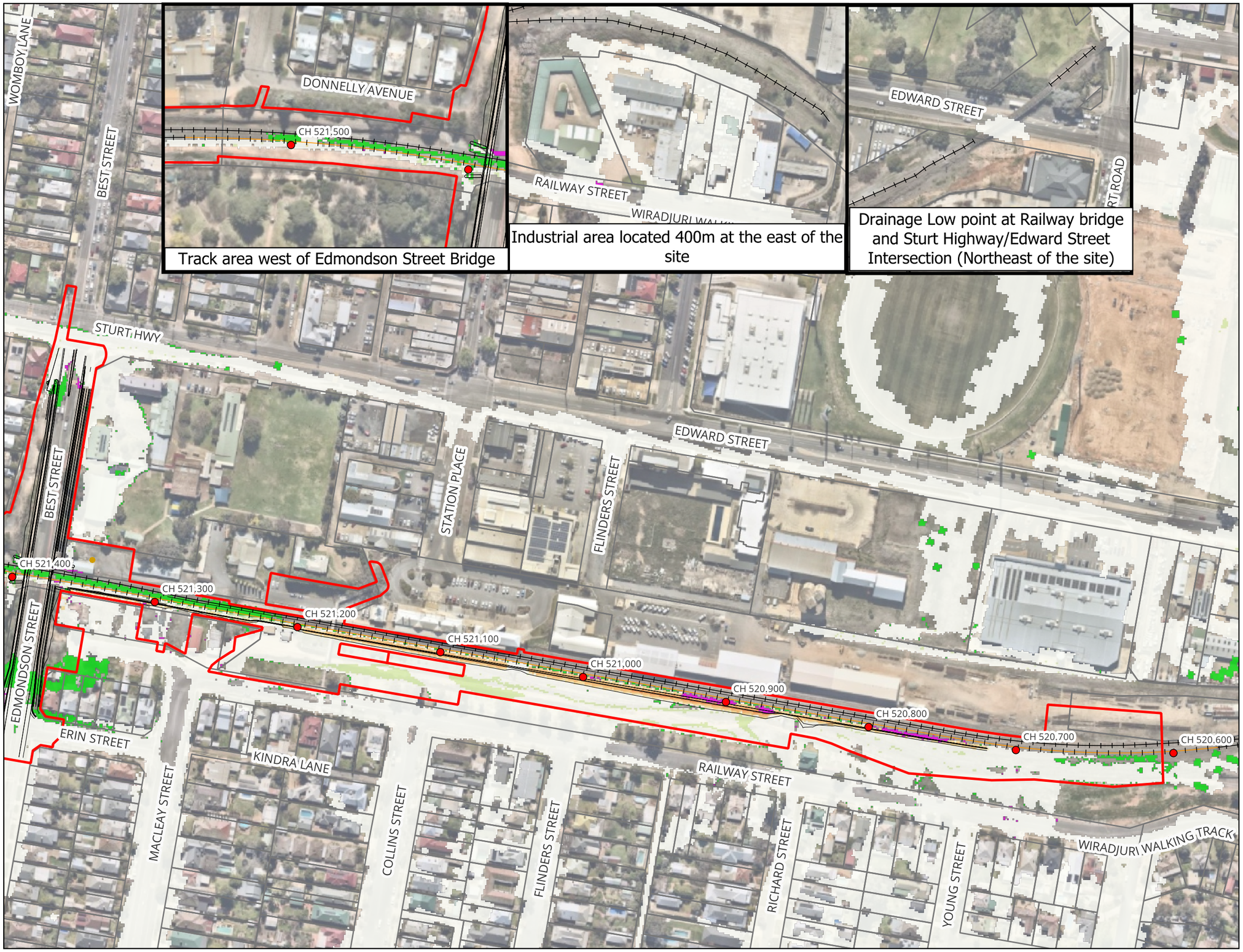
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A46 : Changes in Peak Flood Velocity for 1% AEP Climate Changes - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

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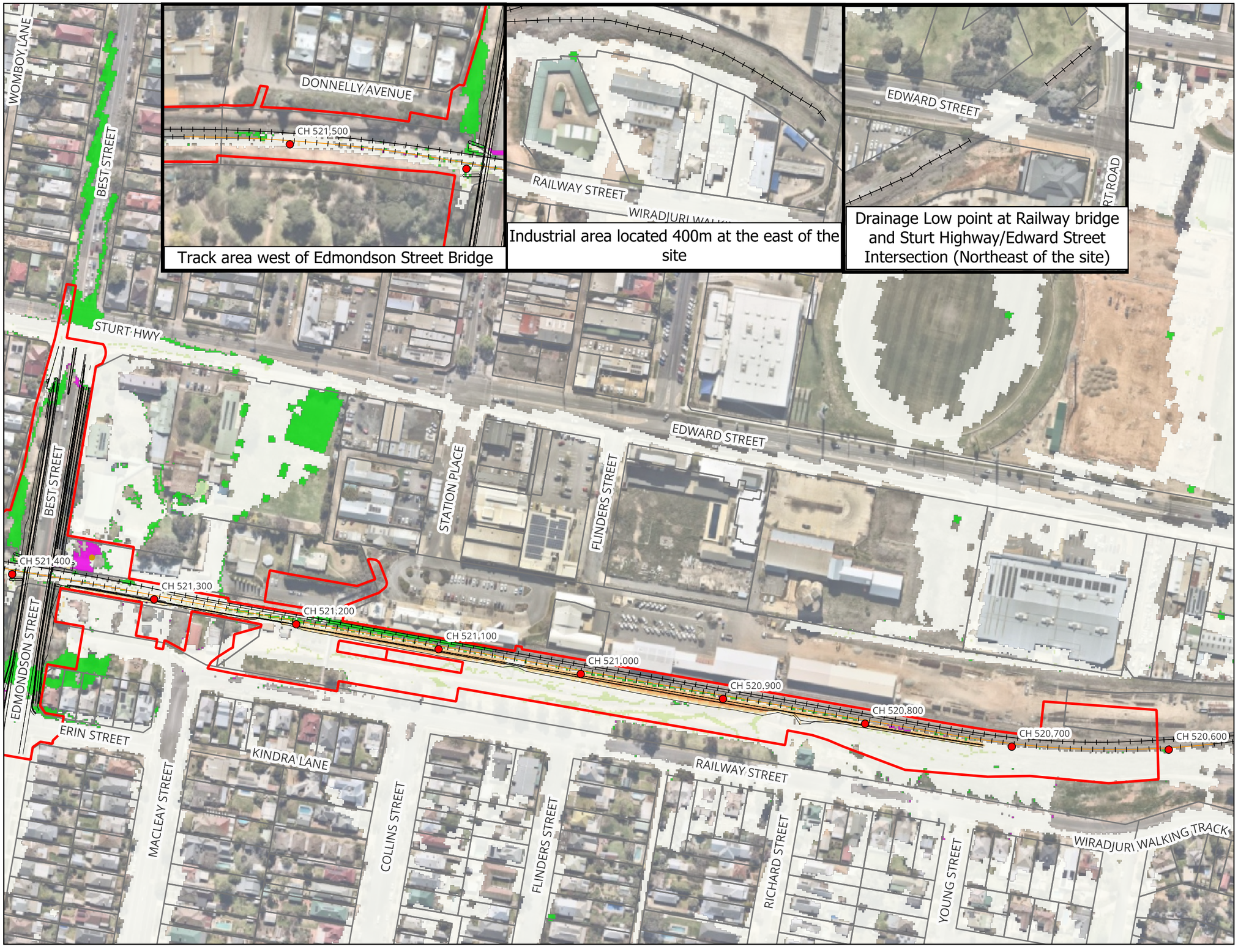
Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A47 : Changes in Peak Flood Hazard for 10% AEP - Master Design Condition vs Existing Condition



MARTINUS
aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

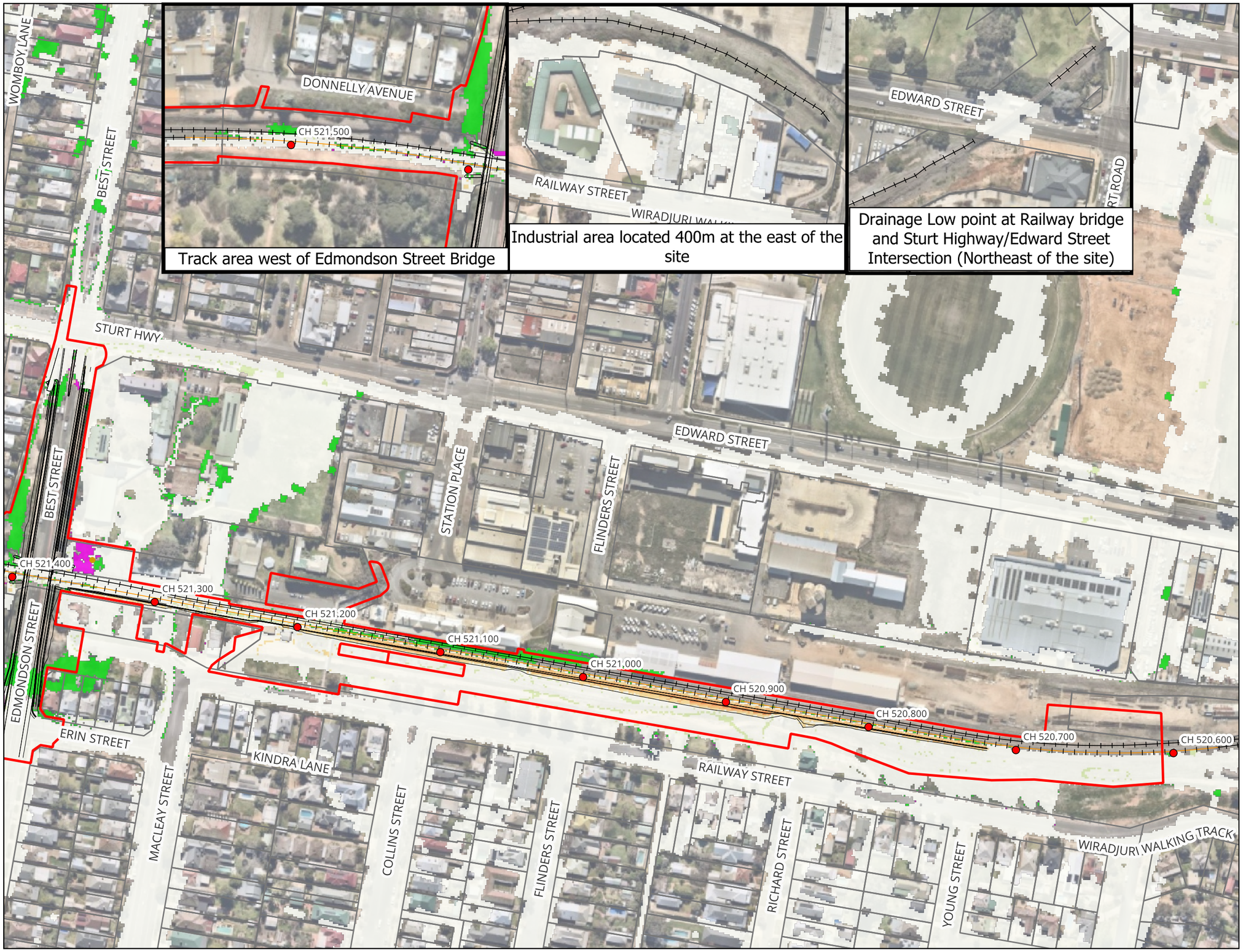
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A48 : Changes in Peak Flood Hazard for 5% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

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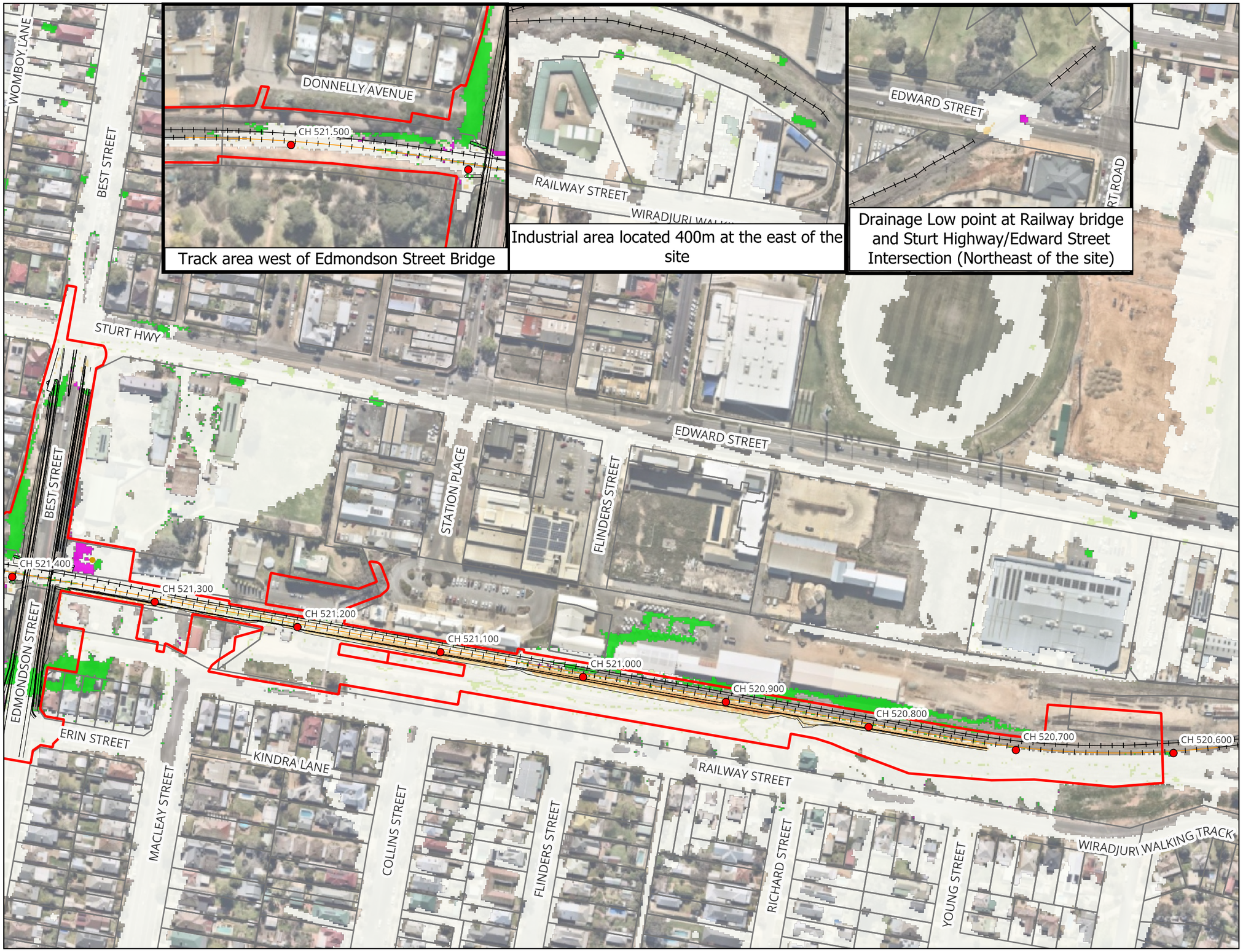
Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A49 : Changes in Peak Flood Hazard for 2% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

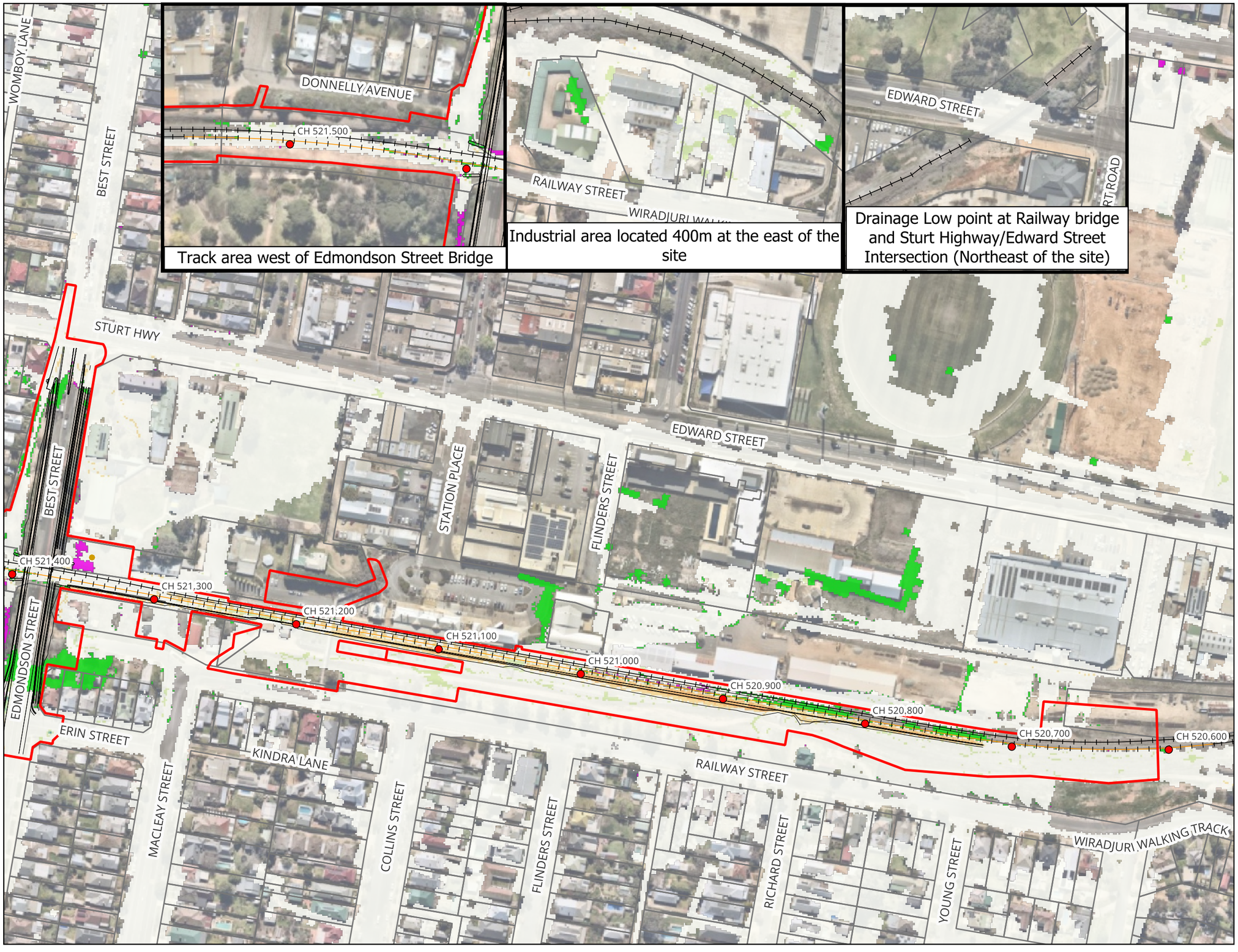
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A50 : Changes in Peak Flood Hazard for 1% AEP - Master Design Condition vs Existing Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Changes in Hazard

- Reduced 5 Classes
- Reduced 4 Classes
- Reduced 3 Classes
- Reduced 2 Classes
- Reduced 1 Class
- No Change
- Increased 1 Class
- Increased 2 Classes
- Increased 3 Classes
- Increased 4 Classes
- Increased 5 Classes
- Was Wet Now Dry
- Was Dry Now Wet

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

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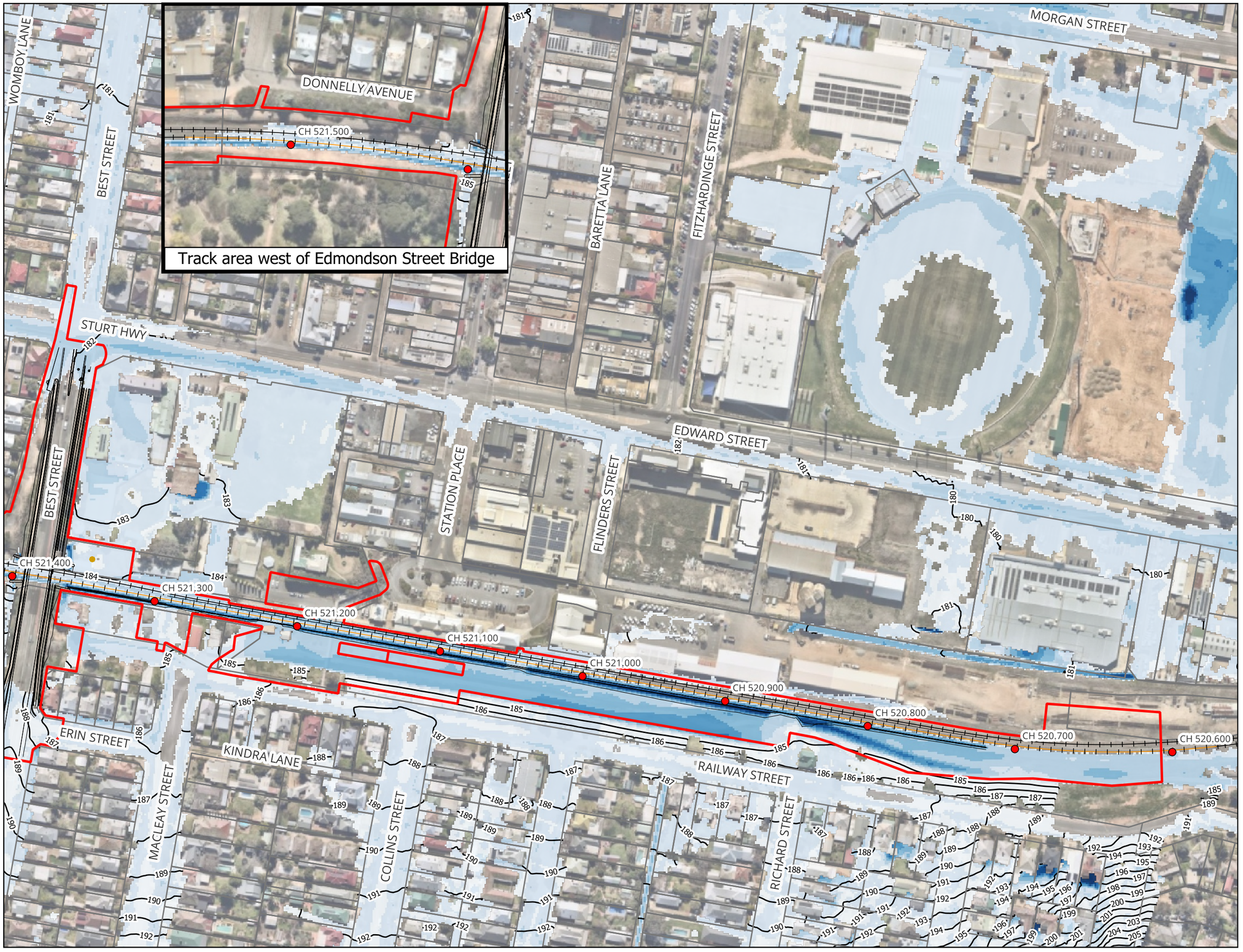
Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A51 : Changes in Peak Flood Hazard for 1% AEP Climate Changes - Master Design Condition vs Existing Condition



Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

MARTINUS aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre
- Flood Level Contours (mAHD)

Peak Flood Depth (m)

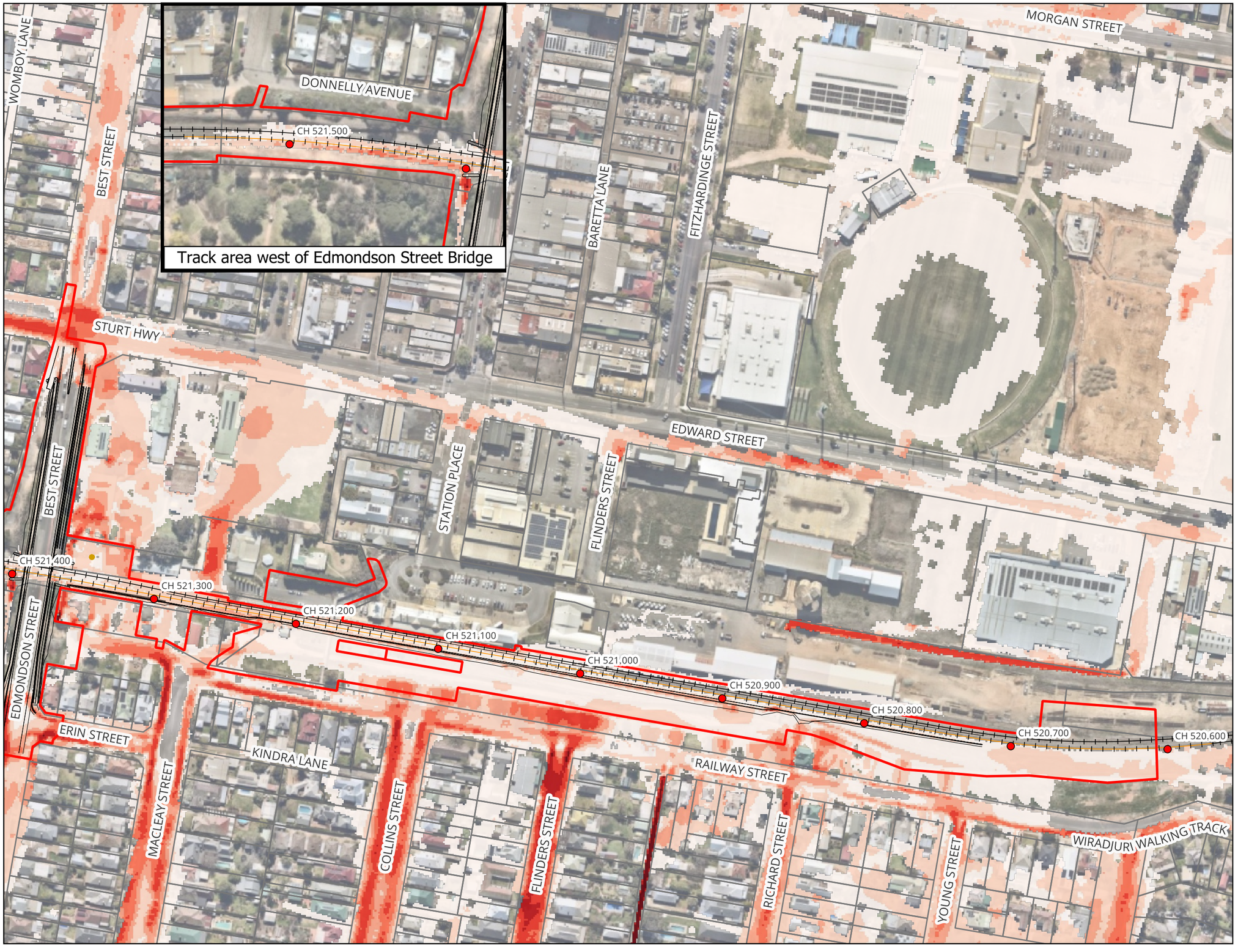
- <= 0.03
- 0.03 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- > 1.2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A52 : 1% AEP Peak Flood Depth and Levels - Master Design Blockage Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Velocity (m/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- > 2

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

Map by: TT

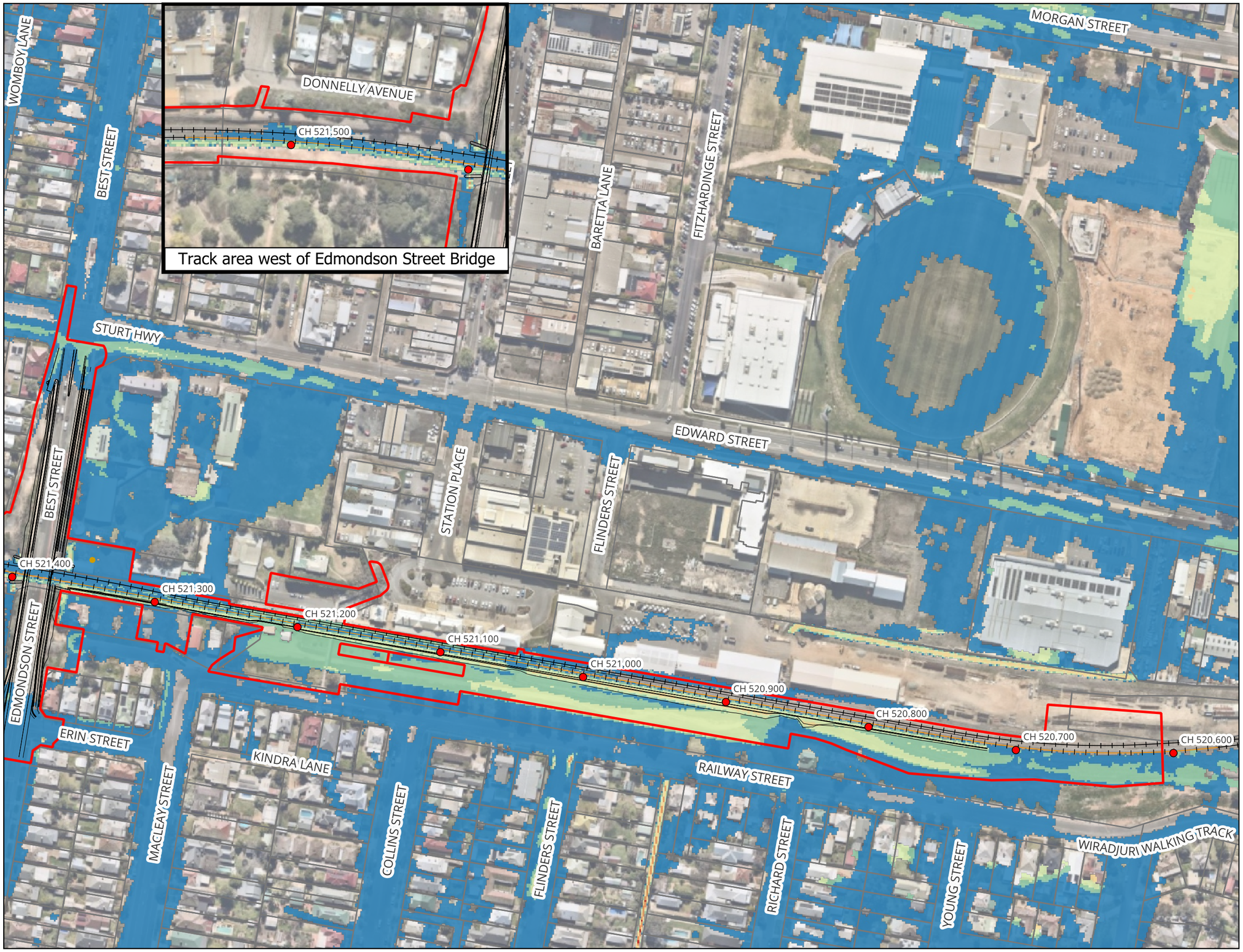
0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A53 : 1% AEP Peak Velocity - Master Design Blockage Condition



MARTINUS

aurecon BG&E

Legend

- Project Boundary
- Chainage (km)
- Civil Design Extent
- Modelled Footbridge Bridge Pier
- Existing Railway Track
- Proposed Railway Track
- Cadastre

Peak Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

Notes:

The maps are based on DDR results (Refer to Flood Design Report)

H1 : Generally safe for vehicles, people and buildings.
H2 : Unsafe for small vehicles.
H3 : Unsafe for vehicles. children and the elderly.
H4 : Unsafe for vehicles and people.
H5 : Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6 : Unsafe for vehicles and people. All building types considered vulnerable to failure.

Map by: TT

0 100 200 m

A3 Scale: 1:2,600

17/9/2025 GDA2020 / MGA zone 55

Wagga Wagga Yard - Inland Rail (A2P) - IFC Stage

Figure A54 : 1% AEP Peak Hazard - Master Design Blockage Condition

APPENDIX B

ARR Data hub Data



Results - ARR Data Hub

[STARTTXT]

Input Data Information

[INPUTDATA]

Latitude,-35.122268

Longitude,147.367080

[END_INPUTDATA]

River Region

[RIVREG]

Division,Murray-Darling Basin

River Number,12

River Name,Murrumbidgee River

[RIVREG_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v1

[END_RIVREG]

ARF Parameters

[LONGARF]

Zone,Southern Temperate

a,0.158

b,0.276

c,0.372

d,0.315

e,0.000141

f,0.41

g,0.15

h,0.01

i,-0.0027

[LONGARF_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v1

[END_LONGARF]

Storm Losses

[LOSSES]

ID,30818.0

Storm Initial Losses (mm),26.0

Storm Continuing Losses (mm/h),4.7

[LOSSES_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v1

[END_LOSSES]

Temporal Patterns

[TP]

code,MB

Label,Murray Basin

[TP_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v2

[END_TP]

Areal Temporal Patterns

[ATP]

code,MB

arealabel,Murray Basin

[ATP_META]

Time Accessed,18 June 2024 01:04PM

Version,2016_v2

[END_ATP]

Median Preburst Depths and Ratios

[PREBURST]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),1.8 (0.089),1.6 (0.057),1.5 (0.044),1.4 (0.034),0.9 (0.019),0.5 (0.010)

90 (1.5),2.8 (0.123),1.9 (0.059),1.3 (0.033),0.7 (0.016),0.6 (0.011),0.5 (0.009)

120 (2.0),4.4 (0.178),3.2 (0.093),2.5 (0.059),1.7 (0.035),0.8 (0.013),0.1 (0.001)

180 (3.0),3.0 (0.108),2.9 (0.075),2.8 (0.062),2.8 (0.052),1.6 (0.025),0.7 (0.010)

360 (6.0),2.2 (0.065),1.3 (0.027),0.7 (0.012),0.1 (0.001),1.2 (0.016),2.1 (0.025)

720 (12.0),0.1 (0.002),1.0 (0.018),1.5 (0.024),2.1 (0.028),4.0 (0.045),5.4 (0.055)

1080 (18.0),0.0 (0.000),0.3 (0.005),0.5 (0.006),0.6 (0.008),2.5 (0.025),3.8 (0.035)

1440 (24.0),0.0 (0.000),0.2 (0.002),0.3 (0.003),0.4 (0.004),0.6 (0.006),0.8 (0.007)

2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST]From preburst class

10% Preburst Depths

[PREBURST10]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

90 (1.5),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

120 (2.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

180 (3.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

360 (6.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

720 (12.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1080 (18.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST10_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST10]From preburst class

25% Preburst Depths

[PREBURST25]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),0.1 (0.005),0.1 (0.002),0.0 (0.001),0.0 (0.000),0.0 (0.000),0.0 (0.000)

90 (1.5),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

120 (2.0),0.1 (0.004),0.1 (0.001),0.0 (0.001),0.0 (0.000),0.0 (0.000),0.0 (0.000)

180 (3.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

360 (6.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

720 (12.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1080 (18.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST25_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST25]From preburst class

75% Preburst Depths

[PREBURST75]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),15.3 (0.750),13.8 (0.480),12.7 (0.369),11.7 (0.291),11.8 (0.246),11.9 (0.220)

90 (1.5),15.3 (0.666),13.0 (0.404),11.5 (0.297),10.0 (0.222),10.5 (0.196),10.9 (0.180)

120 (2.0),16.6 (0.664),16.4 (0.471),16.3 (0.391),16.2 (0.334),12.4 (0.215),9.6 (0.147)

180 (3.0),11.8 (0.423),15.8 (0.410),18.5 (0.401),21.0 (0.393),20.3 (0.320),19.8 (0.278)

360 (6.0),12.7 (0.380),12.2 (0.265),11.8 (0.216),11.4 (0.181),17.4 (0.233),21.9 (0.261)

720 (12.0),5.5 (0.136),9.1 (0.167),11.5 (0.178),13.8 (0.185),18.3 (0.207),21.6 (0.219)

1080 (18.0),2.9 (0.064),6.1 (0.102),8.3 (0.117),10.4 (0.126),13.2 (0.136),15.4 (0.141)

1440 (24.0),0.2 (0.004),3.5 (0.054),5.7 (0.074),7.8 (0.088),9.1 (0.088),10.1 (0.087)

2160 (36.0),0.0 (0.000),0.9 (0.012),1.4 (0.017),2.0 (0.020),3.1 (0.027),4.0 (0.031)

2880 (48.0),0.0 (0.000),0.4 (0.006),0.7 (0.008),1.0 (0.010),1.1 (0.009),1.2 (0.009)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.1 (0.001),0.1 (0.001),0.0 (0.000),0.0 (0.000)

[PREBURST75_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST75]From preburst class

90% Preburst Depths

[PREBURST90]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),36.2 (1.772),29.9 (1.042),25.7 (0.746),21.7 (0.539),29.0 (0.603),34.4 (0.636)

90 (1.5),38.3 (1.665),34.2 (1.061),31.4 (0.814),28.8 (0.640),30.3 (0.566),31.5 (0.522)

120 (2.0),39.0 (1.565),36.1 (1.038),34.1 (0.821),32.3 (0.667),32.3 (0.561),32.3 (0.499)

180 (3.0),26.5 (0.953),31.5 (0.816),34.7 (0.755),37.9 (0.709),41.0 (0.647),43.4 (0.609)

360 (6.0),26.9 (0.804),28.0 (0.611),28.8 (0.528),29.5 (0.467),41.5 (0.555),50.5 (0.601)

720 (12.0),16.1 (0.400),24.9 (0.457),30.8 (0.477),36.4 (0.488),39.8 (0.451),42.3 (0.428)

1080 (18.0),16.2 (0.362),19.2 (0.318),21.1 (0.297),23.0 (0.280),30.3 (0.312),35.7 (0.328)

1440 (24.0),6.7 (0.138),13.4 (0.207),17.9 (0.234),22.2 (0.252),23.2 (0.223),23.9 (0.206)

2160 (36.0),1.1 (0.021),9.3 (0.131),14.8 (0.176),20.0 (0.208),17.3 (0.152),15.2 (0.119)

2880 (48.0),0.4 (0.007),6.8 (0.089),11.0 (0.123),15.1 (0.147),17.3 (0.143),18.9 (0.140)

4320 (72.0),0.0 (0.000),3.1 (0.037),5.1 (0.052),7.0 (0.063),13.9 (0.106),19.0 (0.130)

[PREBURST90_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST90]From preburst class

Interim Climate Change Factors

[CCF]

,RCP 4.5,RCP6,RCP 8.5

2030,0.816 (4.1%),0.726 (3.6%),0.934 (4.7%)

2040,1.046 (5.2%),1.015 (5.1%),1.305 (6.6%)

2050,1.260 (6.3%),1.277 (6.4%),1.737 (8.8%)

2060,1.450 (7.3%),1.520 (7.7%),2.214 (11.4%)

2070,1.609 (8.2%),1.753 (8.9%),2.722 (14.2%)

2080,1.728 (8.8%),1.985 (10.2%),3.246 (17.2%)

2090,1.798 (9.2%),2.226 (11.5%),3.772 (20.2%)

[CCF_META]

Time Accessed,18 June 2024 01:04PM

Version,2019_v1

Note,ARR recommends the use of RCP4.5 and RCP 8.5 values. These have been updated to the values that can be found on the climate change in Australia website.

[END_CCF]

Probability Neutral Burst Initial Loss

[BURSTIL]

min (h)\AEP(%),50.0,20.0,10.0,5.0,2.0,1.0

60 (1.0),17.6,10.7,10.6,11.3,10.9,9.0

90 (1.5),17.1,11.2,10.9,11.8,11.9,9.3

120 (2.0),16.3,10.8,10.5,11.4,11.1,9.4

180 (3.0),17.7,12.1,10.9,11.3,9.7,7.3

360 (6.0),18.1,13.6,13.3,14.1,12.4,8.1

720 (12.0),21.1,15.8,14.6,14.6,12.5,8.5

1080 (18.0),22.0,17.3,16.6,17.1,14.3,9.0

1440 (24.0),24.3,19.2,18.7,19.1,17.1,11.5

2160 (36.0),25.6,21.0,20.4,21.2,19.3,15.9

2880 (48.0),26.2,21.5,21.4,22.4,20.6,15.4

4320 (72.0),26.6,22.1,23.3,24.0,21.9,15.7

[BURSTIL_META]

Time Accessed,18 June 2024 01:04PM

Version,2018_v1

Note,As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. Probability neutral burst initial loss values for NSW are to be used in place of the standard initial loss and pre-burst as per the losses hierarchy.

[END_BURSTIL]

Transformational Pre-burst Rainfall

[PREBURST_TRANS]

min (h)\AEP(%),50.0,20.0,10.0,5.0,2.0,1.0

60 (1.0),8.4,15.3,15.4,14.7,15.1,17.0

90 (1.5),8.9,14.8,15.1,14.2,14.1,16.7

120 (2.0),9.7,15.2,15.5,14.6,14.9,16.6

180 (3.0),8.3,13.9,15.1,14.7,16.3,18.7

360 (6.0),7.9,12.4,12.7,11.9,13.6,17.9

720 (12.0),4.9,10.2,11.4,11.4,13.5,17.5

1080 (18.0),4.0,8.7,9.4,8.9,11.7,17.0

1440 (24.0),1.7,6.8,7.3,6.9,8.9,14.5

2160 (36.0),0.4,5.0,5.6,4.8,6.7,10.1

2880 (48.0),0.0,4.5,4.6,3.6,5.4,10.6

4320 (72.0),0.0,3.9,2.7,2.0,4.1,10.3

[PREBURST_TRANS_META]

The tranformational pre-burst is intended for software suppliers in the NSW area and is simply the Initial Loss - Burst Initial Loss. It is not appropriate to use these values if considering a calibrated initial loss.

[END_PREBURST_TRANS]

[ENDTXT]

APPENDIX C

ARTC Review



Document Control Information			
	Contractor DC to update for re-submission	Submitted Document No. or Transmittal No.:	Martinus-PTRAN-001118
Project:	2100 - A2I	Date Submission Received:	24/03/2025
Comment Sheet Number_Revision:	5-0052-210-IHY-W7-CS-0001_C	Comment Sheet Title:	*External Comment Sheet - A2I | Flood Design Report - Wagga Wagga Yard*
Revision Date:	24/03/2025	Documents related in Aconex (by IR DC)	Yes

	Review Comments (Reviewer)								Responses (Document Owner)					Close-Out			
#	PSR ID No. or Compliance Reference Document *(State the fully qualified reference the deliverable is non-compliant with)*	Document / drawing number - Revision Number	Section # / page #	Engineering Assurance Stage	Comment *(for example must be specific on non compliance. Reference mark-ups, if required)*	Comment Type	Full Name	Date	Full Name	Company	Date	Response *(must be specific on how the comment has been addressed. Agreed approach for re-submission)*	Documentation Section # / Figure #	Full Name	Date	Comment Status	Close-Out Comment
Example	*IR-SR-A2I-517 or 01-3500-PD-P00-DE-0008-A*	*0-0000-900-PEN-00-TE-0020_A*		*CRR*	*Is there sufficient space for a 10m maintenance vehicle to turn around at the end of the RWAP?*	*Non-Compliant*	*Joe Bloggs*	*15/02/2023*	*Fred Bloggs*	*Designer*	*15/03/2023*	*The area has been increased - now possible to turn 12.5m vehicle. The drawings are updated.*	*01-3500-PD-P00-DE-0008-A 01-3500-PD-P00-DE-0015-C*	*Jane Doe*	*27/09/2023*	CLOSED	
1	Annexure F Management Requirements: 6.1.1	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 1, General comments	Draft	can you include a section to cover and address the planning mitigation measures and future conditions of approval. At the minute there's HFWQ3 to HFWQ6 in the EIS specific to flooding. Even if the mitigation is not relevant to the package, I would include a note saying why that's the case.	Minor	Chris Fay	16/11/2023	Jasmine Lee / Zoe Cruice	DJV Flooding Lead	8/12/2023	The Contractor's requirements wrt the EIS are those anticipated CoA included in Deed Schedule 8. We note and understand that these are based on N2N and may not be the same as the A2I EIS CoA or MM once the EIS is determined/approved. The Contractor has been provided with an 'Early Warning Notice' by IR to respond with an indication of impact to engaged scope as a result of the A2I EIS PIR MM. Future reports will include a register of the EIS aCoA as per Schedule 8, and the proposed controls and measures. YL (18/03/2025): A section including HFWQ3 to HFWQ5 has been added to the report. It should be noted that HFWQ6 is related to the construction phase which is outside of DJV scope. As such, HFWQ6 is not included.	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Section 2.3	Stephen Brierley	22/06/2024	TRANSFERRED	COAs were addressed and agreed upon to be transferred to environementally approved forum. IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
2	Annxure F, Appendix F1, Design Development Deliverables-clarification	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 8, Section 1.3.2.1 Flood Studies	Draft	Reference to be updated.	Minor	Liam West	13/11/2023	Jasmine Lee	DJV Flooding Lead	8/12/2023	Noted. This will be updated in the next design report.		Andrew Aitken	14/02/2025	CLOSED	To be reviewed when updated in Next phase Closed - document structure and content revised and no breadcrumbs provided to find issue - no issues in section 1.6 where flood studies are discussed. IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
3	Annexure F, Appendix F1, Design Development Deliverables (Design Mgt Spec 0-0000-900-PEN-00-SP-0008) - Clarification	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 11, 5-0052-210-IHY-W7-RP-0001_A, Section 1.8	Draft	Is there any necessity for a drainage survey? Please include your comments and recommendations with your findings and observations.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	Yes. Correct representation of the existing culverts and drainage channels is important as they will impact the accuracy of model results. This is particularly the case on major flow paths identified in Fig 1-3 of the report where the drainage details used in the supplied model were based on assumed values.		Ayub Ali	26/06/2024	CLOSED	To be reviewed at NP IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
4	Annexure F, Appendix F1, Design Development Deliverables (Design Mgt Spec 0-0000-900-PEN-00-SP-0008) - Clarification	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 14, 5-0052-210-IHY-W7-RP-0001_A, Table 2-1	Draft	Any mitigation measure tested and recommended? Inclusion of some details in response to the above question is required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	A few potential mitigation measures have been identified and provided on Page 37 based on the current understanding of the flood impacts. However, these have not been tested yet. These recommended solutions will be incorporated and evaluated in the next design stage.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
5	IR-SR-A2I-333 The Track System shall prevent water ponding.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 14, 5-0052-210-IHY-W7-RP-0001_A, Table 2-1	Draft	Appropriate drainage system to be incorporated to prevent any ponding.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	Noted. The proposed channel on the southern side of the rail corridor will be further refined in the next stage to prevent ponding.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
6	IR-SR-A2I-352	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 14, 5-0052-210-IHY-W7-RP-0001_A, Table 2-1	Draft	This requirement is more focused on the crossfall and drainage of the formation - what is the relevance of flood velocity to ponding on the formation?	Minor	Oliver Lupton	13/11/2023	Jennyl Estil	DJV Flood Modeller	8/12/2023	Noted. The low flood velocity is less likely to cause any damage to the formation when the flood water overtops the railway. As this requirement is more relevant to drainage, it will be removed from flooding in the next stage.		Oliver Lupton	18/12/2023	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
7	IR-SR-A2I-333 The Track System shall prevent water ponding.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 14, 5-0052-210-IHY-W7-RP-0001_A, Table 2-1	Draft	Any mitigation measure tested and recommended to ensure an appropriate drainage system is incorporated to prevent any ponding.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	A few potential mitigation measures have been identified and provided on Page 37 based on the current understanding of the flood impacts. However, these have not been tested yet. These recommended solutions will be incorporated and evaluated in the next design stage.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
8	IR-SR-A2I-333 The Track System shall prevent water ponding.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 14, 5-0052-210-IHY-W7-RP-0001_A, Table 2-1	Draft	Any mitigation measure tested and recommended to ensure an appropriate drainage system is incorporated to prevent any ponding.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	A few potential mitigation measures have been identified and provided on Page 37 based on the current understanding of the flood impacts. However, these have not been tested yet. These recommended solutions will be incorporated and evaluated in the next design stage.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
9	IR-SR-A2I-333 The Track System shall prevent water ponding.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 15, 5-0052-210-IHY-W7-RP-0001_A, Table 2-2	Draft	Any mitigation measure tested and recommended to ensure an appropriate drainage system is incorporated to prevent any ponding.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	A few potential mitigation measures have been identified and provided on Page 37 based on the current understanding of the flood impacts. However, these have not been tested yet. These recommended solutions will be incorporated and evaluated in the next design stage.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
10	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 16, 5-0052-210-IHY-W7-RP-0001_A, Table 2-2	Draft	Any flood hazard mitigation measure required and recommended? Inclusion of some details are required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	A few potential mitigation measures have been identified and provided on Page 37 based on the current understanding of the flood impacts. However, these have not been tested yet. These recommended solutions will be incorporated and evaluated in the next design stage.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
11	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 16, 5-0052-210-IHY-W7-RP-0001_A, Table 2-2	Draft	Any flood hazard mitigation measure required and recommended? Inclusion of some details are required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	A few potential mitigation measures have been identified and provided on Page 37 based on the current understanding of the flood impacts. However, these have not been tested yet. These recommended solutions will be incorporated and evaluated in the next design stage.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
12	Annexure F, Appendix F1, Design Development Deliverables (Design Mgt Spec 0-0000-900-PEN-00-SP-0008) - Clarification	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 20, 5-0052-210-IHY-W7-RP-0001_A, Section 4.1.1.2	Draft	What is the reason for the latest version 2023-03-AC producing significantly different result? Generally, the latest version would produce more accurate result. Hence, it is expected that the latest version is used for simulation unless there is a valid reason.	Major	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	Significant changes in the TUFLOW computational engine, particularly in the 2023-03-AC release, include updates to elevations sampling from breaklines, structure loss methods, and momentum flux for 1D/2D connections. These changes are expected to impact model results compared to previous versions. While the latest software release may theoretically enhance accuracy, it is crucial to prioritise achieving results similar to the model developed using the 2018 release, as this version of the model underwent calibration. After thorough comparison and testing, the 2020-10-AF version is deemed suitable for the intended purpose.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
13	Annexure F Management Requirements: 6.1.1	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 23, Section 4.1.3.1 Climate Change Pg 22	Draft	'Please provide more detail about the 'climate change factor' included in the modelling. Please refer to the DJV sustainability specialist for details required to address the Climate Change requirements of the IS rating. Please ensure sufficient detail, aligned to the sustainability objectives for the project, are included at the PDR stage.	Minor	Andrew Aitken	15/11/2023	Jasmine Lee	DJV Flooding Lead	8/12/2023	'Section 4.1.3.1 only shows the approach to climate change modelling. Relevant climate change results are described in the results section. If required, climate change could be a separate section in the next design stage.		Andrew Aitken	10/05/2024	CLOSED	To be reviewed when updated in PDR pahse. IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
14	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 30, 5-0052-210-IHY-W7-RP-0001_A, Section 6.2	Draft	Any flood hazard mitigation measure required and recommended? Inclusion of some details are required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	The flood hazard in the green space south of the rail is present in the existing scenario, and is slighly reduced in the design scenario. The high hazard area is within the proposed channel south of the rail. The recommended solutions on Page 37 will focus on not making the current hazard worse in areas outside the project boundary. The high hazard within the proposed channel will be managed through Safety in Design measures, the details of which will be considered in the next design stage.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
15	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 32, 5-0052-210-IHY-W7-RP-0001_A, Table 6-8	Draft	Any mitigation measure tested and recommended? Inclusion of some details are required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	The potential mitigation measures on Page 37 and other additional solutions will be explored and tested in the next design phase.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
16	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 32, 5-0052-210-IHY-W7-RP-0001_A, Table 6-8	Draft	Any mitigation measure tested and recommended? Inclusion of some details are required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	The potential mitigation measures on Page 37 and other additional solutions will be explored and tested in the next design phase.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
17	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 32, 5-0052-210-IHY-W7-RP-0001_A, Table 6-8	Draft	Any mitigation measure tested and recommended? Inclusion of some details are required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	The potential mitigation measures on Page 37 and other additional solutions will be explored and tested in the next design phase.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
18	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 32, 5-0052-210-IHY-W7-RP-0001_A, Table 6-8	Draft	Any mitigation measure tested and recommended? Inclusion of some details are required.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	The potential mitigation measures on Page 37 and other additional solutions will be explored and tested in the next design phase.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
19	Annexure F, Appendix F1, Design Development Deliverables (Design Mgt Spec 0-0000-900-PEN-00-SP-0008) - Clarification	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 35, 5-0052-210-IHY-W7-RP-0001_A, Table 6-9	Draft	'In identifying non-compliance to QDL, it could have been better to delineate non-compliance areas outside the IR corridor separately as the velocity increase is huge (up to four times). Prospective mitigation options are also to be discussed in the report.	Major	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	This is noted, the report will be updated accordingly to distinguish impacts inside and outside the project boundary. Discussion of mitigation measures will be incorporated in the next submission once these solutions have been tested in the model.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
20	IR-SR-A2I-459 The Corridor System shall provide mitigation for flood impacts no worse than existing conditions.	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 36, 5-0052-210-IHY-W7-RP-0001_A, Table 6-10	Draft	A short discussion on its risk and mitigation measure is recommended.	Minor	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	Noted. Risk and mitigation measures will be covered in the Safety in Design workshops and a short discussion will be included in the report.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.

Comment Sheet Number_Revision:	5-0052-210-IHY-W7-CS-0001_C	**Comment Sheet Title:**	***External Comment Sheet - A2I | Flood Design Report - Wagga Wagga Yard***
Revision Date:	24/03/2025	**Documents related in Aconex** (by IR DC)	Yes

Review Comments (Reviewer)								Responses (Document Owner)					Close-Out			
#	PSR ID No. or Compliance Reference Document *(State the fully qualified reference the deliverable is non-compliant with)*	Document / drawing number - Revision Number	Section # / page #	Engineering Assurance Stage	Comment *(for example must be specific on non compliance. Reference mark-ups, if required)*	Comment Type	Full Name	Date	Full Name	Company	Date	Response *(must be specific on how the comment has been addressed. Agreed approach for re-submission.)*	Documentation Section # / Figure #	Full Name	Date	Comment Status	Close-Out Comment
21	Annexure F Management Requirements: 6.1.1	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 76, 5-0052-210-IHY-W7-RP-0001_A, Appendix A4	Draft	Discrete impacts warrant further investigation for its validity (i.e. model noise or not).	Opportunity	Ayub Ali	28/11/2023	Jennyl Estil	DJV Flood Modeller	7/12/2023	Discrete impacts similar to this one normally occur on low lying areas where flood water tend to pond. The validity of this impact will be ascertained in the next submission.		Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
22	Annexure F, Appendix F1, Design Development Deliverables (Design Mgt Spec 0-0000-000-PEN-00-SP-0008) - Clarification	5-0052-210-IHY-W7-RP-0001_A.pdf	Page 20, 5-0052-210-IHY-W7-RP-0001_A, Section 4.1.1.2	Draft	Transferred from #12 It's understood that the TUFLOW version 2020-10-AF produced better calibration result compared to the latest version 2023-03-AC while acknowledging the fact that the latest version introduced a significant change to the model features including the break-line representations, structure losses method and momentum flux for 1d-2d connection. As mentioned earlier, the latest version was of generally		Ayub Ali	28/11/2023	Zoe Cruice	Eng Mgr	5/07/2024	Pleaes refer section of the Design report and the Flood Assessment Report for more details on the calibration of the models.	FAR	Ayub Ali	26/06/2024	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
23	confirmation	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 1	PDR	Steve Smith / Michael Simons: Current track alignment RH curve coming into Wagga yard then into tangent through the yard into a LH curve out of the yard near Edmondson St bridge - Question: Corridor require this arrangement to be maintained and if any changes more details required to explain why.	Non-Compliant	Steve Smith	24/05/2024	Rajesh Yadav	Martinus Rail	3/07/2024	Refer to Responses to comments 122 and 123.		Stephen Brierley	23/01/2025	CLOSED	Design optimised IR DC - 21/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_L (Ref. Martinus-PTRAN-000996) as it was not actined by the reviewer
24	confirmation	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 1	PDR	Corridor (Wagga) have a EOI to relocate 50A points south to remove off the curve, history of steel work failure at this location, wanting to resolve legacy issue for the local team. Steve	Opportunity	Steve Smith	24/05/2024	Rajesh Yadav	Martinus Rail	3/07/2024	Noted. However, relocation of 50A points is not in the current scope of Inland Rail A2P as per PSR Annexure A. It is also not mentioned in the reference design. ARTC directive required.		Stephen Brierley	2/09/2024	CLOSED	Not in scope. IR DC - 21/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_L (Ref. Martinus-PTRAN-000996) as it was not actined by the reviewer
25	PSR Annexure B Technical Requirements (IR-SR-A2I-349, IR-SR-A2I-352, IR-SR-A2I-458, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 12, 5-0052-210-IHY-W7-RP-0001_B, Section 1.8 (Page 11)	PDR	Detailed survey of existing drainage structures is critical for its accurate modelling and the design of any mitigation works. Response to an SDR comment identified its importance. However, it appears to be still outstanding. When this survey will be completed and its data will be utilised?	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	5-0052-210-IHY-W7-RP-0001_B (PDR flood design report) is superseded by 5-0052-210-IHY-W7-RP-0001_C (DDR Flood Design report). Detailed Survey has been provided for the DDR stage. Existing drainage data for the site was adopted based on comparing the MOFFS TUFLOW model (WMAwater, 2021) and detailed survey along with assumptions for missing drainage details as provided by the DJV drainage team.	Section1.11 in 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
26	PSR Annexure B Technical Requirements (IR-SR-A2I-349, IR-SR-A2I-352, IR-SR-A2I-458, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 12, 5-0052-210-IHY-W7-RP-0001_B, Section 1.8 (Page 11)	PDR	Detailed survey of existing drainage structures is critical for its accurate modelling and the design of any mitigation works. It appears to be still outstanding. When this survey will be completed and its data will be utilised?	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	5-0052-210-IHY-W7-RP-0001_B (PDR flood design report) is superseded by 5-0052-210-IHY-W7-RP-0001_C (DDR Flood Design report). The detailed survey does not cover the area (Colemans Street) as it is located far upstream of the site. However, as per the Proof Engineer comments, the inflow from the upstream catchment has been assigned to the open channel at Colemans Street as a conservative method. As such, the drainage system at Colemans Street is less likely to affect the flooding within the site.	Section1.11 in 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
27	PSR Annexure B Technical Requirements (IR-SR-A2I-349, IR-SR-A2I-352, IR-SR-A2I-458, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 12, 5-0052-210-IHY-W7-RP-0001_B, Section 1.8 (Page 11)	PDR	When this survey will be undertaken	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	5-0052-210-IHY-W7-RP-0001_B (PDR flood design report) is superseded by 5-0052-210-IHY-W7-RP-0001_C (DDR Flood Design report). The detailed topography survey of Railway street was added to the model. Existing drainage data for the site was adopted based MOFFS TUFLOW model. The flood impact is compliant as the proposed conditions of Wagga Wagga Yard do not worsen the existing flooding conditions in the industrial area.	Section 5 (page 29) in 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
28	Opportunity	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 22, 5-0052-210-IHY-W7-RP-0001_B, Table 4-2 (Page 21)	PDR	Reference appears to be incorrect. Correction is recommended	Opportunity	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	Noted. This has been corrected in the Wagga Yard DDR Flood Design report report (Refer to 5-0052-210-IHY-W7-RP-0001_C)	Table 4-2 in 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
29	PSR Annexure B Technical Requirements (IR-SR-A2I-349)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 37, 5-0052-210-IHY-W7-RP-0001_B, Section 6.3 (Pages 36 and 37)	PDR	What about the depth of overtopping? Inclusion of both horizontal and vertical scales in Figures 6-4 and 6-5 will help getting this information. Discussion on the depth of overtopping is also essential for its clarity.	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	Noted. Overtopping depth is discussed in the Wagga Yard DDR Flood Design report for existing and design scenario in Table 6-1 and Table 6-7 respectively. (Refer to 5-0052-210-IHY-W7-RP-0001_C)	Table 6-1 and Table 6-7 in 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
30	PSR Annexure B Technical Requirements (IR-SR-A2I-459, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 38, 5-0052-210-IHY-W7-RP-0001_B, Section 6.3 (Page 37)	PDR	Are there any changes of velocity at that location due to IR? Does it exceed the limit? What is the solution if the velocity impact exceeds its limits at that location?	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	5-0052-210-IHY-W7-RP-0001_B (PDR flood design report) is superseded by 5-0052-210-IHY-W7-RP-0001_C (DDR Flood Design report). In the DDR assessment, the changes in velocity comply with CoA limits and there is no non-compliance identified.	Section 6.3 of 0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
31	PSR Annexure B Technical Requirements (IR-SR-A2I-459, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 39, 5-0052-210-IHY-W7-RP-0001_B, Section 6.4.1 (Page 38)	PDR	What solutions are proposed?	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	The non-compliance about the property on Sturt Highway identified in PDR stage has been solved by incorporating the latest survey and DDR design. So there is no non-compliance in DDR stage (Refer to section 6.4 of 5-0052-210-IHY-W7-RP-0001_C) .	Section 6.4 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
32	PSR Annexure B Technical Requirements (IR-SR-A2I-459, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 41, 5-0052-210-IHY-W7-RP-0001_B, Section 6.4.2 (Page 40)	PDR	How much is the impacted area outside the project boundary? What solutions are recommended?	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	The impacted area is very limited. Please note that Wagga Wagga Yard DDR Flood Report has been completed (5-0052-210-IHY-W7-RP-0001_C). By incorporating the latest DDR design and survey, there is no non-compliance identified. (Refer to section 6.4 of 5-0052-210-IHY-W7-RP-0001_C).	Section 6.4 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
33	PSR Annexure B Technical Requirements (IR-SR-A2I-459, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 42, 5-0052-210-IHY-W7-RP-0001_B, Section 6.4.2 (Page 41)	PDR	What is impacted area outside the project boundary? What solutions are recommended?	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	The impacted area is very limited. Please note that Wagga Wagga Yard DDR Flood Report has been completed (5-0052-210-IHY-W7-RP-0001_C). By incorporating the latest DDR design and survey, there is no non-compliance identified. (Refer to section 6.4 of 5-0052-210-IHY-W7-RP-0001_C).	Section 6.4 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
34	PSR Annexure B Technical Requirements (IR-SR-A2I-459, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 42, 5-0052-210-IHY-W7-RP-0001_B, Section 6.4.2 (Page 41)	PDR	What is impacted area outside the project boundary? What solutions are recommended?	Non-Compliant	Ayub Ali	9/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	The impacted area is very limited. Please note that Wagga Wagga Yard DDR Flood Report has been completed (5-0052-210-IHY-W7-RP-0001_C). By incorporating the latest DDR design and survey, there is no non-compliance identified. (Refer to section 6.4 of 5-0052-210-IHY-W7-RP-0001_C).	Section 6.4 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
35	Opportunity	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 42, 5-0052-210-IHY-W7-RP-0001_B, Section 6.4.2 (Page 41)	PDR	Appears to be out of place	Opportunity	Ayub Ali	10/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	Noted. This has been corrected in the Wagga Yard DDR Flood Design report report (Refer to 5-0052-210-IHY-W7-RP-0001_C section 6.4.2)	Section 6.4.2 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
36	PSR Annexure B Technical Requirements (IR-SR-A2I-349, IR-SR-A2I-352, IR-SR-A2I-458, IR-SR-A2I-459, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 44, 5-0052-210-IHY-W7-RP-0001_B, Section 7 (Page 43)	PDR	This option may increase the flood level upstream and reduce the rail flood immunity.	Non-Compliant	Ayub Ali	10/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	The design of cess drain has been assessed in the Wagga Wagga Yard DDR Flood Report (5-0052-210-IHY-W7-RP-0001_C) and it is found the cess drain does not result in impacts outside the project boundary or worsen the flood immunity.	Section 6.4.1 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
37	PSR Annexure B Technical Requirements (IR-SR-A2I-352, IR-SR-A2I-459, IR-SR-A2I-464 and IR-SR-A2I-465)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 44, 5-0052-210-IHY-W7-RP-0001_B, Section 7 (Page 43)	PDR	This option may cause ponding upstream.	Non-Compliant	Ayub Ali	10/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	Please note that Wagga Wagga Yard DDR Flood Report has been completed (5-0052-210-IHY-W7-RP-0001_C). In the DDR design, there is no bund proposed. DDR design has been assessed and it shows compliances with CoA.	Section 6.4 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
38	PSR Annexure B Technical Requirements (IR-SR-A2I-333)	5-0052-210-IHY-W7-RP-0001_B.pdf	Page 44, 5-0052-210-IHY-W7-RP-0001_B, Section 7 (Page 43)	PDR	This 'ponding' means lack of free drainage which is to be prevented	Opportunity	Ayub Ali	10/05/2024	Thinesh Thirumurugan	DJV Flood Modeller	11/02/2025	Please note that Wagga Wagga Yard DDR Flood Report has been completed (5-0052-210-IHY-W7-RP-0001_C). In the DDR design, there is no ponding in the track system as the proposed channels have grading towards proposed culvert outlets which prevents ponding. Refer to Drainage Design section 4.5 on the Wagga Yard Design report (5-0052-210-BEN-W7-RP-0001).	Section 2.1 of 5-0052-210-IHY-W7-RP-0001_C	Ayub Ali	19/02/2025	CLOSED	IR DC - 13/02/2025: The comment transferred from 5-0052-210-PEN-W7-CS-0001_K (Ref. Martinus-PTRAN-000946) IR DC - 21/02/2025: 5-0052-210-PEN-W7-CS-0001_L received via Martinus-PTRAN-000996 with slighlty different version, however this comment has not been updated as it was already updated by reviewer.
39	MISSING COMPLIANCE REFERENCE	5-0052-210-IHY-W7-RP-0001_C.pdf	General Comment	DDR	as this location resides within the levee banks some notation regarding this.	Opportunity	Anthony Godfrey	24/02/2025	Zoe Cruice	Eng Manager	24/03/2025	Can you please confirm the location of the levee banks you are referring to here at Wagga Wagga Yard? Is this comment applicable to this package or an accidental copy from another review?		Stephen Brierley	1/05/2025	CLOSED	SME unable to respond, no compliance reference, MR assume are compliant, closed.
40	IS v1.2 TM and A2I SuMP	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 1, Overarching comment	DDR	Despite previously confirming they will not be targeting this credit, Martinus have indicated they are targeting lvl 1 of the Lan-4 credit. The MR Sustainability Team need to review this document and confirm whether the outcomes align with the IS ruling and additional guidance around flooding limits for the four different categories. As the Lan-4 credits is now being targeted, it would be reasonable for a section to be included on the requirements MR must address and where this has been addressed.	Non-Compliant	Ben Casey	17/02/2025	Jye Witham	Martinus Rail	17/03/2025	Confirmation has been previously provided to Inland Rail stating that Lan-4 is not being targetted for A2I during recent weightings assessment (refer MARTINUS-TRANSMIT-002442) Confirming that no further action is required within the Wagga Wagga Yard Flood Design Report.	Refer to MARTINUS-TRANSMIT-002442 regarding Lan-4	Ben Casey	10/04/2025	CLOSED	Comment closed upon re-confirmation that MR are not targetting Lan-4
41		5-0052-210-IHY-W7-RP-0001_C.pdf	Page 21, Table 3-3	DDR	Spelling - Ballast, not ballas.	Opportunity	Hartley Bulcock	26/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	The spelling has been corrected.	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Table 3-3	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the snipped evidence of correction.
42	Opportunity	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 25, 5-0052-210-IHY-W7-RP-0001_C, Section	DDR	Appears to be a typo. It would be WBNM instead of WBMN.	Opportunity	Ayub Ali	17/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	The typo has been corrected	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Section 4.1	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the snipped evidence of correction.
43	Opportunity	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 34, 5-0052-210-IHY-W7-RP-0001_C, Table 6-	DDR	The second dot points (Refer to) do not refer to anything. Hence, its removal or rewriting is suggested.	Opportunity	Ayub Ali	17/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	The cross-reference issue has been corrected. The 3rd dot point is removed, connecting the 2nd and 4th dot points.	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Table 6-5	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the snipped evidence of correction.
44	Opportunity	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 34, 5-0052-210-IHY-W7-RP-0001_C, Table 6-	DDR	The second dot point (Refer to) does not refer to anything. Hence, its removal or rewriting is suggested.	Opportunity	Ayub Ali	17/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	The cross-reference issue will be corrected. The 3rd dot point is removed, connecting the 2nd and 4th dot points.	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Table 6-9	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the snipped evidence of correction.

Comment Sheet Number_Revision:	5-0052-210-IHY-W7-CS-0001_C	**Comment Sheet Title:**	***External Comment Sheet - A2I | Flood Design Report - Wagga Wagga Yard***
Revision Date:	24/03/2025	**Documents related in Aconex** (by IR DC)	Yes

	Review Comments (Reviewer)							**Responses (Document Owner)**					**Close-Out**			
#	PSR ID No. **or** Compliance Reference Document *(State the fully qualified reference the deliverable is non-compliant with)*	Document / drawing number - Revision Number	Section # / page #	Engineering Assurance Stage	Comment *(for example must be specific on non compliance. Reference mark-ups, if required)*	Comment Type	Full Name	Date	Full Name	Company	Date	Response *(must be specific on how the comment has been addressed. Agreed approach for re-submission)*	Documentation Section # / Figure #	Full Name	Date	Comment Status	Close-Out Comment
45	PSR Annexure B: Technical Requirements (identifiers 5.4.2 and 4.5.3)	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 37, 5-0052-210-IHY-W7-RP-0001_C, Section 6.3	DDR	Tables 6-1 and 6-7 identified a location where floodwater overtops the rail in 10% AEP (smallest modelled design flood) events and included overtopping flood depths on the rail in various events from 10% AEP up to 1% AEP floods. It is understood that the flood immunity of the rail has not been worsened in developed conditions compared to existing conditions. However, it has not been identified what is the flood immunity at this location (i.e., in which largest event flood water does not overtop the rail and the top of formation). We understand that the smallest modelled flood event (10% AEP) shows overtopping at this section of the rail and further smaller design flood events modelling will be necessary to identify which flood events do not overtop the rail and the top of formation. At least another event (e.g., 20% AEP flood) could have been simulated to ascertain its flood immunity. Otherwise, justification in the report is needed why further smaller events are not simulated. In that case, inclusion of the top of formation level, rail level and simulated flood levels into the report at this location is necessary for understanding the flooding risks, service reliability and possible mitigation measures.	Non-Compliant	Ayub Ali	17/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	This is not a non-compliance, but rathre an Opportunity. There is no contract or CSSI CoA requirement to ascertain the actual rail immunity. As such, justification is provided as to why the events modelled have been adopted.The table containing top of formation, top of the rail and flood level have been provided in Section 4.2.3 and Section 6.3 **4.2.3 Design Events** The storm durations of 10min, 15min, 20min, 25min, 30min, 45min, 60min, 90min, 120mins, 180mins, 270min, 360mins, 540min and 720min were modelled. An ensemble of 11 temporal patterns for PMF and 10 temporal patterns for other events was run for each duration as recommended in ARR2019. The critical durations were determined based on the maximum envelope method across the selected durations. As per CoA E39, the document listed in Condition A1 (EIS report) should be carried out. In the EIS report, the smallest modelled event is 5% AEP. However, to be consistent with the previous stage (SDR) and PDR),all flood design reports 10% AEP is selected as the smallest design event. Table 6-9: Peak Flood Velocity – Design Condition **Design Events / Flood Velocity** 10% AEP: • The peak velocity on the site is generally below 1m/s. The peak velocity (generally below 1.5m/s at downstream of culverts (Events 1 and 2) and within open channels (Point 6). 5% AEP: • Refer to Table 6-10 for velocity based on points of interest. 2% AEP 1% AEP 1% AEP + Climate Change PMF: • The peak velocity on the site is generally below 1.5m/s. The peak velocity (e generally below 2.1 m/s at downstream of culverts (Events 1 and 2) and within open channels (Point 6).; • Refer to Table 6-10 for velocity based on points of interest. **Design Events / Flood Hazard** 10% AEP: • The peak hazard along the site is generally H1 to H2; • Refer to Table 6-8 for flood hazard comparison based on points of interest. 5% AEP: • The peak hazard along the site is generally H1 to H2; • Refer to Table 6-8 for flood hazard comparison based on points of interest. 2% AEP: • The peak hazard along the site is generally H2 to H3; • Refer to Table 6-8 for flood hazard comparison based on points of interest. 1% AEP: • The peak hazard along the site is generally H2 to H3; • Refer to Table 6-8 for flood hazard comparison based on points of interest. 1% AEP + Climate Change: • The peak hazard along the site is generally H3 to H4; • Refer to Table 6-8 for flood hazard comparison based on points of interest. PMF:	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Refer to Section 4.2.3, Table 6-13 and 6-14 in Section 6.3 3.3 PDR to DDR Key design changes between the PDR and the DDR Design are listed in Table 3-3 Table 3-3: Design Differences Between PDR and DDR Item / Difference / Reason for Difference 1 / Incorporation of the latest existing conditions survey / A new existing conditions survey was undertaken 2 / Updated Existing Drainage data / Updated based on detailed survey and Wagga Wagga City Council (WWCC) data provided by DJV drainage team 3 / Incorporation of updated rail design (ballast) capping and top of Rail) / New rail design	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the satisfactory response.
46	CoA E42	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 40, 5-0052-210-IHY-W7-RP-0001_C, Section 6.4.4	DDR	It appears that the flow rate vs time hydrographs at some locations have been utilised for estimating the duration of inundation which is not appropriate. Instead, flood level vs time hydrographs should be used for all locations in estimating the duration of inundation. The term "flow level vs time" should also be corrected to "flood level vs time".	Non-Compliant	Ayub Ali	17/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	The flow rate vs time hydrographs is removed. Section 6.4.4 is updated. The term "Flow level vs time will be corrected to "Flood level vs time"	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Section 6.4.4 **6.4.4 Changes in Duration of Inundation** The analysis around the changes in the duration of inundation was undertaken by comparing the existing and design flow rate vs time, and flood level vs time in selected locations. The locations adopted for the comparison are shown in Figure 6-4. Figure 6-5 & Figure 6-6 show the comparison of flow level vs time for Reporting Locations 1 and 2, respectively. Both the existing and design flood level vs time, and flow rate vs time are mostly similar. These demonstrate that the design will not create an extra duration of inundation upstream and downstream outside the project boundary. Consequently, the changes in the duration of inundation comply with the CoA E42(a).  Figure 6-4: Reporting Locations for the Changes in Duration of Inundation	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the satisfactory response.
47	Clarification	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 43, 5-0052-210-IHY-W7-RP-0001_C, Section 6.4.5	DDR	No information about master design condition referred here is found in Section 4 under "Modelling Methodology". Hence, a clarification is required about it. More details to be included in the report how cumulative impact has been assessed. Generally, all the proposed designs to be included in the post development model.	Non-Compliant	Ayub Ali	17/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	The information of cumulative impact is added in Section 4 and Section 6.4.5.1	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Section 4	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the satisfactory response.
48	Opportunity	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 43, 5-0052-210-IHY-W7-RP-0001_C, Section 6.4.6	DDR	Appears to be a typo. Hence, correction is suggested.	Opportunity	Ayub Ali	17/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	The word "the" will be removed from the sentence	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Section 6.4.6 As stated in Section 6.2, due to implementation of a drainage channel south of the proposed rail line and two designed culverts at the site improved the flooding conditions. This resulted in lesser flood water flowing eastern downstream, resulting in improved flooding conditions at the industrial area (Approximately by 0.02 m) compared to the existing condition in 1% AEP (Refer to Figure 6-7 for changes in water level for 1% AEP). Hence the industrial area is not impacted due to Wagga Yard's proposed conditions. Refer to maps A37 to A51 in Appendix A for changes in flood level, velocity and hazard for all events up to 1% AEP with climate change in the industrial area. This complies with condition E40 of CoA and HFWQ4 of Updated Mitigation Measures (UMM) (refer to Table 2-2 and Table 2-3).	Ayub Ali	11/04/2025	CLOSED	This item is closed based on the snipped evidence of correction.
49	Opportunity	5-0052-210-IHY-W7-RP-0001_C.pdf	Page 43, 6.4.6	DDR	Please check units. This says that there is a 0.02mm reduction in flood level - like the width of a hair. Damn good model you've got :-) Is this actually noise? I don't need to see the revision, Gary, Ayub or Hartley can check	Opportunity	Wayne Window	24/02/2025	Thinesh Thirumurugan	DJV Flood Modeller	14/03/2025	It is a typo. The value is corrected to "0.02 m"	IFC submission design deliverables 5-0052-210-IHY-W7-RP-0001_D, Section 6.4.6 As stated in Section 6.2, due to implementation of a drainage channel south of the proposed rail line and two designed culverts at the site improved the flooding conditions. This resulted in lesser flood water flowing eastern downstream, resulting in improved flooding conditions at the industrial area (Approximately by 0.02 m) compared to the existing condition in 1% AEP (Refer to Figure 6-7 for changes in water level for 1% AEP). Hence the industrial area is not impacted due to Wagga Yard's proposed conditions. Refer to maps A37 to A51 in Appendix A for changes in flood level, velocity and hazard for all events up to 1% AEP with climate change in the industrial area. This complies with condition E40 of CoA and HFWQ4 of Updated Mitigation Measures (UMM) (refer to Table 2-2 and Table 2-3).			CLOSED	Sorted

Non-Compliant:	Non-compliance which requires correction before further design development occurs.
Opportunity:	Comment which identifies an opportunity to save capex, achieve increased quality or operational outcome. Not a non-compliance.

OPEN:	Comment has not been addressed.
CLOSED:	Comment is closed. No further action.
NEXT PHASE:	Comment response has been accepted. Resulting actions have been deferred to the next Phase of the Project (for Doc Control purposes the comment is considered OPEN)
TRANSFERRED:	Response is not acceptable or review has been split and the comment has been transferred to another comment sheet. (for Doc Control purposes comment is considered CLOSED)

APPENDIX D

External Consultation Review

D1 - TfNSW – awaiting IFC to status comments

D2 - CPHR – comments closed

D3 - WWCC – review period expired (considered close)

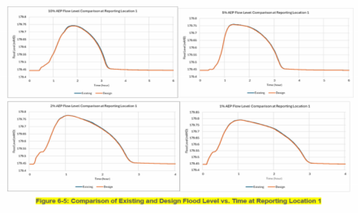


APPENDIX D1

TfNSW Review Comments



A2I Flood Design Report CONSULTATION - COMMENTS REGISTER

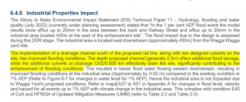
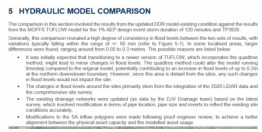
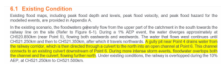
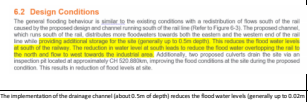
Stakeholder Category	Stakeholder Name	Flood Design Report name	Document reference (e.g. section, figure, table)	Date raised	Topic that comment relates to	Comments	Full Name	Role	Date	Response (must be specific on how the comment has been addressed)	Where addressed (Section # / Figure #)	Full Name	Company	Date	Comment Outcome	Close-Out Comment
State Government	TfNSW	5-0052-210-IHY-W7-RP-0001_C.1_Wagga Wagga Yard	Figures	14/04/2025	Flood Impacts	Please update/extend the flood impact figures to show the area where the Railway bridges over the Sturt Highway/Edward Street. There is a drainage trap-low point on the highway in this location that is prone to flooding and TfNSW needs to be assured that the project will not detrimentally impact the highway in this location.	Yucen Lu	DJV flood mdoeller	28/05/2025	This area is away from Wagga Yard site and is not affected by the Wagga Yard design. The Flood impact figures will be updated the show the Railway bridges over the Sturt Highway/Edward Street extent in IFC stage.					OPEN	
State Government	TfNSW	5-0052-210-IHY-W7-RP-0001_C.1_Wagga Wagga Yard	Figure 4-1	14/04/2025	Flooding	The WBNM subcatchments appear to be inconsistent in both size and shape. WBNM requires subcatchments to be relatively uniform in size and reasonably compact (i.e. not elongated) to ensure accurate hydrologic modelling. It is understood that the current WBNM model has been adopted from the Wagga Major Overland Flow Flood Study (MOFFS, 2021). Where errors are identified in an adopted model, it is appropriate to update the model in line with software requirements. A WBNM model with appropriately sized subcatchments should be developed. Flows from the revised model and the MOFFS 2021 model at the Wagga Wagga Yard should be compared.	Yucen Lu	DJV flood mdoeller	28/05/2025	WBNM model has been adopted from the Wagga Major Overland Flow Flood Study (MOFFS, 2021) and it did not show an error when running the model. The catchments contributing to Wagga Yard are similar, and the inflows adopted from the WBNM model are for local flows only. In addition, Instead, the subcatchment size and shape are based on the terrain and delineation. Based on the above, the current WBNM model is deemed appropriate for this assessment.					OPEN	
State Government	TfNSW	5-0052-210-IHY-W7-RP-0001_C.1_Wagga Wagga Yard	Figure 6-5 to 6-8	14/04/2025	Flooding	It would be much clearer to report flow (m^3/s) and level (mAHD) separately.	Yucen Lu	DJV flood mdoeller	28/05/2025	The flow comparison has been removed from the report, and only the flood levels will be compared for changes in duration of inundation. The figure captions have been updated to provide more clarity as "Comparison of Existing and Design Flood Level vs. Time"  Figure 6-5: Comparison of Existing and Design Flood Level vs. Time at Reporting Location 1	5-0052-210-IHY-w7-RP-0001_D Section 6.4.4 5.1 Existing Condition Existing flood maps, including peak flood depth and levels, peak flood velocity, and peak flood hazard for the modelled events, are provided in Appendix A. In the existing scenario, the floodwaters generally flow from the south and west towards the west. There are two major flow paths from Rocky Creek (east) and Lower Bullers Gully (south) and one minor one from a local tributary catchment (north). The rail corridor and area outside Jones				OPEN	

APPENDIX D2

CPHR Review Comments



A2I Flood Design Report CONSULTATION - COMMENTS REGISTER

Stakeholder Category	Stakeholder Name	Flood Design Report name	Document reference (e.g. section, figure, table)	Date raised	Topic that comment relates to	Comments	Full Name	Role	Date	Response (must be specific on how the comment has been addressed)	Where addressed (Section # / Figure #)	Full Name	Company	Date	Comment Outcome	Close-Out Comment
	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Generally	10/04/2025	Change to the design from that proposed in the EIS	The EIS flood assessment identified significant impacts at the Industrial area located to the east of the site. These impacts seem to have been mitigated by the redesign of the works including oess drains and culverts to redivert the overland flows through existing culverts under the rail line. Commentary on this major change in the design and the resultant change in flood impacts is lacking.	Thinesh Thirumurugan	DJV flood modeller	22/05/2025	Additional Commentary is added to provide more clarity on improved flooding conditions. 	5-0052-210-IHY-W7-RP-0001_D Section 6.4.6	Steve Manwaring	CPHR	21/7/2025	CLOSED	Support the additional words added.
	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Figure 5-2	10/04/2025	Poor quality figure and not referenced in the text.	Impossible to discern details in this figure (5-2). Suggest replacing with a higher quality image. Important since it seems that the changes between the different models are significant in the areas surrounding the site. WWCC need to be made aware of this as many areas are no longer flooded in the 1%AEP event whereas others are newly inundated. This figure is also not referenced in the text, I believe.	Thinesh Thirumurugan	DJV flood modeller	22/05/2025	The image issue will be investigated in the IFC stage. The flood model has been submitted to Wagga Wagga City Council for review. Areas with newly inundated and no longer dry cannot be directly compared with the results from the previous council flood study (MOFFS 2021). This is because the DJV model is updated specifically to assess the flooding characteristics of the Wagga Yard site area. It has been updated from the original Council model to incorporate a finer Model grid size and more detailed topographical data, including LiDAR, detailed surveys, drainage data, and inflow applications. These details are discussed in Section 5. 	5-0052-210-IHY-W7-RP-0001_D Section 5	Steve Manwaring	CPHR	21/7/2025	CLOSED	Explanation accepted.
	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Section 6.1 & Figure 6-1	10/04/2025	Accurate representation of existing drainage system	Figure 6-1 and the corresponding text details that overland flows are diverted via a gully pit (at point 4) under the rail line to an existing open drain to the north of the rail line to point 6. After this location there is confusion as to the details of the existing drainage infrastructure. The figure (6-1) seems to indicate an overland flow path to the north headed towards the Sturt Hwy between buildings. But discussions at the site visit (held between Martinus and CPHR on 2 April 2025) with Council Staff indicated that there is a box culvert that connects this drain to Bolton Park which does not seem to be represented correctly in this figure nor the modelling. Need to confirm with WWCC the details of this drainage infrastructure and correct the modelling if required.	Thinesh Thirumurugan	DJV flood modeller	22/05/2025	The flood model does contain a culvert at the end of Point 6. However, this was based on the data that was already modelled in the flood model, as no survey data was available during the time of modelling. The flow patterns indicate that the water overflows from the channel flowing further north. The section has been updated to provide more clarity. 	5-0052-210-IHY-W7-RP-0001_D Section 6.1	Steve Manwaring	CPHR	21/7/2025	CLOSED	Accept this explanation but still suggest that the details (location, dimensions) of the box culvert located after point 6 be confirmed with Wagga Council and included in the model to ensure accuracy .
	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Section 2.3 and Table 2-3	10/04/2025	Updated Mitigation Measures Compliance	Condition HF:W24 required additional survey and a review of the existing drainage structures at the Industrial area to confirm the adverse impacts identified at the EIS stage. Pleasingly this seems to have been completed and the model updated to now show no adverse impacts at this location. Although this seems to have been achieved through the addition of the cess drain to the south of the rail line it is unclear how the general reductions in flood impacts both north and south of the rail line has been achieved.	Thinesh Thirumurugan	DJV flood modeller	22/05/2025	The proposed channel, which runs south of the rail, provides additional storage for the area (generally up to 0.5m depth). This reduces the flood water levels south of the railway which also reduces the flood water overtopping the rail to the north. The section has been updated to provide more clarity. 	5-0052-210-IHY-w7-RP-0001_D Section 6.2 and 6.4.6	Steve Manwaring	CPHR	21/7/2025	CLOSED	Accept the explanation and additions to the report.
	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Section 6.2	10/04/2025	Cross drainage infrastructure	This section states that "*two proposed culverts drain the site via an inspection pit located at approximately CH 520.880km, improving the flood conditions at the site during the proposed condition*". The recently supplied design report indicates that the existing culverts will be retained. As such, suggest changing "*proposed*" to "*existing*" for consistency.	Thinesh Thirumurugan	DJV flood modeller	22/05/2025	The DDR flood model was developed based on the DDR Drainage design elements. The below image (4-31) from the S-0052-210-PEN-W7-RP-0001 suggests that the 2 proposed pipes are located left and right of the inspection and existing pipes are retained at the top and bottom of the inspection pit. The wording will be changed if the design is changed in IFC stage and this will be communicated with DJV Drainage Team during IFC stage. 		Steve Manwaring	CPHR	21/7/2025	CLOSED	Accept this clarification.
	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Figure 6-7	10/04/2025	Counterintuitive reduction in flow rates downstream	Figure 6-7 shows that in all flood events modelled the peak flows in the existing drainage channel to the north of the rail line have decreased. Given that the flows that previously were directed towards the Railway Avenue Industrial area (to the east of the site) are now redirverted through new culverts into this drainage channel (I think) this general decrease in peak flows does not make sense. Please explain how this has been achieved.	Thinesh Thirumurugan	DJV flood modeller	22/05/2025	The Proposed channel design provides additional storage (generally up to 0.5m depth). This reduces the flood water levels south of the railway. The reduction in water level in the south leads to reduce the flood water overtopping the rail to the north and flowing to the east towards the industrial area. This resulted in a decrease in flood levels in the north and west. Additional details added in the report to clarify. 	5-0052-210-IHY-w7-RP-0001_D Section 6.2	Steve Manwaring	CPHR	21/7/2025	CLOSED	Accept this clarification and the added words.
	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Section 6.4.6	10/04/2025	Decrease in the impacts at the Industrial Area.	As above, if this area now experiences a net decrease in flood impacts (as per Figure 6-9) where does the afflux now occur? Please elaborate.	Thinesh Thirumurugan	DJV flood modeller	22/05/2025	The implementation of the drainage channel (about 0.5m of depth) reduces the flood water levels (generally up to 0.02m or 20mm in the 1% AEP) south of the railway. The design channel adds additional flood storage. The reduction in water level in the south leads to reduce the flood water overtopping the rail to the north and flowing to the west towards the industrial area. The flood water overflows to the west near Edmondson Street Bridge where an increase in flood water level and a new wet area can be observed within the project boundary. The flood level increase outside the project boundary is less than 10mm. The flood design report was updated to provide more clarity. Please note that the water is not diverted but reduced due to additional flood storage which is the main reason for the improvement in water levels. A figure noting the changes in topography is included in the report for more clarification. 	5-0052-210-IHY-w7-RP-0001_D Section 6.4	Steve Manwaring	CPHR	21/7/2025	CLOSED	Accept this clarification and added words. The additional figure adds to the understanding.

	CPHR	A2I-Wagga Wagga Yard-Flood Design Report (S-0052-210-IHY-W7-RP-0001)	Figures A37-A41	10/04/2025	Design vs Existing Condition flood mapping	We cannot understand how a general decrease in flood impacts have been achieved across the board except for a small area of afflux at the ATRC owned site adjacent to Edmonson St. Generally when there is a flood level decrease somewhere there is usually a corresponding increase somewhere else. Clarification required.	Thinesh Thirumunugan	GIV flood modeller	22/05/2025	The implementation of the drainage channel (about 0.5m of depth) reduces the flood water (generally up to 0.02m or 20mm in the 1% AEP) levels at the south of the railway and increased the flood depth in the proposed scenario. The design channel adds additional flood storage. The reduction in water level in the south leads to reduce the flood water overtopping the rail to the north and flowing to the west towards the industrial area. Please note that the water is not diverted but reduced due to additional flood storage which is the main reason for the improvement in water levels. A figure noting the changes in topography is included in the report for more clarification.  Figure 4-6: Changes in Topography (Design vs Existing)	S-0052-210-IHY-w7-RP-0001_D Section 4.2.2	Steve Manwaring	CPHR	21/7/2025	CLOSED	Accept this clarification and the added figure.
	CPHR	A2I-Wagga Wagga Yard **Detailed Design Report** (S-0052-210-PEN-W7-RP-0001_C)	Section 4.6.1 - Existing Culverts	22/04/2025	Existing Culvert at Chainage 520.865lm	This section states that existing culverts passing underneath the track will be retained without modification. However there seems to be some confusion regarding the actual number and dimensions of the culvert/s located at chainage 520.865lm with a detailed survey report not being available. As a result the flood design report and corresponding flood modelling has assumed that 2x2.39Wx1.05H box culverts exist in this location consistent with ARTC records but contravening Council records and flood modelling. Table 2-7 in the DDR even states that "*existing drainage representations in the flood model have not been modified as there is no further drainage survey available at this stage*". Before finalising the designs it is recommended that detailed survey of this culvert structure is obtained and incorporated into the design reports and flood modelling to confirm impacts.	Thinesh Thirumunugan	GIV flood modeller	22/05/2025	The existing culvert information adopted in the flood model is consistent with the information stated in the main report (S-0052-210-PEN-W7-RP-0001_C Section 4.6.1). The culvert size will be confirmed via survey and if there is a significant discrepancy, further investigation will be carried out.		Steve Manwaring	CPHR	21/7/2025	CLOSED	Accept that the culvert dimensions will be confirmed with a physical survey and the modelling and reports corrected if needed.

APPENDIX D3

WWCC Review Comments



A2I Flood Design Report CONSULTATION - COMMENTS REGISTER

Stakeholder Category	Stakeholder Name	Flood Design Report name	Document reference (e.g. section, figure, table)	Date raised	Topic that comment relates to	Comments	Full Name	Role	Date	Response (must be specific on how the comment has been addressed)	Where addressed (Section # / Figure #)	Full Name	Company	Date	Comment Outcome	Close-Out Comment
Local Government	Wagga Wagga City Council	Flood Design Report - Wagga Wagga Yard	Hydraulic Model	14.04.2025	TUFLOW Model	Please provide a copy of the TUFLOW model files for review.	Yucen Lu	DJV flood mdoeller	28/05/2025	Once all mitigations and independent review are finalised the TUFLOW model will be provided.					OPEN	
Local Government	Wagga Wagga City Council	Flood Design Report - Wagga Wagga Yard	Hydraulic Model	14.04.2025	TUFLOW Model	The WWCC MOFFS model does not incorparate the subsuface 1d network. Can you please confirm the extent of the 1d network included in the updated model. Can you confirm the assumed boundary conditions for the downstream 1d network.	Yucen Lu	DJV flood mdoeller	28/05/2025	The 1d pit and pipe network is included in the TUFLOW model of Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021) received from Wagga Wagga City Council, which was shown in Figure 4-2 in Section 4.2.1. The 1d networks around the Wagga Yard area were updated based on the available survey data. A zoomed-in figure around the site area including the 1d network will be added in Section 4.2.1 in the next design stage. The downstream boundary of the 1d network adopted Waterlevel (Murrumbidgee River) vs Time as per Wagga Wagga Major Overland Flow Floodplain Risk Management Study and Plan (WMAwater, 2021). 	5-0052-210-IHY-w7-RP-0001_D Section 4.2.1				OPEN	
Local Government	Wagga Wagga City Council	Flood Design Report - Wagga Wagga Yard	Hydraulic Model	14.04.2025	TUFLOW Model	The impact mapping suggests the upgrades create mostly flood level reductions with minimal increases shown on the mapping and I don't believe they have added any storage through the upgrade works. Need the TUFLOW model files to validate where the water is being pushed.	Yucen Lu	DJV flood mdoeller	28/05/2025	The implementation of the drainage channel (about 0.5m of depth) reduces the flood water (generally up to 0.02m or 20mm) levels at the south of the railway. The design channel adds additional flood storage. The reduction in water level at the south leads to reduced flood water overtopping the rail to the north and reduced flow to the west towards the industrial area. Please note that the water is not diverted but water levels are reduced due to additional flood storage from the channel which is the main reason for the improvement in water levels. A figure noting the changes in topography is included in the report for more clarification. Figure 4-6: Changes in Topography (Design vs Existing)	5-0052-210-IHY-w7-RP-0001_D Section 4.2.2				OPEN	

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APPENDIX E

Independent Flood Consultant Review



Project: 2300 **Deliverable:** Wagga Wagga Yard

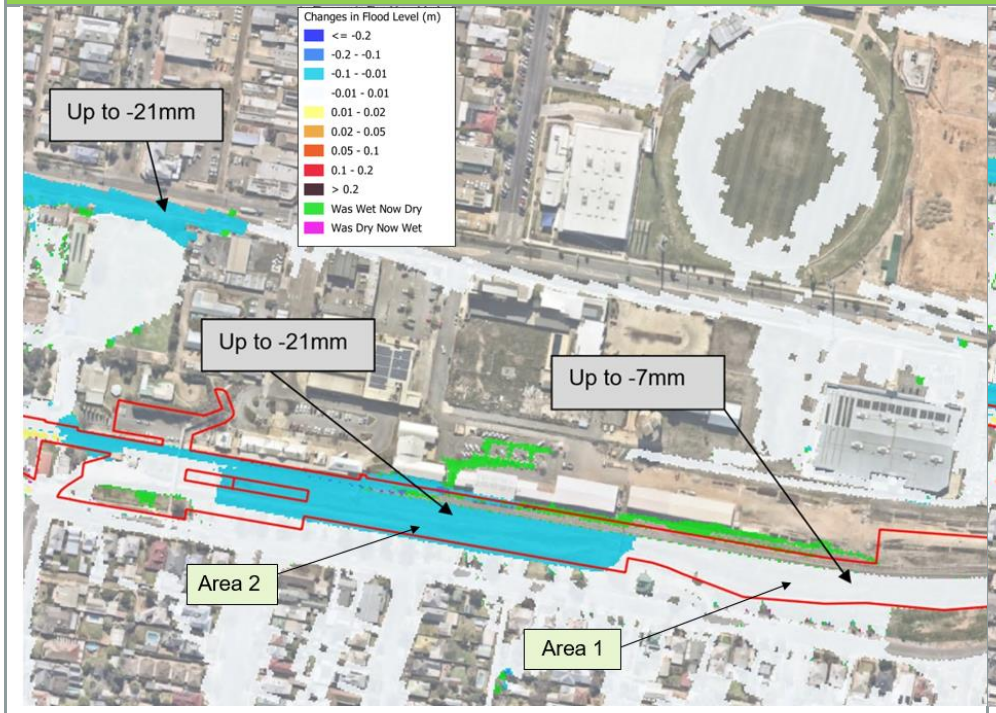
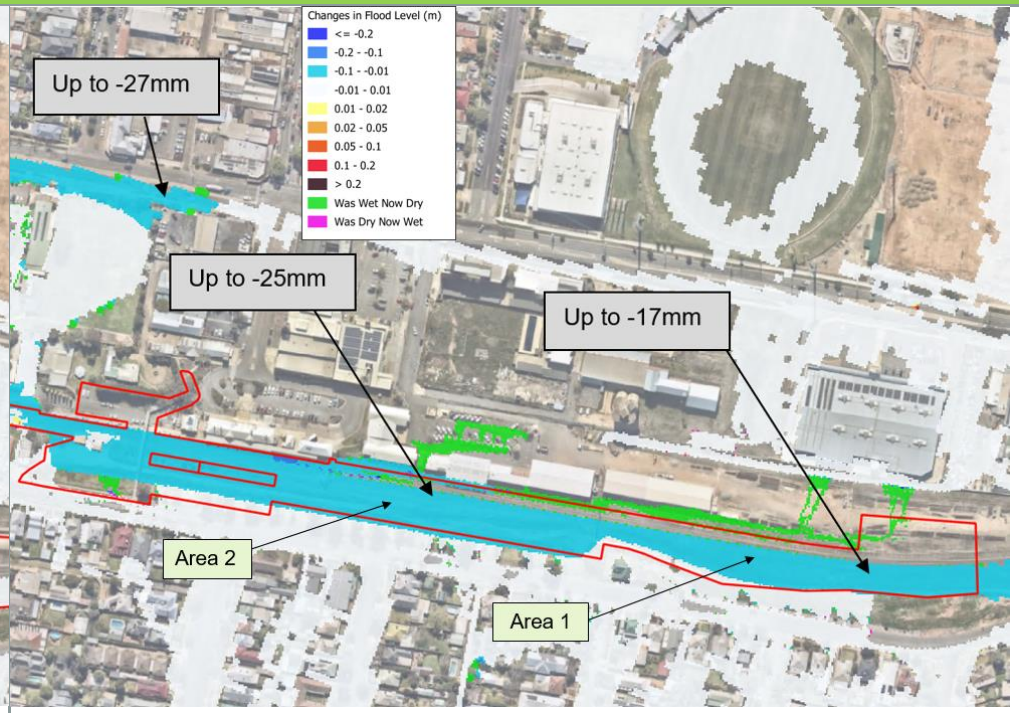
Comment Sheet Reference: 5-0052-210-IHY-W7-CS-0001-PE_G

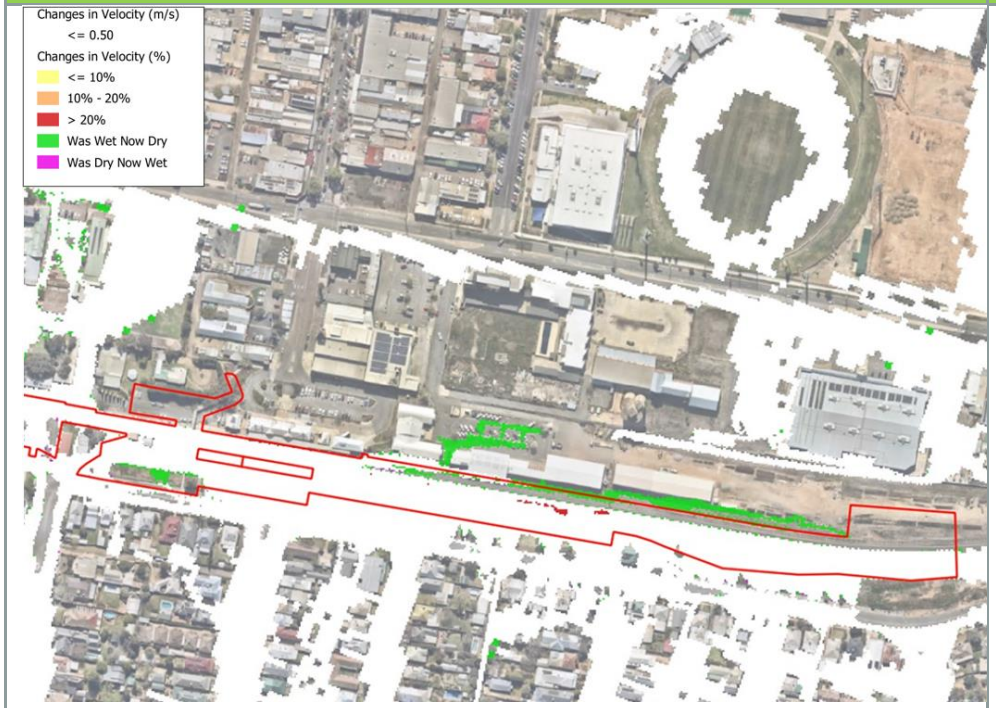
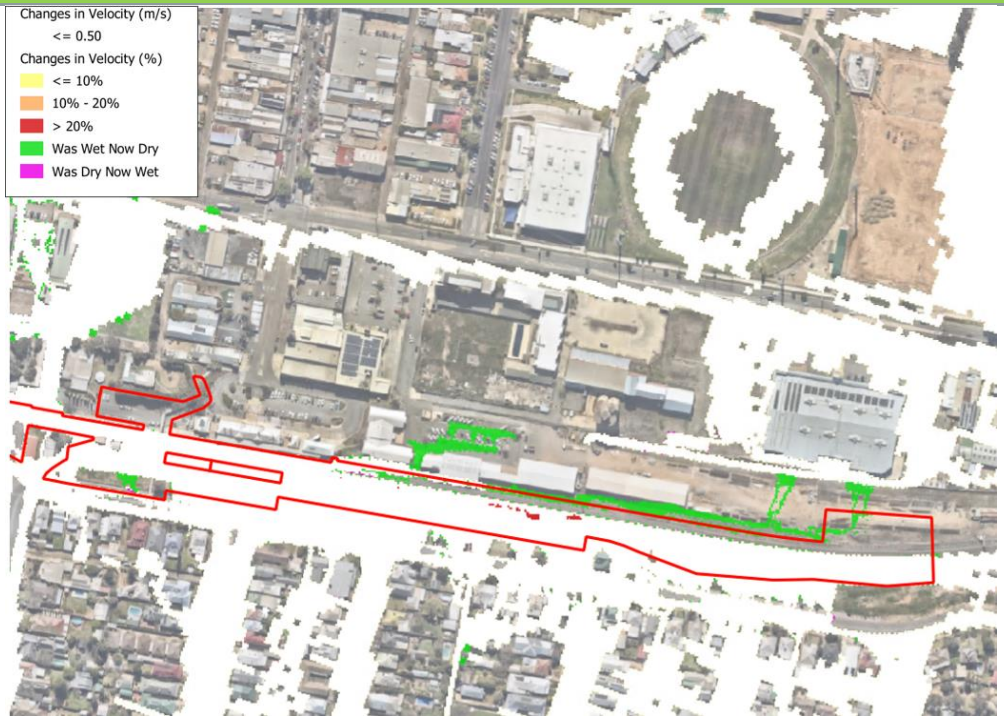
Review Comments (Reviewer)										Responses (Document Owner)					Close-Out				
#	Document number / drawing number - Revision Number	Section # / page #	Company	Full Name	Functional Area	Date	Design Gate	Comment (for example must be specific on non compliance. Reference mark-ups, if required)	Comment Type	Full Name	Role	Date	Response (must be specific on how the comment has been addressed)	Where addressed (Section # / Figure #)	Full Name	Company	Date	Comment Outcome	Close-Out Comment
1	5-0052-210-IHY-W7-RP-0001_B	TUFLOW files	Hatch	Dan Williams	Flood Assessment	30/09/2024	PDR	The Proof Engineering Review of the proposed design cannot be undertaken with confidence due to significant deficiencies in the TUFLOW model represenation of the existing flood conditions. The stormwater trunk drainage network is not conveying the upstream catchment runoff and is resulting in excess overland flow spilling into the Wagga Wagga Yard site.	Major	Jasmine Lee	DJV Flooding Lead	8/10/2024	The stormwater drainage system around and upstream of Wagga Wagga Yard has been reviewed and updated to be at the correct location. In addition, the catchment delineation has been checked and updated to drain into the stormwater system properly.	Within the re-submitted model files.	Darren Lyons	Hatch	8/01/2025	CLOSED	The updated model is performing as expected.
2	5-0052-210-IHY-W7-RP-0001_B	TUFLOW files	Hatch	Dan Williams	Flood Assessment	30/09/2024	PDR	The IWL polygon for the dam at the upstream end of the catchment extends onto the downstream face of the dam wall batter, which will result in an erroneous initial release of water. It should be trimmed back to inside the dam wall.	Minor	Jasmine Lee	DJV Flooding Lead	8/10/2024	The IWL polygon has been trimmed back into the dam wall to avoid the initial release of water.	Within the re-submitted model files.	Darren Lyons	Hatch	8/01/2025	CLOSED	The updated model is performing as expected.
3	5-0052-210-IHY-W7-RP-0001_B	TUFLOW files	Hatch	Dan Williams	Flood Assessment	30/09/2024	PDR	The stormwater drainage system upstream of Coleman Street is inadequately represented, with minimal water being directed to the open channel of the trunk drainage alignment. This impacts the flood hydrology at the Wagga Wagga Yard site. It is recommended that the catchment runoff upstream of Coleman Street be input at the upstream end of the open channel, enabling the channel to flow at deisgn capacity and excess flow to then run overland.	Major	Jasmine Lee	DJV Flooding Lead	8/10/2024	The stormwater drainage system upstream of Coleman Street has been reviewed based on topography, aerial imagery, and street view, and it has been adjusted to appropriate low points. In addition, the catchment delineation has been reviewed and re-distributed to enable the flow going into the drainage system, and open channel is correctly represented.	Within the re-submitted model files.	Darren Lyons	Hatch	8/01/2025	CLOSED	The updated model is performing as expected.
4	5-0052-210-IHY-W7-RP-0001_B	TUFLOW files	Hatch	Dan Williams	Flood Assessment	30/09/2024	PDR	The box culvert structure enabling surface flow in Coleman Street to enter the open channel is not represented in the TUFLOW model. The details of this should be incorporated accordingly.	Major	Jasmine Lee	DJV Flooding Lead	8/10/2024	The box culvert is located far from the site which is outside the survey extent. Thus the box culvert details are unknown. However, the catchment draining into the box culvert has been reviewed and updated. The flow generated by this catchment is assigned into the upstream of the open channel to mimic the real flood behaviour.	Within the re-submitted model files.	Darren Lyons	Hatch	8/01/2025	CLOSED	The updated model is performing as expected.
5	5-0052-210-IHY-W7-RP-0001_B	TUFLOW files	Hatch	Dan Williams	Flood Assessment	30/09/2024	PDR	The inlet pits at the Railway Street / Flinders Street intersection are not represented in the TUFLOW model. This should be rectified. Also, the modelled inlet pits on Railway Street are situated on the footpath and should be moved into the gutter alignment.	Major	Jasmine Lee	DJV Flooding Lead	8/10/2024	The survey information of the inlet pits and pipes at Railway Street / Flinders Street is still unavailable at the time of this response being prepared. Once the survey data is available, the pits and pipes will be included in the model in the DDR design stage. The modelled inlet pits on Railway Street have been reviewed and updated. They are moved to the gutter alignment.	DDR model submission	Darren Lyons	Hatch	8/01/2025	CLOSED	The updated model is performing as expected.
6	5-0052-210-IHY-W7-RP-0001_B	TUFLOW files	Hatch	Dan Williams	Flood Assessment	30/09/2024	PDR	The open channel of the trunk drainage system that recieves flows from the box cluvert at the downstream side of Wagga Wagga Yard is represented in the 2D domain rather than the 1D domain. It is currently in the 5 m grid resolution part of the model, is not accurately representing channel conveyance and appears to be causing model stability issues. The 1.25 m quadtree domain should be extended north to cover this channel and the channel geometry should be reinforced if necessary.	Major	Jasmine Lee	DJV Flooding Lead	8/10/2024	Quadtree extent has been extended north to cover the open channel. The channel is now represented with a 1.25m grid cell. The model stability issue has been resolved by extending the quadtree.	Within the re-submitted model files.	Darren Lyons	Hatch	8/01/2025	CLOSED	The updated model is performing as expected.
7	5-0052-210-IHY-W7-RP-0001_B	TUFLOW files	Hatch	Dan Williams	Flood Assessment	7/11/2024	PDR	Simulation of the model without any mitigation works indicates off-site impacts to the north of Wagga Yard. This is a result of the reduced track level allowing additional water to spill across at the Multicultural Council of Wagga Wagga. Whilst the implemented mitigation option (a 1 m deep storage trench) resolves this, there are likely better alternative mitigation options to be investigated. For example, a small wall structure (or similar) along the northern side of the works to prevent this additional overtopping.	Minor	Zoe Cruice	Eng Manager	8/10/2024	Updated modelling provided on Hardrive		Darren Lyons	Hatch	8/01/2025	CLOSED	The updated model improves the representation of flow within the box culvert of the stormwater trunk drainage system under Wagga Yard. With less overland flow within the yard, the previously modelled off-site impacts have been resolved and no mitigation works are required.
8	5-0052-210-IHY-W7-RP-0001_C	TUFLOW files	Hatch	Sam Drysdale	Flood Assessment	24/03/2025	DDR	No comments		Zoe Cruice	Eng Manager	25/03/2024	Noted. No action.		Darren Lyons	Hatch	24/03/2025	CLOSED	No comments
			Hatch	Darren Lyons	Flood Assessment	31/10/2025	IFC	No further comments											

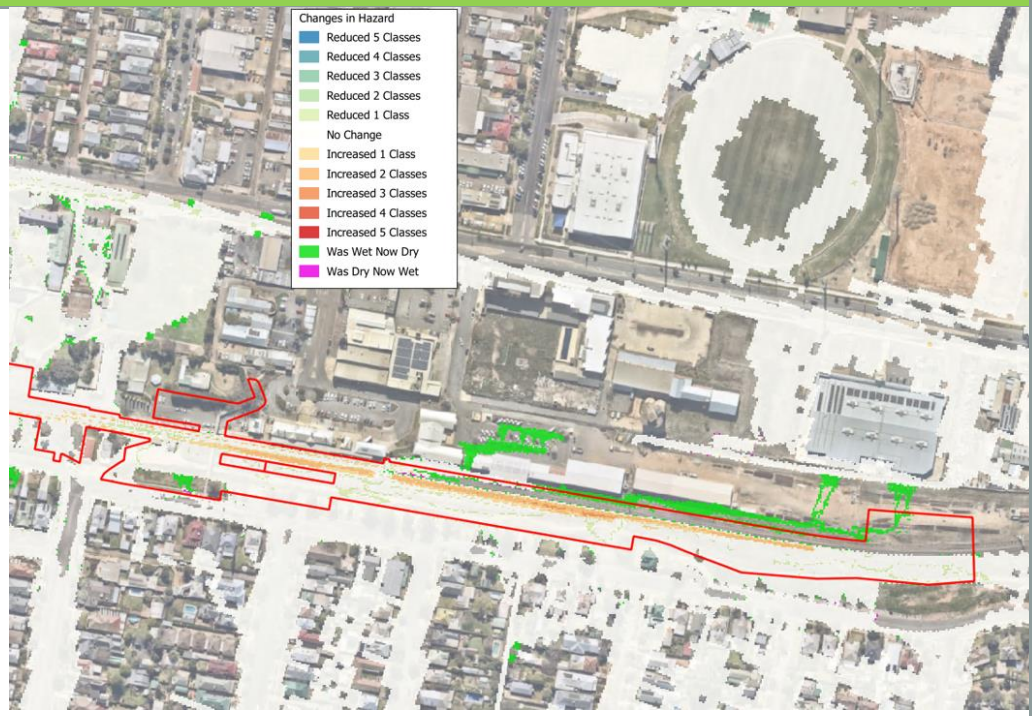
APPENDIX F

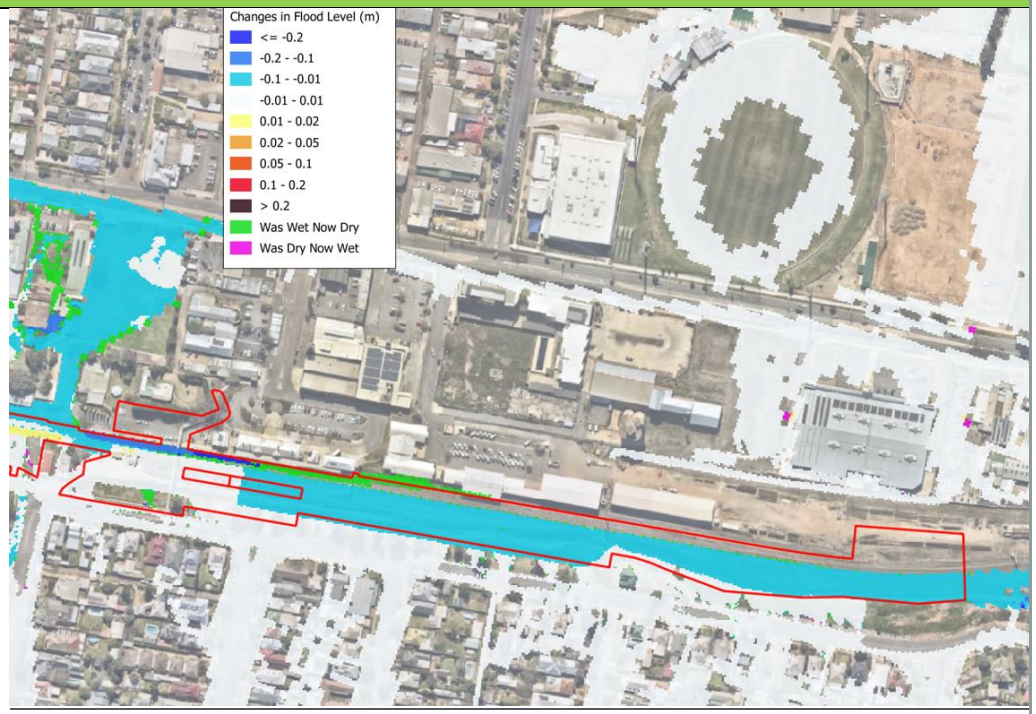
IFC Sensitivity Analysis Results Comparison

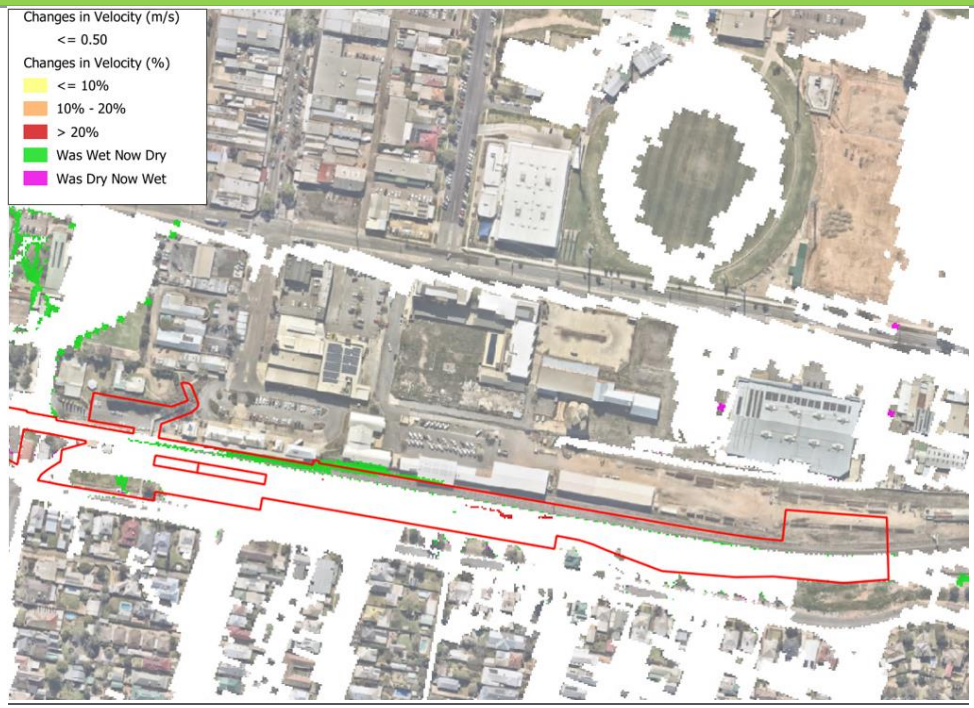


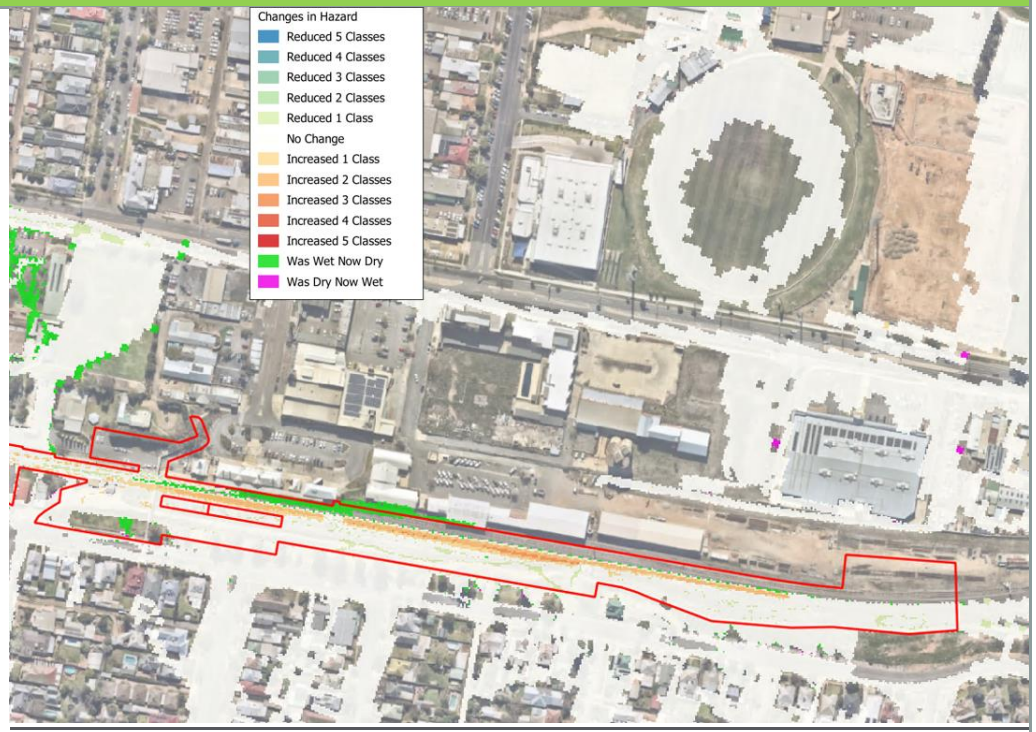
DDR	IFC
Wagga Yard extent for 1% AEP Storm event	
Changes in Flood Level(m)	
	
Changes in Flood Level 1. The changes in flood level outside the project boundary are less than 0.05m and no residential, commercial or industrial properties are impacted 2. Area 1 experiences water level reduction up to 7mm and area 2 experiences water level reduction up to 21 mm	Changes in Flood Level 1. The changes in flood level outside the project boundary are less than 0.05m and no residential, commercial or industrial properties are impacted Area 1 experiences water level reduction up to 17mm and area 2 experiences water level reduction up to 25 mm
Changes in Flood Velocity (m/s)	

DDR	IFC
	
Changes in Flood Velocity 1. The changes in velocity outside the site is less than 0.5m/s.	Changes in Flood Velocity 1. The changes in velocity outside the site is less than 0.5m/s.
Changes in Flood Hazard	

DDR	IFC
	
Changes in Flood Hazard 1. There is no increase in flood hazard outside the project boundary.	Changes in Flood Hazard 1. There is no increase in flood hazard outside the project boundary.
Wagga Yard extent for 2% AEP Storm event	

DDR	IFC
Changes in Flood Level (m)	
	
Changes in Flood Level 1. The changes in flood level outside the project boundary are less than 0.05m and no residential, commercial or industrial properties are impacted	Changes in Flood Level 1. The changes in flood level outside the project boundary are less than 0.05m and no residential, commercial or industrial properties are impacted
Changes in Flood Velocity (m/s)	

DDR	IFC
	
Changes in Flood Velocity 1. The changes in velocity outside the site is less than 0.5m/s.	Changes in Flood Velocity 1. The changes in velocity outside the site is less than 0.5m/s.
Changes in Flood Hazard	

DDR	IFC
	
Changes in Flood Hazard 1. There is no increase in flood hazard outside the project boundary.	Changes in Flood Hazard 1. There is no increase in flood hazard outside the project boundary.



MARTINUS

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