

7.0 Environmental assessment

7.14 Climate change

This section presents an overview of the climate change risk assessment for the proposed modification and the approach to managing identified climate change risks. The proposed management approaches include adaptation measures to be incorporated into the design of the proposed modification.

7.14.1 Introduction

Table 7-105 outlines the SEARs that relate to climate change and identifies where they are addressed in this modification report. The full assessment of climate change impacts is provided in **Appendix N** (Climate change risk and greenhouse gas assessment).

Table 7-105 SEARs – Climate change

Desired Performance Outcome	SEAR	Where addressed within the Modification Report
Other issues <i>[No performance outcome stated]</i>	<p>An assessment of the following issues must be undertaken in accordance with the commitments in Attachment 2 of the M7 Motorway (SSI 663) – Project Modification letter submitted 9 May 2022 (via Major Projects Portal):</p> <ul style="list-style-type: none"> Climate change risk <p><i>Extract from Attachment 2 of the M7 Motorway (SSI 663) – Project Modification letter submitted 9 May 2022:</i></p> <ul style="list-style-type: none"> Assess the risk and vulnerability of the proposed modification to climate change in accordance with the current guidelines. Quantify specific climate change risks with reference to the NSW Government's climate projections at 10 kilometre resolution (or lesser resolution if 10 kilometre projections are not available) and incorporate specific adaptation actions in the design. 	<p>Section 7.14.5 provides the climate change risk assessment (CCRA)</p> <p>Section 7.14.6 provides the climate adaptation actions</p>
Flooding <p>The project minimises adverse impacts on existing flooding characteristics.</p> <p>Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.</p>	<p>A flood impact and risk assessment (FIRA) must be undertaken by a qualified flooding engineer. As a minimum the FIRA should consider:</p> <ul style="list-style-type: none"> d. impacts of climate change on both existing and post development flood behaviour due to increase in rainfall intensities; and e. proposed temporary management actions to mitigate impacts of flooding during construction on the community, personnel, machinery, and construction sites. 	<p>Section 7.14.5 provides the climate change risk assessment, including flooding.</p> <p>Section 7.14.6 provides the climate adaptation actions, including flood mitigation issues.</p> <p>Refer also Chapter 7.4 (Hydrology and flooding)</p>

7.14.2 Method of assessment

The methodology applied for the CCRA was guided by the Transport *Climate Risk Assessment Guidelines* (Transport, 2021b).

The following steps were undertaken to complete the CCRA:

- Identification of key climate variables (e.g. those related to temperature, rainfall and extreme events) across the study area for the proposed modification.
- Identification of potential climate change scenarios, based on climate science, which describes how each variable may change over the design life of the proposed modification.
- Identification of project-specific climate-based risks that may impact on the proposed modification.
- Completion of the CCRA, with risk ratings evaluated using the Transport's *Climate Risk Assessment Guidelines*. These guidelines include likelihood and consequence criteria (refer to **Appendix N** (Climate change risk and greenhouse gas assessment) for further information). Consequence ratings have been selected based on the highest rating for the risk categories. The risk assessment ratings were determined in a workshop with key stakeholders, including the current operators of the Westlink M7.
- Identification of potential measures to mitigate and adapt to the identified climate change risks.

7.14.3 Study area

The study area for the climate change assessment includes the physical boundary of the existing Westlink M7, and the construction and operational footprints of the proposed modification (described in Chapter 4.0 (Proposed modification)). The study area also includes the surrounding traffic network and local areas, as these can directly impact the level of exposure of the Westlink M7 to climate-related risks.

7.14.4 Existing environment

Climate

Greater Sydney currently has a significant variation in climate, ranging from the coastal fringes of Metropolitan Sydney to the Blue Mountains. Table 7-106 provides a brief overview of Greater Sydney's current climate.

Table 7-106 Greater Sydney's baseline [1961-1990] climate (AdaptNSW, 2014)

Climate component	Summary
Temperature	<ul style="list-style-type: none"> • Summer average temperatures range from 16-24 degrees Celsius (°C) • On average, Greater Sydney experiences less than 10 days over 35°C per year • Winter average temperatures range from 4-14°C • On average, Greater Sydney experiences less than 10 nights below 2°C per year • An increase in temperature has been observed across the region since the 1960s.
Rainfall	<ul style="list-style-type: none"> • Annual average rainfall is in the range of 800–1200 millimetres for Greater Sydney • There is typically more rainfall in summer and autumn than in winter and spring.
Fire weather	<ul style="list-style-type: none"> • Greater Sydney experiences on average one to two days per year of fire weather conditions considered 'severe' or greater.

Australia's climate has warmed by 1.44°C since 1910. The warmest observed years in Australia have been during the 21st century with 2019 being the hottest year on record (Commonwealth Scientific and Industrial Research Organisation - CSIRO, 2021). The increase in average temperatures has negative effects on the environment, such as the warming of oceans, sea level rise, more flooding, more intense storms, longer droughts and fire seasons.

7.14.5 Impact assessment

Given the expected design life of the infrastructure, the proposed construction timeframe and the available climate data, the time periods selected for the assessment were 2030 (representative of the 2025 opening year) and 2090 (representative of the far future). Climate change projections for 2030 were identified as appropriate for assessment of short-term impacts of climate change and construction, while projections for 2090 are relevant to the longer-term operation and maintenance stages of the proposed modification.

The key climate hazards identified for this assessment include:

- Extreme heat – which may drive health and safety concerns for road users and workers on the motorway
- Bushfire – which smoke could impact on reduced visibility for road users and result in poor air quality
- Drought – which could reduce the availability of water for landscaping and increased cracking of soils
- Extreme rainfall and flooding – which could result in scour of embankments and cuttings resulting in landslips causing damage to infrastructure
- Extreme storms – which can result in damage and disruption to electrical equipment (monitoring cameras and toll collection systems).

Construction

The CCRA identified a total of six risks for the construction period, the highest of which was a medium risk, with the remaining risks rated as low. The low risks include those relating to extreme heat events, extreme rainfall events, drought related water restrictions and bushfire risks. Further details on the low risks are found in **Appendix N** (Climate change and greenhouse gas assessment). The medium risk is outlined on Table 7-107. The medium and low risk ratings are prior to the implementation of mitigation measures (detailed in **Section 7.14.6**).

Table 7-107 Climate change construction risks to proposed modification identified as medium or higher

Impact	Risk ID	Risk Statement	2030 risk rating
Extreme rainfall and flooding	C-P2	Extreme rainfall and wind events leading to construction interruption resulting in construction delays for day to day works	Medium

Operation

The CCRA identified a total of 18 risks and two opportunities for the proposed modification during operation. At the 2030 time period, 14 low risks and four medium risks were identified. At the 2090 time period, 11 medium risks were identified. Table 7-108 outlines the medium rated risks for 2030 and 2090. The medium and low risk ratings are prior to the implementation of mitigation measures (detailed in **Section 7.14.6**).

The opportunities identified were of low risk and relate to the proposed modification providing additional capacity for the local road network when an event such as extreme rainfall, flooding and bushfire prevents access to the local roads.

Table 7-108 Climate change operational risks to proposed modification identified as medium or higher

Impact	Risk ID	Risk Statement	2030 risk rating	2090 risk rating
Increasing temperatures and number of hot days	T1	Extreme heat events leading to health and safety concerns for motorway staff, contractors and road users (e.g. heat stress, dehydration)	Medium	Medium
	T2	Extreme temperatures leading to increased stress of carriageway to bridge connections resulting in structural failure of motorway	Medium	Medium
	T3	Extreme heat/extreme weather leading to higher rates of vehicle breakdown resulting in demand on incident response crews	Low	Medium
	T5	Increase in paved surfaces exacerbating urban heat island effects resulting in cumulative increase in extreme temperatures	Low	Medium
	T6	Heat-related failure of intelligent transport systems (ITS) and critical roadside technology, leading to service interruption	Low	Medium
	T7	Prolonged duration of heatwave leading to increased energy demands and peak usage period consumption, resulting in unplanned cost increases	Low	Medium
Extreme rainfall and flooding	P1	Increased rainfall intensity leading to a higher frequency of floods resulting in flooding and reduction or loss of infrastructure service	Low	Medium
	P2	Increased rainfall intensity leading to scour of embankments and cuttings resulting in landslips causing damage to infrastructure	Medium	Medium
Bushfire	B2	Increasing bushfire frequency and intensity resulting in damage to the motorway corridor and/or ancillary assets and infrastructure	Low	Medium
Storm	S1	Extreme weather events leading to damage and disruption to electrical equipment (lighting, toll collection systems, monitoring cameras)	Low	Medium
	S2	Extreme storms and winds leading to increased instances of debris on the motorway resulting in health and safety concerns for road users	Medium	Medium

7.14.6 Management and mitigation

Based on the assessment described above, Table 7-109 summarises mitigation and management measures to be implemented to ensure that the proposed modification manages potential risks from climate change during all stages of the proposed modification.

Table 7-109 Mitigation measures

Impact	ID	Mitigation measures	Responsibility	Timing
Impacts related to increased rainfall and weather event intensities (Risk ID C-P2)	CC1	Transport will clearly communicate to construction contractor/s that there is expected to be an increased likelihood of extreme rainfall and wind events occurring during construction. The ordering of materials for, and breadth and scope of implementation of mitigation measures proposed as part of this modification report will take this into account. The delivery schedule will allow contingency for potential delays associated with extreme rainfall.	Transport Construction contractor	Construction
Increasing temperatures and number of hot days (Risk IDs T1, T2, T3, T5, T6)	CC2	During detailed design, opportunities will be considered to provide additional shading for road users who may be exposed to high temperatures for prolonged periods (e.g. breakdown bays).	Transport	Detailed design
	CC3	Routine maintenance and inspections will be undertaken of key structural components. Maintenance programs will be augmented to account for extreme weather events. Construction planning will include consideration of extreme heat impacts and additional measures to implement.	Transport Construction contractor	Operation Prior to construction planning
	CC4	Resourcing and capacity of response crews will be reviewed ahead of expected extreme heat events.	Transport Northwest Roads	Operation
	CC5	Appropriate landscape design will consider future climate impacts relating to drought (i.e. tolerant species) to provide ongoing shading along the operational footprint of the proposed modification.	Transport	Detailed design Construction
	CC6	During detailed design, options for implementing redundancy (e.g. batteries) into the ITS will be considered.	Transport	Detailed design
	CC7	Implement use of energy efficient LED lighting and low power mode options for other electrical equipment to reduce to reduce energy demand.	Transport	Detailed design

Impact	ID	Mitigation measures	Responsibility	Timing
Extreme rainfall and flooding (Risk IDs P1, P2)	CC8	Drainage design should consider the projected flooding impacts from the climate change projections.	Transport	Detailed design
	CC9	To address erosion/scour potential from increased rainfall intensity due to climate change, options for stabilising and/or reducing the slope of embankments will be considered during detailed design.	Transport	Operation Detailed design
Storms (Risk ID S1)	CC10	Ensure electrical equipment will be able to connect generators to roadside cabinets in the event of wider power outages. Lightning protection systems/earth proofing to be installed on major electrical equipment.	Transport	Detailed design