Transport for NSW

M1 Pacific Motorway extension to Raymond Terrace

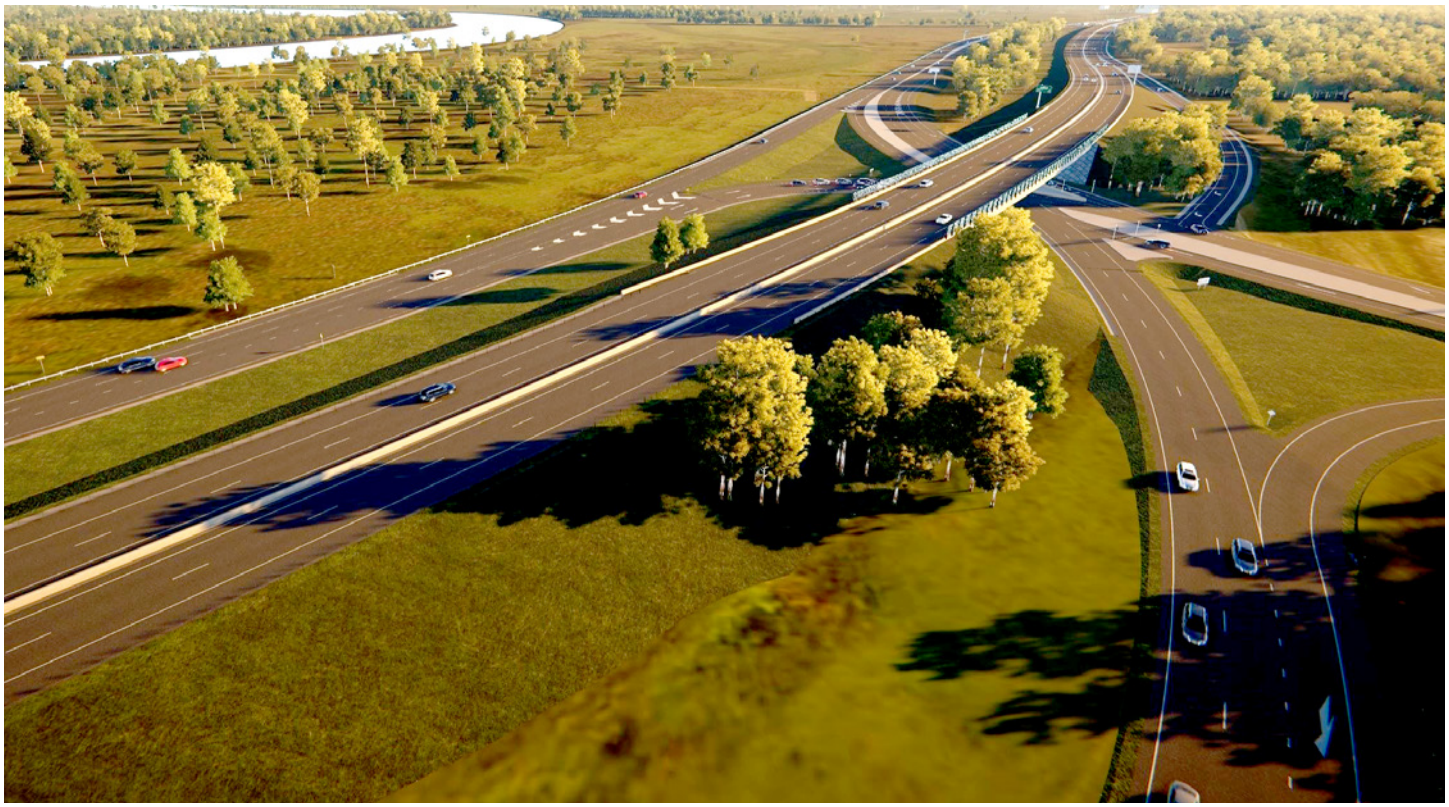
Flood Design Report - Summary

July 2025

Australian Government | BUILDING AUSTRALIA

NSW GOVERNMENT

Transport for NSW acknowledges the Wonnarua, Worimi and Awabakal people as the Traditional Custodians of the lands on which we work and pays respect to Elders past and present.



Aerial of Tomago Interchange

The Australian and NSW governments are investing in the M1 Pacific Motorway extension to Raymond Terrace. This summary outlines the findings of the Flood Design Report, which assesses potential flooding impacts associated with the completed project.

In this update

- Overview of flood behaviour in the region and project context
- Project operational flood assessment and quantitative design limits
- Flood model outcomes and independent verification
- Mitigation and community preparedness.

Regional flood behaviour and project context

Building in flood-prone areas

Flood behaviour in the Hunter region is influenced by many factors such as rainfall, land use, topography, waterway capacity, weather conditions before rainfall, ground moisture, ground cover, built structures like flood levee heights and tidal influences. A major road project like the M1 Pacific Motorway extension to Raymond Terrace can affect some of these factors and minimising the impact of the project on water flow and drainage has been an important objective.

This summary explains how the project design has considered these factors and how we have collaborated with local councils and emergency services to enhance the region's flood preparedness.

History of flooding in the Hunter River and surrounding catchments

The project passes through the Lower Hunter River floodplain and several associated local waterways, wetlands and creeks. This area has experienced significant flooding due to both river-dominated and local catchment events. The Hunter Valley catchment, spanning approximately 21,000 km^2, is one of the largest in coastal NSW and has seen major floods in its history. Among these, the 1955 and 1990 floods are two of the highest on record.

Over the past two decades, the catchment has experienced significant flood events. We know it will flood again in the Hunter Valley and the project has been designed to minimise its impact on future floods and ensure more reliable access for communities during flood events.

Work along Pacific Highway looking north towards Heatherbrae

Landscape changes and flooding impacts

Construction projects can influence flooding by removing surfaces that naturally absorb water and adding structures, like embankments and bridge piers, which may restrict or slow the flow of floodwater. For these reasons, we have investigated the potential impact of the project on flood levels, duration, velocity, hazard, and direction of floodwater.

Project operational flood assessment and quantitative design limits

Our flood study area

The project is located downstream of the junction of the Hunter River and Williams River and upstream of Hexham. The study area spans 473 km^2 and extends from the mouth of the Hunter River, west of the Project along the Hunter River to Oakhampton and north along Williams River to East Seaham. To the east, the study area extends to Grahamstown Dam and Williamtown.

The study area also covers the adjacent floodplain areas including swamp areas and coastal wetlands within Hunter Wetlands National Park, the Fullerton Cove overflow onto the Tilligerry Creek floodplain and the Tilligerry Creek outlet to Port Stephens.

The eastern section of the project is also within the Tomago Sandbeds Catchment Area, classified as a Special Area under the *Hunter Water Act 1991* and protected as a drinking water supply.

How we describe flood events

Floods are measured on the likelihood of an event occurring over a period of time. Flood events are expressed as Annual Exceedance Probability (AEP), which is the probability of that event occurring in any one year. The Flood Design Report looks at the predicted impacts of the M1 Pacific Motorway extension to Raymond Terrace for one in 5, 10, 20 and 100 year flood events as required by the Minister's Conditions of Approval granted on 8 November 2022.

A one in 100 year flood means there is a one percent chance this size flood will occur in any year. A one in 5 year event means there is a 20 percent chance this size flood will occur in any year.

This probability is based on past flood events which are used to predict future events and are based on probability, not certainty. A one in 100 year flood does not mean this size event will only occur once every 100 years. In fact, it is possible to have two one in 100 year flood events in the same year.

Flood assessment and quantitative design limits

The Minister's Conditions of Approval, granted in November 2022, outline specific operational flood limits referred to as quantitative design limits for the project. These are outlined in the following table.

Investigating flood levels, duration, velocity and hazard of floodwater

Table 1: Quantitative design limits

Quantitative design limits	Location	Parameter
A maximum increase of 10 mm in above-floor inundation to habitable rooms where floor levels are currently inundated. No above-floor inundation of habitable rooms which are currently not inundated in the 1% AEP flood event.	Residences	Flood level
No significant increase in the flood hazard or risk to life.	Land	Flood Hazard
A maximum increase of 50 mm in inundation of land zoned as residential, industrial or commercial.	Land zoned as residential, industrial, or commercial	Flood level
A maximum increase of 100 mm in inundation of land zoned as rural, primary production, environment zone or public recreation.	Grazing, forested, environmental, recreation and other rural lands	Flood level
A maximum increase in inundation time of one hour or 10% (whichever is greater).	Land	Flood duration
Maximum relative increase in velocity of 10%, where the resulting velocity is greater than 1.0 m/s, 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.	Land	Flood velocity

Flood model outcomes and independent verification

Background on flood modelling

Since 2016, we have been studying how the M1 Pacific Motorway extension to Raymond Terrace could affect flood behaviour. This process began during the Environmental Impact Assessment phase that evaluated potential flood impacts from the initial concept design. Following project approval in 2022, we updated flood modelling and refined the design to further reduce potential flood impacts.

Design refinements to mitigate flood impacts

Several design changes were made to reduce potential flood impacts throughout project development and design. The project alignment has been moved closer to the New England Highway and other existing infrastructure corridors, crossing the Hunter River 1.4 kilometres north of the originally planned location.

In addition to shifting the alignment, we have:

- Reduced upstream potential flooding impacts by designing a 2.6-kilometre viaduct rather than an embankment across the Hunter River floodplain.
- Reduced impacts on drainage capacity, flood storage, and water flow in the swamp area upstream near Hexham, which would have been affected by the previously proposed embankment.
- Lowered the height of maintenance access tracks on the floodplain.

These refinements were incorporated into our updated flood model, developed in line with the Minister's Conditions of Approval decided on in November 2022.

Updated flood modelling and independent verification

Our updated flood model was developed by WMAwater using the latest hydrologic data from the Hunter River catchment. We tested various design scenarios to predict the project's impact on flood behaviour.

The model development and results have been documented in the Flood Design Report. This report has been reviewed and endorsed by an independent hydrologist, approved by the NSW Department of Planning, Housing and Infrastructure (DPHI).

The project alignment has been moved to reduce flood impacts

Work along Pacific Highway at Tomago looking south

Artist's impression of the viaduct over the Hunter River

Aerial view of Tomago looking west

Flood model outcomes and impact assessment

The impact of the Project on flood characteristics was assessed by comparing existing conditions (without the Project) to the conditions under the Project scenario. In a 1% AEP event:

- **Flood Levels:** Upstream of the project, an increase in flood levels of up to 60 mm is expected, primarily near the project corridor. Typically, on the floodplain upstream of the Project, impacts are in the order of 20 mm for the 1% AEP event.
- **Flood Velocity:** Peak flood velocity may increase slightly (less than 10%) in some areas, especially near the project boundary where new infrastructure like abutments and piers has changed the landscape. A site specific risk assessment for erosion due to increased velocity confirmed that these areas can withstand the changes.
- **Flood Hazard:** Overall, the Project has minimal impact on flood hazard classifications. The exceedances above the quantitative design limits are concentrated along the flood boundary and are not significant.
- **Flood inundation duration:** Changes to inundation duration are minimal and localised, with temporary increases observed near project infrastructure. These changes do not significantly alter overall flood behaviour across the floodplain.

Overall, the Project has minimal impact on flood hazard classifications

Quantitative Design Limit (QDL) exceedances

We assessed flood impacts and QDL exceedances at all lots within the model extent and a total of 9,211 floor levels. The total number of impacted properties that experience a minimum of one QDL exceedance (considering lots and habitable and undetermined structures), in at least one of the modelled AEP flood events is 591. The exceedances are minor, with the highest flood level increase (afflux) being 23 mm on top of the 1.91m of above floor flooding already experienced by this impacted building in a 1% AEP flood event. Transport for NSW will engage directly with affected landowners to discuss specific flood impacts and explore mitigation options where a material impact is determined.

Independent Flood Impact Advisory Panel

The Condition of Approval (CoA) E34 requires Transport for NSW to reach agreements with landowners on either alternative flood levels or mutually agreed mitigation measures in cases of material impact. CoA E42 requires the formation of the Independent Flood Impact Assessment Panel (IFIAP) to provide expert advice and recommendations if agreements with landowners cannot be reached.

The IFIAP operates under a Terms of Reference, which was developed and approved by the Planning Secretary in line with CoA E43. The Terms of Reference outlines factors to be considered on a case-by-case basis when determining material impact.

These factors include, where relevant to a particular property, the existing depth and duration of flooding, the original function of the building(s), whether a habitable floor is affected, impacts on primary production activities and public recreation facilities, and the overall vulnerability to flooding impacts.

When operational quantitative design limits are not achieved, resulting in material impact, and agreement on mitigation measures cannot be reached with the affected landowner, the issue can be referred to the IFIAP for further review.

Mitigation and community preparedness

How we mitigate our flood impacts

We have reduced the risk of potential flood impacts of the project by investigating many different design options to achieve better flooding outcomes. Transport for NSW seeks to provide the best design possible while delivering a balance of engineering, safety, environment and community outcomes. We are working directly with stakeholders impacted by flooding and addressing individual requests where feasible and reasonable.

Contributions to local knowledge about flood patterns and emergency preparedness

We have worked with local authorities and emergency services during construction of the project. We have provided the NSW State Emergency Service (SES) and local councils with information about our flood modelling process and the predicted flood behaviour associated with the project. We are also required in line with CoA E39 to provide the SES and others with the results of the final updated flood model which will help them update their flood datasets and inform emergency response plans in preparation for the next flood.

The M1 extension will provide more efficient and reliable flood evacuation routes and minimum flood immunity along the new roadway for a one in 20 year event. The project would also provide a new flood emergency and evacuation access route for the communities between Black Hill and Raymond Terrace, providing increased resilience for future flood events, like those that occurred across the Hunter region in 2022.

Thank you for your input

Work to understand and predict potential flooding around the M1 extension to Raymond Terrace project has occurred over many years.

We would like to thank all residents, local landowners, industry partners, flood focus group members, and local authorities. The time and knowledge you have given to us to help our understanding of how flooding works and how it affects you has been invaluable.

More information

Unless the M1 extension team has contacted the resident/property owner directly then the impact at their property is within the project's quantitative design limits.

More specific information can be obtained by looking at the flood design report online at **nswroads.work/m12rt** or by speaking with a member of the project team.

Contact us:

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Website: **nswroads.work/m12rt**

Customer feedback: **Locked Bag 2030 Newcastle NSW 2300**

Visit the online portal: **nswroads.work/m12rtportal**

For the latest traffic updates:
Call 132 701, visit live traffic.com or download the app Live Traffic NSW

Interpreter service

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