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Memo

To:	Andrew Mason Wagga Wagga City Council	From:	Manoj Shrestha Stantec
File:	300203869	Date:	August 7, 2024

Reference: Wagga Wagga Pump Levee Augmentation Project – Kooringal Spillway Assessment for 0.5% AEP event

1. INTRODUCTION

Stantec were engaged by Wagga Wagga City Council (*Council)* to assess various pump duty flow rates options for the Wagga Wagga Pump Levee Augmentation Project. During this, the available local city domain model was updated by Stantec to improve model resolution and incorporate the latest LiDAR information (available in 2020) along with other minor changes as necessary for the project.

The Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan (WMA Water, 2018) assessed the flooding conditions during the spillway activation for a major 0.5% AEP event (1 in 200 AEP) from the Murrumbidgee River. Given the availability of the updated local model developed by Stantec, that represents the existing conditions more accurately, Council requested Stantec to investigate the flooding risks for the floodgate catchment 25 when the Kooringal Spillway is activated.

For further background and context, this Memo should be read in conjunction with the 'Flood Modelling Assessment Report - Levee Pump Augmentation Project' (Stantec, February 2024) and the Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan (WMA Water, 2018).

2. PURPOSE

This Memo details our methodology and findings of the updated flooding conditions within floodgate catchment 25 (refer Figure 1), study area, in an event of the Kooringal Spillway activation in a 0.5% AEP event. This assessment includes an update to the previous modelling work carried out in 2018 by WMA for the Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan. The approach undertaken and the results of Stantec's assessment is detailed within this Memo. This includes peak flood depth, extent, velocity and hazard maps.

3. KOORINGAL SPILLWAY

The Wagga Wagga City Levee is approximately 9.6km long starting from the Kooringal Road along the Marshal Creek in the east and ending to the Olympic Highway in the west following the southern bank of Murrumbidgee River. There are two spillways on this levee that allows for controlled overtopping in events greater than its design level of protection. For this study, the focus is on the Kooringal Spillway along the Kooringal Road as shown in Figure 1 below, which affects the floodgate Catchment 25 directly once the spillway is activated.

The Levee has been designed to protect the Wagga Wagga CBD for flood events up to and including 1% AEP beyond which the spillway will be activated to release controlled flows within the CBD.

Reference: **Kooringal Spillway Assessment**

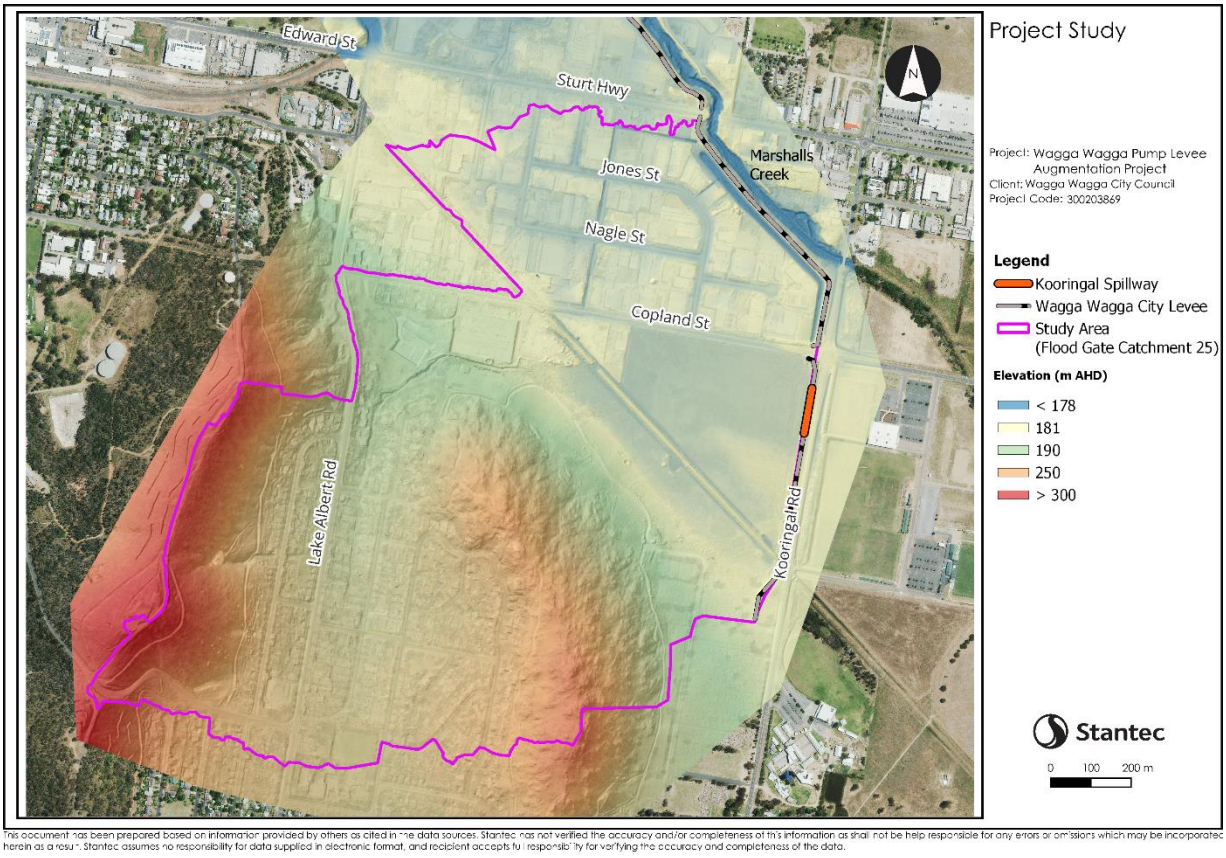

Figure 1 Study Area

4. EXISTING INFORMATION REVIEW

- Wagga Wagga Revised Murrumbidgee River Floodplain Risk Management Study and Plan: Reports along with associated model (WMA, 2018) was downloaded from the NSW Flood Data Portal on May 2024. The model was run in TUFLOW 2012 version in Classic scheme with a grid resolution of 20m.
- Updated City Domain Model (Stantec, 2024) as part of the Wagga Wagga Levee Pump Augmentation project: This model is based on TUFLOW 2020 version in HPC scheme supporting quadtree functionality with a minimum grid resolution of 2m in the flood gate catchments – 8, 10, 17 and 25.
- Levee information: As-constructed drawings of the City Levee were provided by council. The crest level of the Levee and spillway in the 2018 model by WMA Water matches well with the as-constructed drawing. However, the WMA model represented the levee fail condition by lowering the CBD levee and the Kooringal spillway by 400mm from the crest level for events rarer than 1% AEP.
- Lidar information: 2018 study adopted 5m grid information based on topographic data captured in 2008. There is a new 1m grid LiDAR information collected in 2020, which will be used for the purpose of this study.

Reference: **Kooringal Spillway Assessment**

5. METHODOLOGY

The 2018 riverine model was run for 0.5% AEP with addition of PO lines adjacent to spillway in TUFLOW to estimate the flows entering the catchment 25 from the spillway activation. An additional test was done to update the 2012 version of TUFLOW to 2020 TUFLOW version as the local model was built in latter version of TUFLOW. Model results show slight reduction in water level by approximately 10mm and marginal reduction in peak flows through the spillway by approximately 1m^3/s as shown in Figure 2 when run in 2020 TUFLOW version. Hence, to be conservative the hydrograph from the original 2018 model run in TUFLOW 2012 version was used as an inflow to the local model.

A local TUFLOW model based on updated City Domain Model (Stantec, 2024) was used, where Manning's values and topographical modifications along with the implementation of quadtree functionality to represent 2m for the area of interest from the updated City Domain Model were retained. However, to replicate the 2018 model the associated local catchment inflow hydrographs and the 1d elements were removed as they were not modelled in 2018 model. The spillway discharge extracted from the 2018 riverine model using PO lines was used as an inflow to the local model to assess the updated flooding conditions.

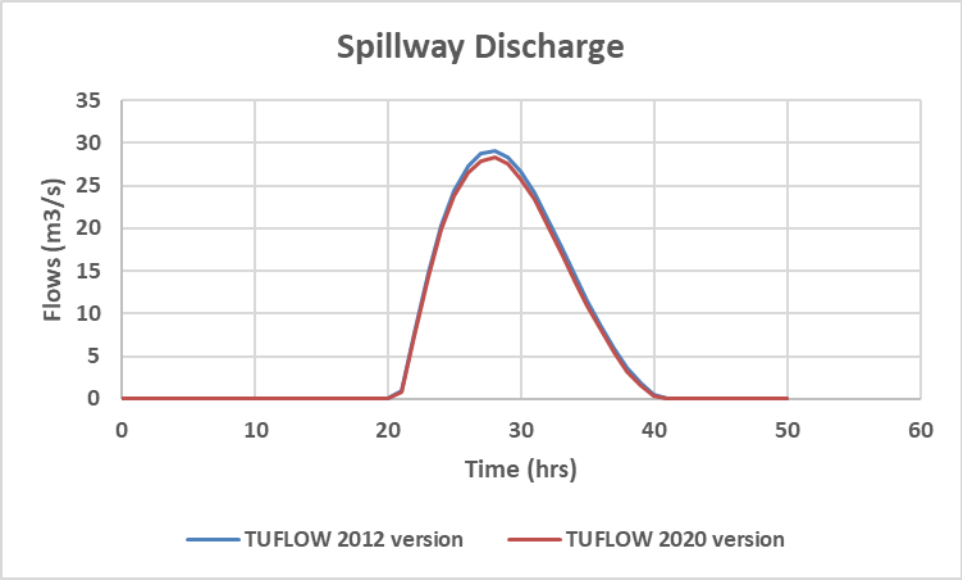

Figure 2 Spillway Discharge in 0.5% AEP from the Riverine Model

6. MODEL RESULTS AND DISCUSSIONS

The new flood extent, depth, velocity and hazard maps for the 0.5% AEP is provided in Appendix for the updated local model for the study area. The local flood extent compared well with the flood extent from the 2018 model (provided in Appendix), however, a reduction in flood level of up to 300 mm has been observed consistently in the area of interest between the Copland Street and Sturt Hwy. Also, a reduction in flood level by up to 150 mm has been observed in the open space between the Kooringal Road and Copland Street. The new flood level

sits at 180.9m AHD with a flood depth of up to 0.9m in this area. This area is estimated to be a high hazard category of H3, which is unsafe for vehicle, children and elderly.

This is anticipated as an average reduction of elevation by approximately 300mm within the extent of flood was observed for the local model compared to the coarse model topography. In addition, the 20m grid resolution model will not capture the underlying terrain properly, for example the storage gully behind the levee stores water depth between 1.5m to 3m, while 2018 model shows depth between 0.1m to 2 m. The newly built industrial areas are elevated compared to when the original model was built, however the main flow path being the roads, are lower compared to the coarser model thus providing less obstructions for flood water to flow downstream (refer Figure 3). Furthermore, differences in manning's values application (higher values were used in 2018 study for the industrial areas) and the selection of model domain size are also a contributing factor.

For further confirmation, that this reduction did not occur because of underestimation of the inflows at the spillway, the local model was rerun with the same inflow but adopting the features of the riverine model – model orientation, manning's values, grid resolution and old 5m LiDAR data. This provided very similar results compared to the riverine model which confirms the reduction in flood level in the updated model is not due to the application of the inflows, but from reason discussed in above paragraphs.

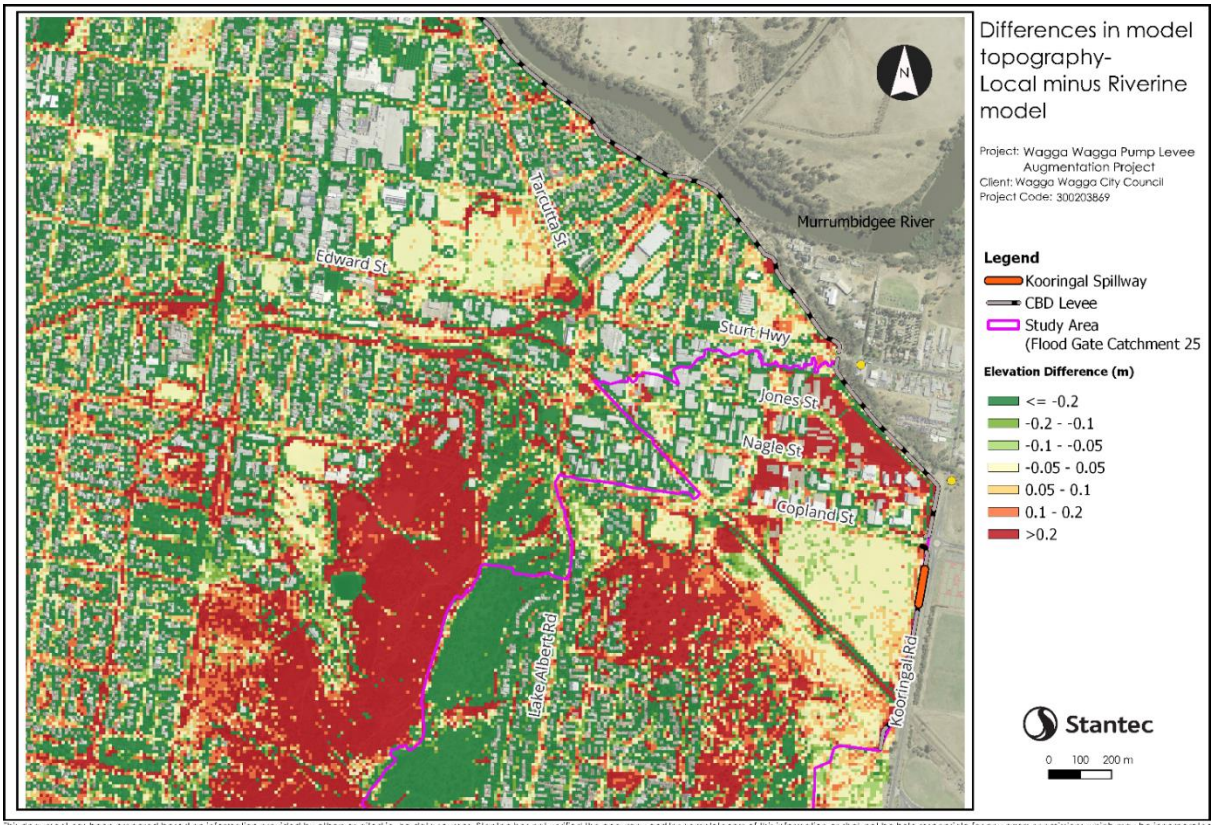

Figure 3 Elevation differences between the local model and the riverine model

Reference: **Kooringal Spillway Assessment**

7. QUALIFICATIONS

- It has been assumed that the supplied riverine model was fit-for-purpose and as such Stantec has not undertaken a review of this model. The original model was re-run with addition of new PO lines to extract flows at the Kooringal Spillway.
- For like-for-like estimation of flood levels in catchment 25 between the updated local model and the riverine model, 1d elements have been removed in the local model to replicate the riverine model.
- The assessment is limited to area within floodgate catchment 25 only based on Kooringal Road Spillway activation for a 0.5% AEP.

8. CONCLUSION

This Memo details the methodology adopted to update the local flooding conditions in catchment 25 under the Kooringal Spillway activation event during 0.5% AEP event. The following findings are noted:

- Floodwater ingress into the study area from the Kooringal Spillway only. The peak discharge is approximately 29 m^3/s.
- A reduction in flood level by up to 150 mm was observed between Kooringal Road and Copland Street. Furthermore, there is a consistent decrease in water level by approximately 300 mm in the industrial area between the Copland Street and Sturt Hwy.
- The model domain size, changes in topography and recent development have contributed to the discrepancy between the riverine model and the local model, which is anticipated.

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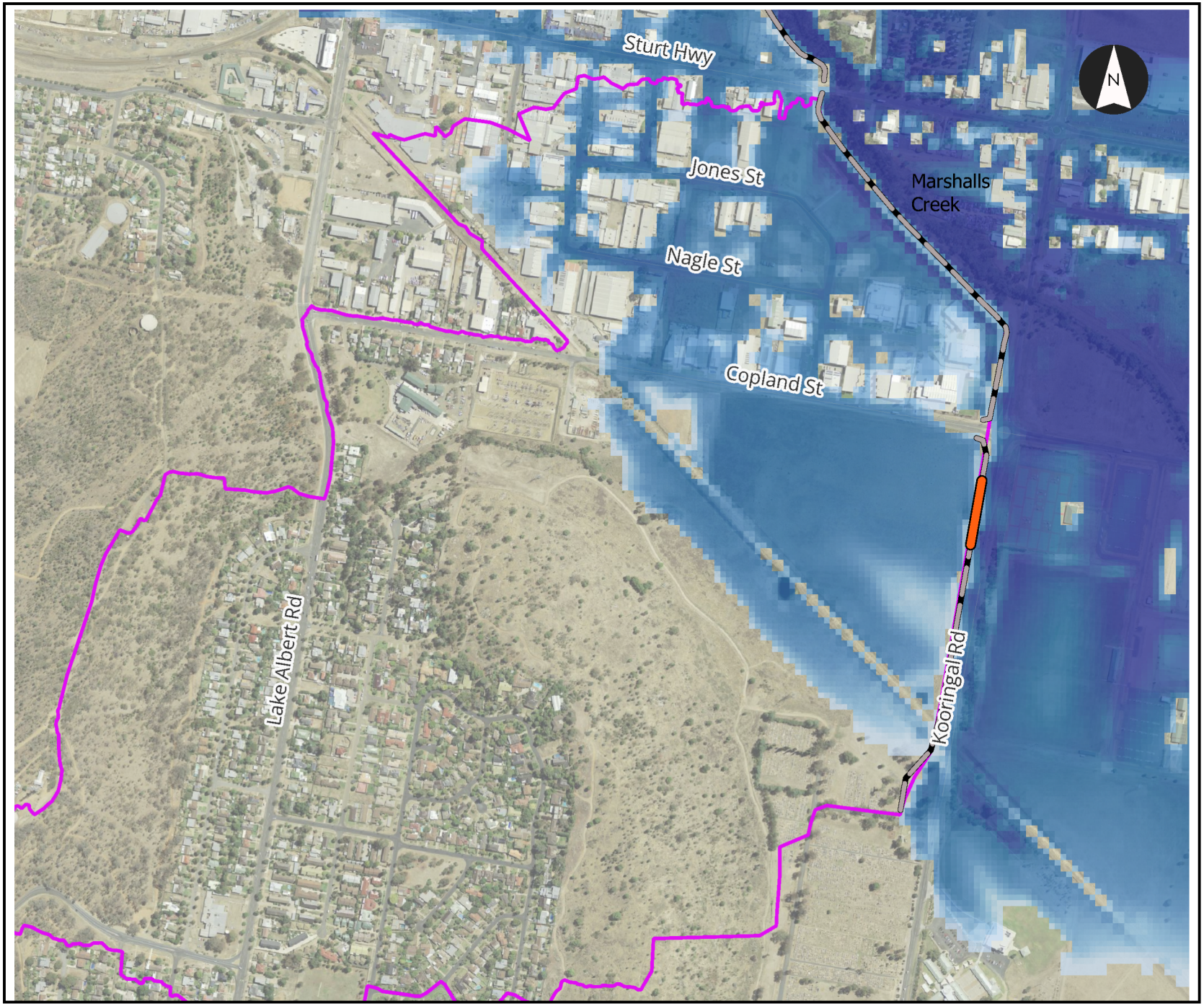
Attachments: Appendix Figures



0.5% AEP Peak Flood Depth Riverine Model

Project: Wagga Wagga Pump Levee Augmentation Project
Client: Wagga Wagga City Council
Project Code: 300203869

Legend

- Kooringal Spillway
- City Levee
- Study Area (Flood Gate Catchment 25)

Flood Depths (m)

- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- >2

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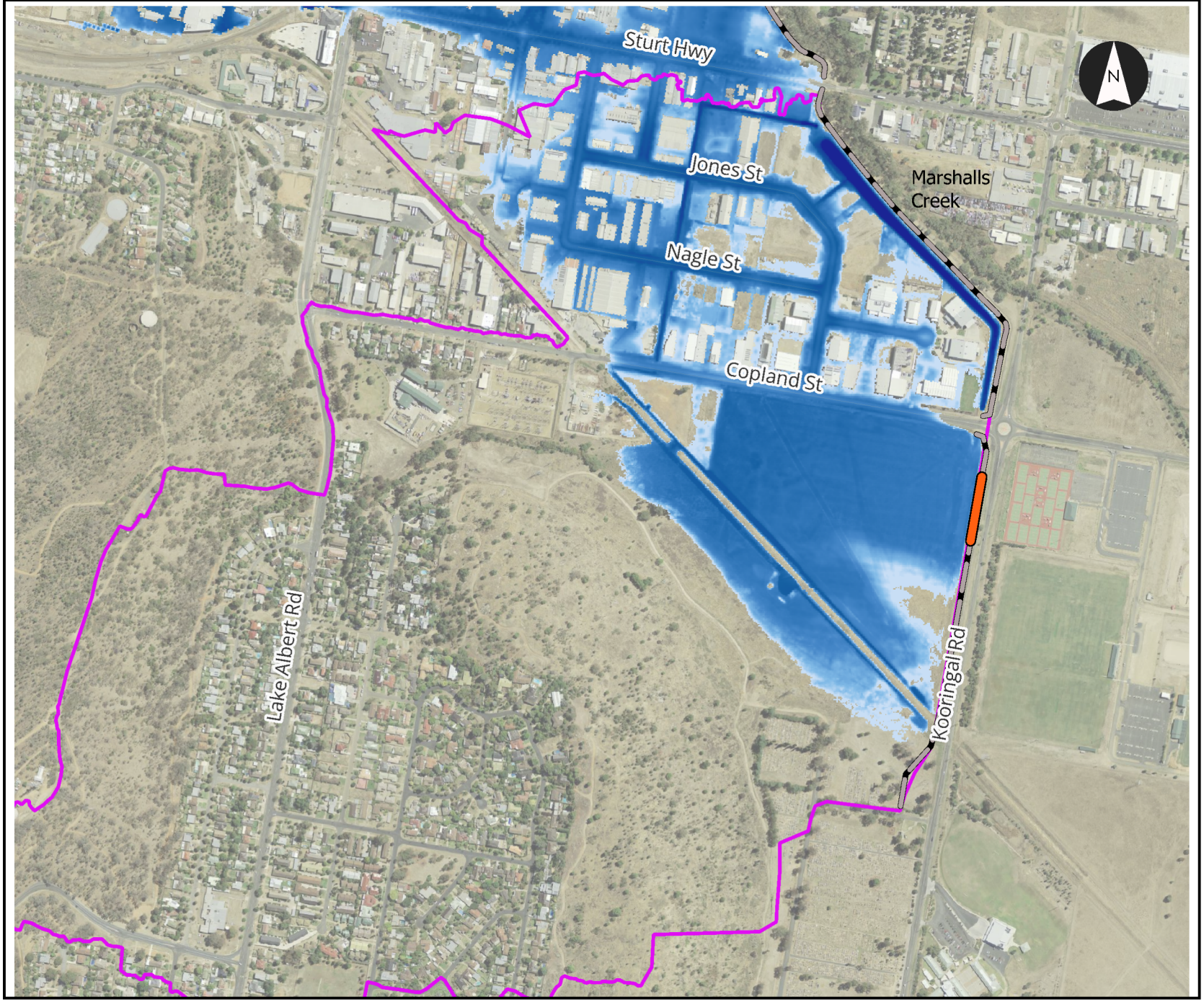
0 100 200 m



0.5% AEP Peak Flood Depth Local Updated Model

Project: Wagga Wagga Pump Levee Augmentation Project
Client: Wagga Wagga City Council
Project Code: 300203869

Legend

- Kooringal Spillway
- City Levee
- Study Area (Flood Gate Catchment 25)

Flood Depths (m)

- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- >2

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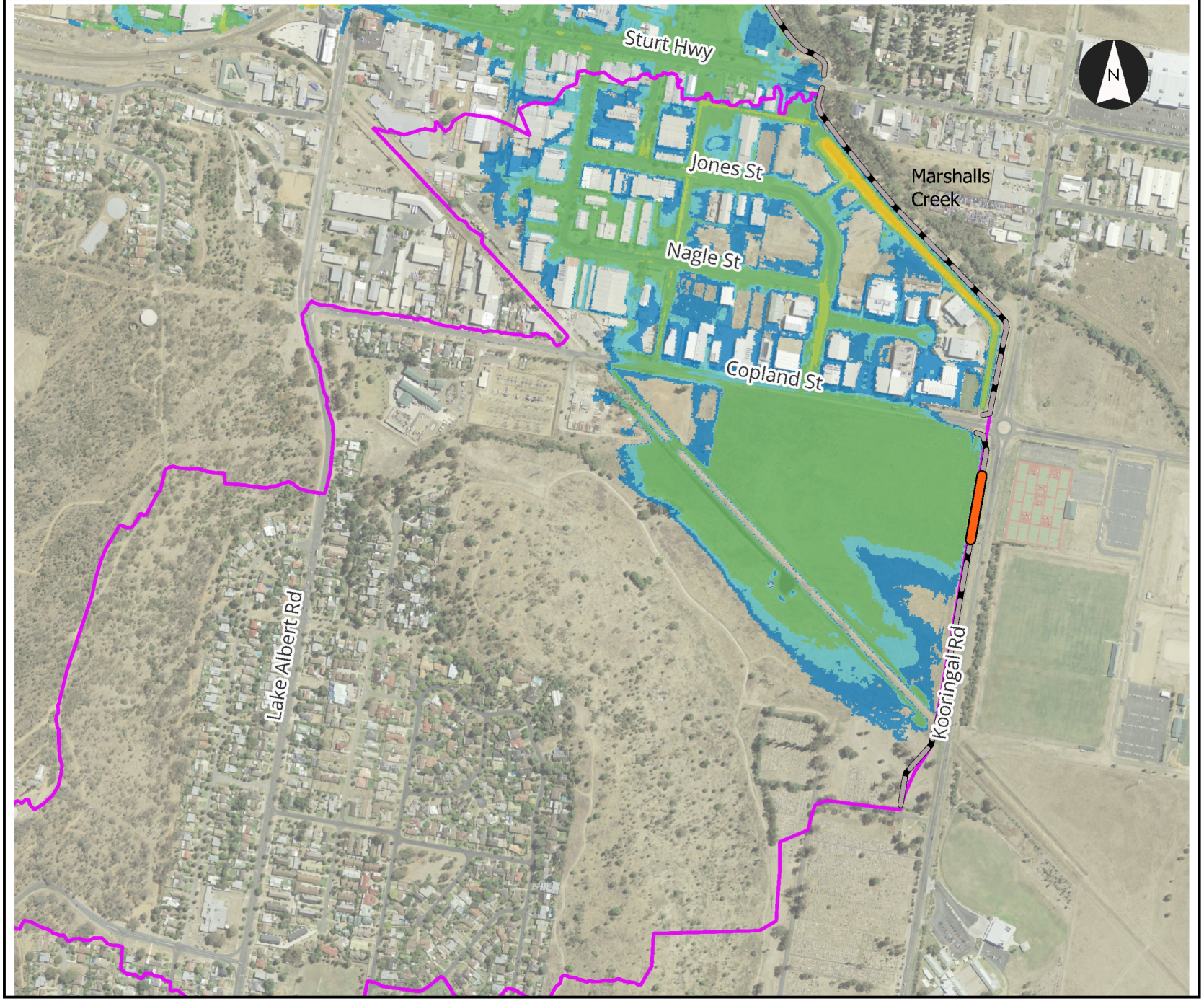
0 100 200 m



0.5% AEP Peak Flood Hazard Local Updated Model

Project: Wagga Wagga Pump Levee Augmentation Project
Client: Wagga Wagga City Council
Project Code: 300203869

Legend

- Kooringal Spillway
- City Levee
- Study Area (Flood Gate Catchment 25)

Hazard Category

- 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.

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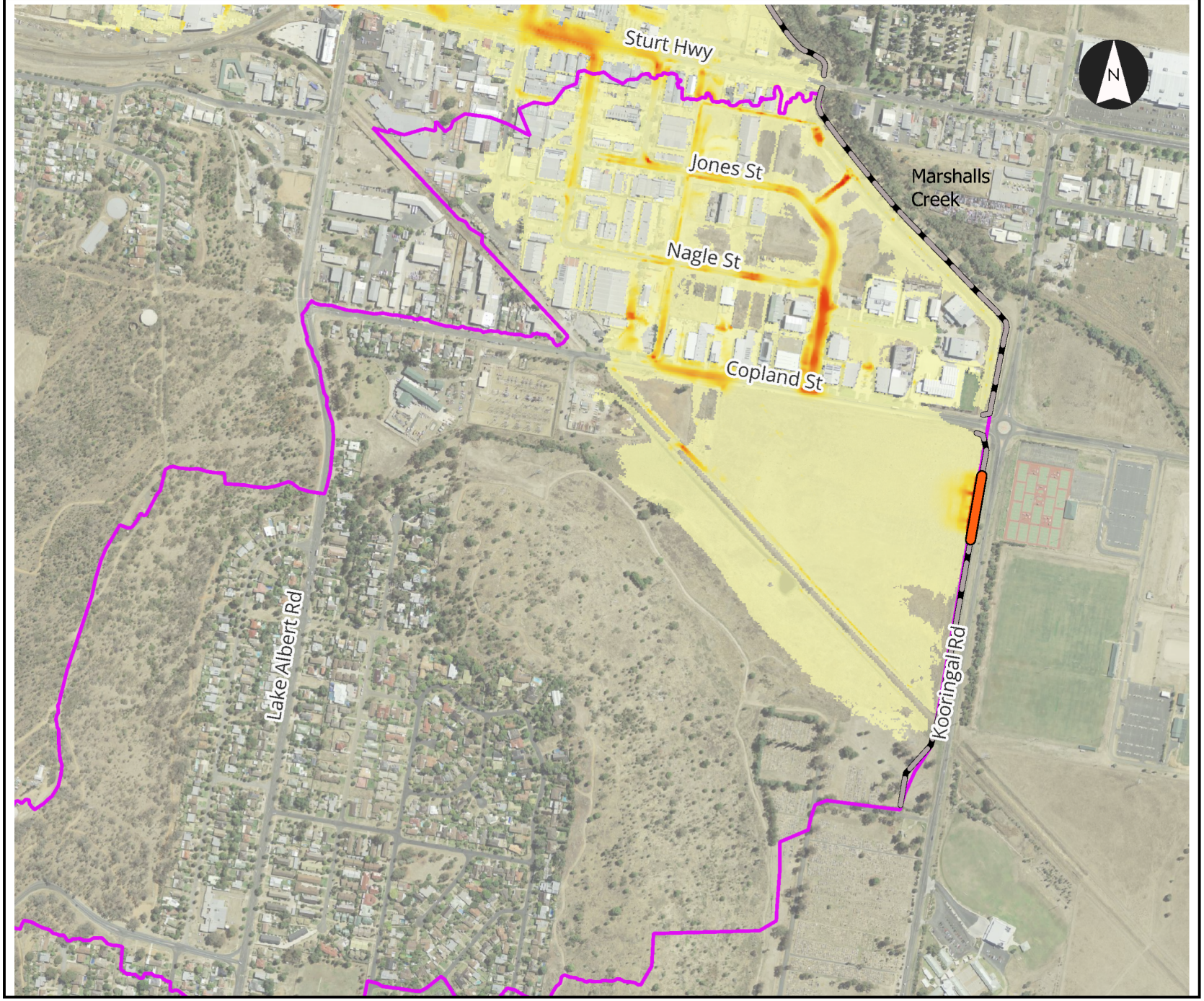
0 100 200 m



0.5% AEP Peak Flood Velocity Local Updated Model

Project: Wagga Wagga Pump Levee Augmentation Project
Client: Wagga Wagga City Council
Project Code: 300203869

Legend

- Kooringal Spillway
- City Levee
- Study Area (Flood Gate Catchment 25)

Peak Velocity (m/s)

- <0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.5
- >1.50

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0 100 200 m