



Narrabri to Northstar Phase 2 EIS Review

Surface Water Hydrology & Hydraulics

NOVEMBER 18, 2022

PREPARED FOR MOREE PLAINS
SHIRE COUNCIL

DRYSIDE ENGINEERING (AUST) PTY

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1. Introduction

1.1. Project Aim

Dryside Engineering were engaged by Moree Plains Shire Council to undertake a technical review of two sections of the Narrabri to Northstar Inland Rail Phase 2 Environmental Impact Statement (EIS) and provide advice on opportunities, issues and impacts to the Moree Plains community.

The two sections are:

- Surface Water
- Hydrology & Flooding

1.2. Reviewers

Surface Water technical review has been undertaken by Ed Henty (CPEng & FIE Aust) who has knowledge of Moree and surrounds from the Moree Flood Management Plan Recommendations Investigations which Ed was Project Management for.

Hydrology & Flooding technical review has been undertaken by Julian Skipworth from Cumulus Engineering. Julian undertook the flood modelling updates for the Moree Flood Management Plan Recommendations Investigation.

2. Surface Water Technical Review

2.1. Sections Reviewed

For the Surface Water review, the following sections of the EIS were reviewed:

- Chapter 13 – Surface Water
- Tech Paper 5A – Surface Water Impact
- Appendix F – CEMP Outline

2.2. Review Summary

The key/relevant points from the EIS & CEMP Outline are summarised as:

- The main concern in terms of surface water quality is erosion and sedimentation from banks & batters exposed in the vicinity of the waterways for the crossing construction works.
- The CEMP outline includes contents for a Soil & Water Management Plan and an Erosion and Sediment Control Plan and it is crucial that these documents are reviewed, implemented and inspected during the construction period.
- The EIS states that *“All culverts and bridges would be located to maintain existing drainage characteristics and minimise impacts on drainage and flooding patterns around the proposal site. This will prevent the formation of new flow paths or changes to existing flow paths and therefore reduces potential for erosion and scour and maintains the ecological and drainage functionality of existing waterways adjacent to the proposal”* If this intention is progressed to the detailed design, then future erosion at new locations should not be an issue.
- The Water Quality Monitoring locations suggested are suitable to identify any potential water quality issues.
- The final design has to ensure vegetation is re-established where it has been stripped to reduce erosion and sediment pollution.
- The final culvert rock apron designs where erosion impacts extend beyond the rail corridor are to be agreed with the relevant landowner
- The Skinners Creek bridge abutments are to be designed to mitigate the increase velocities at this section of the upgrade.

2.3. Recommended Inclusions in the CEMP and Detail Design

DSE recommended the following:

- CEMP to include Erosion and Sediment Control Plans for each waterway crossing to ensure exposed batters and construction works do not add sediment and hydrocarbons etc to designated waterways
- CEMP to ensure stockpile locations are outside of 20% AEP flood extents
- The final design has to include measures to ensure vegetation is re-established in a timely manner where it has been stripped to reduce erosion and sediment pollution.
- Council review future documentation as it is released (refer to Section 2.4).

2.4. Recommended Future Actions for Council as the Project Progresses

The following are future actions for Council as the detail design and related documents progress:

- Council be given the opportunity to review the Soil & Water Management Plan when completed to ensure there are measures to mitigate impacts to waterways (confirm what is stated in the CEMP outline has been implemented)
- Council be given the opportunity to review the Erosion and Sediment Control Plan (ESCP) to ensure there are measures to mitigate impacts to waterways (confirm what is stated in the CEMP outline has been implemented)
- Council be given the opportunity to review the shutdown procedure should a flood event be predicted in terms of stabilising/protected exposed soil/batter
- The final water sources that will be used for construction should be reviewed when they are decided upon
- Council be given the opportunity to review the Surface Water Quality Monitoring Program when it is completed.
- Council be given the opportunity to review to draft detailed design plans in terms of:
 - The final culvert rock apron designs where erosion impacts extend beyond the rail corridor are to be agreed with the relevant landowner (including evidence of Landowner acceptance)
 - The Skinners Creek bridge abutments design to mitigate the increase velocities at this section of the upgrade.
 - The revegetation design for all waterway crossings embankments

3. Hydrology & Flooding Technical Review

3.1. Sections Reviewed

For the Hydrology and Flooding review, the following sections of the EIS were reviewed:

- Chapter 12 – Hydrology and flooding impact assessment.

The following document was also reviewed and the findings considered:

- Technical Paper 04 - Appendix E Record of Independent Peer Review of flood model

3.2. Review Summary

The following presents the key findings of the review of the hydrology and flood impact assessment (Chapter 12)

3.2.1. Model Build and Schematisation

The points below summarise the findings of the review of the model build, schematisation and modelling methodology as outlined in Chapter 12 and Technical Paper 04. It should be noted that this was a high level review of the report, and not a review of the model and model files themselves which were not available at the time of the review.

Key findings:

- The adopted hydrology for the major model inflow which is based on flood frequency analysis at Gravesend is considered appropriate and a suitable approach. It is noted that the assessment is not fully in line with Australian Rainfall and Runoff 2019 (ARR2019) but given the assessment is largely based on flood frequency analysis which has not changed substantially under ARR2019, the impact is considered negligible.
- The hydrology approach for the catchments downstream of Gravesend is considered appropriate. It is noted that the approach was also validated by BMT in their detailed peer review and deemed appropriate.
- The hydraulic modelling approach involved the development of a new TUFLOW model based on the existing Mike Flood model developed in the original flood study (WRM 2017). There is little detail provided on the hydraulic model development in Chapter 12 itself and much of the detail was determined from the peer review by BMT.
- The findings from the full peer review by BMT (which reviewed the model files in detail) are noted – they found the model has been built generally in accordance with best practice.
- It is noted that the agricultural levees and Zone C areas were not incorporated into the TUFLOW model. The assumption from the original WRM study was adopted that those Zone C areas should be blocked out. A subsequent peer review deemed this assumption not appropriate as those areas are known to flood in large events. As a result of adopting this assumption in the IR modelling flood levels are likely to be conservative, but the impact of the assessed works could be understated.
- The model appears to have been validated to two design events only - the 10% and 1% AEP events however there is little information provided on this in the documents provided in Chapter 12 of the EIS. Chapter 12 notes that there is a good validation in large magnitude events however there are significant discrepancies in the 10% AEP event. The specifics of this validation exercise is not provided but it is stated that it will be re-visited at detailed design stage. Additional events, particularly historic events for which there is significant observed/recorded data, should have been included. A comparison of the March 2021 event to the modelled 5% AEP event was undertaken but it was not a thorough validation in the sense that the event wasn't modelled explicitly in the hydraulic model and it didn't make use of surveyed flood levels that are available. There are two recent events (2012 and 2021) which have extensive surveyed levels and gauge data which would improve the confidence in the modelling, particularly for lower magnitude events.

3.2.2. Flood Impacts and Compliance with QDLs

The points below summarise the review of the flood impacts and compliance with Quantitative Design Limits (QDLs) described in Chapter 12 of the EIS.

- It is noted that the Quantitative Design Limits (QDLs) for N2NS Phase 2 of the Inland Rail project allow for the following increases in flood levels:
 - Up to 10mm increase to habitable floors
 - Up to 20mm increase to non-habitable floors
 - Up to 100mm for external areas of residential properties
 - Up to 200mm on agricultural land
 - Up to 300mm in forests and unimproved grazing land
 - Up to 50mm on Transport for NSW roads which already flood, otherwise no increase
 - Up to 50mm on other sealed roads (unless there is risk of aquaplaning)
 - Up to 100mm on unsealed roads
- In addition, the QDLs allow the following impacts with regards to flood hazard and flood durations:
 - No greater than 10% increase in velocity-depth product (vd)
 - No greater than 5% increase in flood duration for habitable floors which flood above floor and flood for greater than 1 hour.
 - No greater than 10% increase in flood duration for habitable floors which flood below floor and flood for greater than 1 hour.
- The impacts of the proposed work are significant and some of these impacts exceed the QDLs described above. The key exceedances are noted below:
 - Afflux is noted with the township under the cumulative impact scenario with Phase 1 and 2 modelled together. The impact is 10-40mm of afflux in the 1% AEP event at up to 86 properties. This exceeds the QDL and is unacceptable for the community. Mitigation works are proposed to address this. It must be ensured that these works are constructed prior to the completion of Phase 2 of the project.
 - Areas to the north and in the vicinity of the Camurra hairpin – impacts exceed 200mm on cropping land (10% through to 1%) and 50mm on Newell Highway (20% through to 1% AEP).
 - Exceedance of flood level at four buildings in the 1% and 10% AEP events, 2 buildings in the 2% AEP event, 3 buildings in the 5% AEP event, as well as at sensitive locations including the TAFE and Moree Gun Club. Of the impacted buildings floor level survey was unavailable for 3 so the impact with respect to above or below floor flooding is unknown.
 - Exceedance on the Newell Highway in more frequent events.
 - Exceedance of flood hazard in the 2% AEP event and 1% AEP event (1 building in each).
 - Exceedance of flood duration criteria to residential buildings across the range of design events as well as Agricultural Skills Centre in the 2% AEP event.
- In addition to the exceedances described above, Chapter 12 presents the cumulative impacts of both IR and Newell Highway upgrades with additional impacts within Moree and between the IR corridor and Newell Highway reported. The report describes no QDL exceedances as a result of the cumulative impact however the resulting impacts should be noted by Council, IR and Transport for NSW and improved solutions considered.

3.3. Areas of Concern

The following points outline key areas of concern. Key issues:

- The model was validated against two events only, and in one of those the validation was reported to be poor. Chapter 12 notes that a good validation was achieved in the 1% however there are significant differences in the 10% AEP event between the IR model and the original flood study results (WRM 2017). Additional events should have been included – ideally historic events for which there is significant data available to validate the model to. There are recent events (2012 and 2021) which have extensive surveyed levels and gauge data which would improve the confidence in the modelling, particularly for lower magnitude events.
- The model has blocked out the Zone C/Rural Levee areas for the model. This was an assumption from the original flood study but has since been deemed not a reasonable assumption. There is survey data available

to in-fill these areas and the model should be updated. This assumption could result in the impacts of the proposed works being understated.

- There remains impacts which exceed the QDLs. These must be addressed at detailed design either through revised design and/or negotiation with landholders and relevant parties occurs to ensure acceptable outcomes are achieved for all parties.
- There are residential buildings where QDL exceedances occur for which survey of dwellings is not available. Survey of all impacted buildings should be sought so the full nature of the impact can be understood.

3.4. Recommended inclusions in the Detail Design

The following actions are recommended to be enforced at or prior to Detailed Design:

- It is recommended that an additional, smaller event be modelled such as the 2011 or 2021 event to give confidence that the model performs across the range of design events.
- The Zone C areas and agricultural levees should be incorporated into the model and the impact assessment then remodelled. The current schematisation is likely to be conservative with respect to flood levels but may understate the impact of the railway.
- It is recommended that survey of floor levels for any impacted dwellings or commercial buildings be gathered.
- The QDL criteria are currently not met. Once the other items are addressed, it is recommended that the design be refined, and models rerun to ensure all QDL criteria are achieved and/or negotiation with landholders and relevant parties occurs to ensure acceptable outcomes are achieved for all parties.

3.5. Recommended Future Actions for Council as the Project Progresses

The following actions are recommended for Council as the project progresses:

- In the revised flood impact assessment ensure the following:
 - A smaller, historic flood (2012 or 2022) is modelled to improve confidence in the modelling
 - Ensure Zone C areas and agricultural levees are incorporated into the hydraulic model
 - Ensure QDLs are achieved and/or negotiation with landholders and relevant parties has occurred which ensures acceptable outcomes are achieved for all parties.
- Facilitate floor survey for required properties and incorporate into Council floor level database.
- Ensure the proposed mitigation works to mitigate the cumulative impact of Stage 1 and 2 are constructed prior to or as part of Stage 2 works.