

Appendix B10

Climate Change Monitoring and Adaptive Management Framework

M12 Motorway


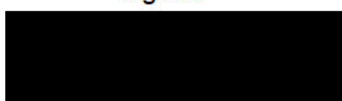
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D	03/08/2021	Updated with Final NSW and Commonwealth CoA
E	22/11/2021	Response to TfNSW and ER comments
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Glossary/ Abbreviations

Abbreviations	Expanded text
AR	Amendment Report
AR5	IPCC 5 th Assessment Report
AR6	IPPC 6 th Assessment Report
ARSR	Amendment Report to the Submissions Report
BoM	Bureau of Meteorology
CA	Consistency Assessment
CAQMP	Construction Air Quality Management Plan
CCMAMF	Climate Change Monitoring and Adaptive Management Framework
CCRA	Climate Change Risk Assessment
CCS	Community Communication Strategy
CFFMP	Construction Flora and Fauna Management Plan
CO ₂	Carbon dioxide
CoA	Conditions of Approval
Commonwealth CoA	Federal Conditions of Approval under the EPBC Act
Construction	Includes all activities required to construct the CSSI as described in the documents listed in Condition A1, including commissioning trials of equipment and temporary use of any part of the CSSI, but excluding Low Impact Work which is carried out to complete prior to the approval of the CEMP, works approved under a Site Establishment Management Plan, demolition of acquired residential houses, structures and sheds, and works specified in Appendix B of the Infrastructure Approval and approved under an environmental management plan(s) in accordance with Condition A24.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSSI	Critical State Significant Infrastructure
CSWMP	Construction Soil and Water Management Sub-plan
CWRMP	Construction Waste and Resources management Plan
DPE	Former NSW Department of Planning and Environment

Abbreviations	Expanded text
DPHI	NSW Department of Planning, Housing and Infrastructure (formerly NSW DPE which has now been split into NSW DCCEEW and NSW DPHI, with all planning functions falling to DPHI)
DPIE	Former Department of Planning, Industry and Environment
EAD	Environmental Assessment Documentation
EDC	Elizabeth Drive Connection
EES	Former Environment, Energy and Science
EHG	Environment and Heritage Group (a part of NSW DCCEEW)
EIS	Environmental Impact Statement
EMS	Environmental Management System

<p>Environmental Assessment Documentation</p>	<p>The set of documents that comprise the Division 5.2 Approval:</p> <ul style="list-style-type: none"> • Roads and Maritime Services (October, 2019) M12 Motorway, Environmental Impact Statement (EIS) • Transport for NSW (October, 2020) M12 Motorway, Submissions Report (the Submissions Report) • Transport for NSW (October, 2020) M12 Motorway, Amendment Report (AR) • Transport for NSW (December, 2020) M12 Motorway, Amendment Report submissions report (ARSR) • Transport for NSW (March, 2021) The M12 Motorway Amendment Report Submissions Report – Amendment (ARSR amendment) • WSP (October, 2021) M12 Motorway – West Package Detailed Design Consistency Assessment • GHD (October, 2021) M12 Motorway – Central Package Detailed Design Consistency Assessment • Arcadis (June, 2022) M12 Motorway – Sydney Water Crossings Consistency Assessment • Arcadis (July, 2022) M12 Motorway – Design Boundary Changes Consistency Assessment • Arcadis (August, 2022) M12 Motorway Minor Consistency Assessment for Proposed Change to the M12 Motorway Project (M12 Central) • Arcadis (September, 2023) M12 Motorway – Devonshire Road Temporary Roundabout Consistency Assessment • WSP (September, 2023) M12 Motorway - Elizabeth Drive Connections Consistency Assessment • TfNSW (September, 2023) M12 Motorway – Minor Consistency Assessment M12 West demolition of structures as 752 Luddenham Road • TfNSW (October, 2023) M12 Motorway – Minor Consistency Assessment M12 East AF9 Power Supply • TfNSW (October, 2023) M12 Motorway – Minor Consistency Assessment M12 East Cecil Road Laydown Area • TfNSW (October, 2023) M12 Motorway – Minor Consistency Assessment M12 East Temporary Construction Signage • Arcadis (December, 2023) M12 Motorway – East Site 48, 50 and 51 Boundary Changes Minor Consistency Assessment • Arcadis (January, 2024) M12 Motorway – Minor Consistency Assessment M12 Central Water Tower Access Road <p>The documents that comprise the EPBC referral:</p> <ul style="list-style-type: none"> • Submission #3486 – The M12 Motorway Project between the M7 Motorway, Cecil Hills and The Northern Road, Luddenham, NSW <p>Notification of referral decision and designated proponent - controlled action; date of decision 19 October 2018; ID: 2018-8286.</p>
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Abbreviations	Expanded text
Environmental Representative	A suitably qualified and experienced person independent of project design and construction personnel employed for the duration of construction. The principal point of advice in relation to all questions and complaints concerning environmental performance.
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPL	Environmental Protection License
ER	Environmental Representative
ESM	Transport for New South Wales Environment and Sustainability Manager
ESR	Construction Contractor Environmental Site Representative
Extreme event	Referred to as extreme heat, extreme precipitation, severe storm or wind event and/or bushfire
Federal Approval	Approval (EPBC 2018/8286) for carrying out the M12 Project under Part 8 of the Environmental Protection and Biodiversity Conservation Act 1999 subject to specific CoA as detailed in Annexure A of the approval.
Final construction footprint	The area shown in the map(s) submitted under Commonwealth CoA 2, determined by TfNSW in accordance with a consistency assessment(s) or a modification assessment under the <i>NSW Environmental Planning and Assessment Act 1979</i> where no new significant impacts to protected matters are identified.
CFMP	Construction Flood Management Plan
Framework	All activities related to this CCMAMF
GHG	Greenhouse gas
Infrastructure Approval	Approval (SSI 9364) for carrying out of the M12 Project under Section 5.19 of the Environmental Planning and Assessment Act 1979 subject to specific CoA as detailed in Schedule 2 of the approval.
IPCC	Intergovernmental Panel on Climate Change
IS	Infrastructure Sustainability
ISCA	Infrastructure Sustainability Council of Australia
M7 Motorway (MOD 6 Widening)	Refers to the State Significant Infrastructure project (SSI-663-MOD 6) to construct and operate an additional lane in both directions within the existing median of the M7 Motorway, south of the Kurrajong Road overhead bridge at Prestons to the M7 Motorway bridge at Richmond. This project interacts with the M12 East stage at the M7 interchange.
M7 Widening	Shorthand term for M7 Motorway (MOD 6 Widening)

Abbreviations	Expanded text
M7-M12 Integration Project	<p>The M7-M12 Integration project incorporates the following:</p> <ul style="list-style-type: none"> • M7 Motorway (Mod 6 Widening) (SSI 663 Mod 6) – modification (mod) to the M7 Motorway approved on 17 February 2023 under Division 5.2 of the Environmental Planning and Assessment Act 1979 (EP&A Act) • M12 Motorway (CSSI 9364) – approved on 23 April 2021 under Division 5.2 of the EP&A Act and split into separate stages or packages of work (West, Central (main construction), Central (temporary roundabout) and East). The M12 Motorway is also subject to a federal approval under the Environment Protection and Biodiversity Conversation Act 1999. The M7-M12 Integration project incorporates the M12 East package only.
NSW CoA	NSW Conditions of Approval
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water (formerly NSW DPE which has now been split into NSW DCCEEW and NSW DPHI)
OCEMP	Overarching Construction Environmental Management Plan
OCS	Overarching Communication Strategy
OEMP	Operational Environmental Management Plan
Planning Secretary	Secretary of the NSW Department of Planning and Environment, or delegate
Ppm	Parts per million
Primary CoA/REMM	CoA/REMM that are specific to the development of this Framework
Project CCRAs	Collective term for Climate Change Risk Assessments and climate change monitoring and adaptive management frameworks from M12 West, Central and East Detailed Design packages
RCP	Representative Concentration Pathway
REMM	Revised Environmental Management Measure
RMS	Former Roads & Maritime Services (now Transport for NSW)
Secondary CoA/REMM	CoA/REMM that are related to, but not specific to, the development of this Framework
SEMP	Site Establishment Management Plan
TfNSW	Transport for New South Wales
WHS	Workplace Health and Safety

Abbreviations	Expanded text
Work	<p>Any physical work to build or facilitate the building of the CSSI, including low impact work, environmental management measures and utility works.</p> <p>However, it does not include activities that inform or enable detailed design of the CSSI and generate noise that is no more than 5 dB(A) above the rating background level at any sensitive receiver.</p>
WSIA	Western Sydney International Airport

1 Introduction

1.1 Context

This Climate Change Monitoring and Adaptive Management Framework (CCMAMF or Framework) forms part of the Overarching Construction Environmental Management Plan (OCEMP) for the M12 Motorway (the Project).

This CCMAMF has been prepared to address the requirements of the Revised Environmental Management Measures (REMMs) listed in the M12 Motorway Environmental Assessment Documentation, listed in the M12 Motorway Environmental Impact Statement (EIS), Amendment Report, and Amendment Report Submissions report (ARSR), all applicable legislation and Transport for New South Wales (TfNSW) specifications.

1.2 Background

TfNSW is planning to construct and operate the M12 Motorway (the Project) to provide direct access between the Western Sydney International Airport (WSIA) at Badgerys Creek and Sydney's motorway network. The M12 Motorway will run between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham for about 16 kilometres (km) and is expected to be opened to traffic prior to opening of the WSIA.

The Project will be constructed in separate stages under separate construction contracts:

- M12 West – between The Northern Road, Luddenham and about 250 metres east of Badgerys Creek
- M12 Central (main construction) – between about 250 metres east of Badgerys Creek and the Western Sydney Parklands at Duff Road, Cecil Park
- M12 Central (Temporary Roundabout) – temporary roundabout installation at Elizabeth Drive and Devonshire Road, Kemps Creek
- M12 East – (as part of the M7/M12 Integration Project)
 - Elizabeth Drive Connections (EDC) – a two-kilometre section from Duff Road to about 300 metres east of the M7 Motorway
 - M7/M12 Interchange – An interchange between the M12 Motorway and M7 Motorway and tie-in works for approximately four kilometres on the M7 Motorway

The Project is subject to an approval under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as Critical State Significant Infrastructure (CSSI) (SSI-9364). The Project is also a controlled action under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), requiring a separate approval from the Australian Minister for the Environment.

An EIS was prepared to describe and assess the Project and recommend management measures to address impacts. The EIS was exhibited by the NSW Department of Planning, Industry and Environment (DPIE, now split into the NSW Department of Planning, Housing and Infrastructure and Environment (DPHI) and Department of Climate Change, Energy, the Environment and Water

(NSW DCCEEW)) for 34 days from 16 October 2019 to 18 November 2019 to give the community and stakeholders the opportunity to provide comment.

In accordance with Section 5.17 of the EP&A Act, the Planning Secretary requested TfNSW to provide a Response to Submissions report on 29 November 2019. These were addressed within the Submission Report. Due to design developments since the exhibition of the EIS, an Amendment Report (AR) was developed to assess the impacts of these amendments. The AR was exhibited by DPIE for 14 days from 21 October 2020 to 4 November 2020. Following exhibition of the AR, an ARSR was developed in December 2020 address the identified issues, followed by the ARSR – Amendment in March 2021 which addressed biodiversity matters only. The following additional assessments have since been undertaken:

- Two Consistency Assessments (CA) for M12 West and Central addressing detailed design changes for the Project construction boundary approved in October 2021
- Sydney Water Consistency Assessment related to construction boundary extensions associated with Sydney Water utility crossings; approved in June 2022
- Design Boundary Change Consistency Assessment related to design boundary changes within the M12 alignment. This required an extension of the construction footprint and operational footprint, property adjustments and the demolition of Building No.1 at McMasters Field Station; approved in July 2022. Threatened Species Surveys were also undertaken along the M12 alignment between September and December 2021 to satisfy the NSW Conditions of Approval (CoA) E4, E5 and E6; the outcomes of which captured within the Design CA.
- Minor Consistency Assessment (M12 Central) required amendments to the construction footprint as a result of utility adjustments and tie in works, property adjustments for flood alleviation and improvements to ancillary facility access due to safety concerns, temporary widening of Elizabeth Drive and signage installation; approved in August 2022.
- Devonshire Road Temporary Roundabout Consistency Assessment required to address the requirements of REMM TT10. This has resulted in an increase to the construction footprint at the Elizabeth Drive and Devonshire Road intersection to allow for the construction of a temporary roundabout; approved in September 2023.
- Elizabeth Drive Connections Consistency Assessment addressed detailed design changes for the Elizabeth Drive Connections. This involved minor construction and operation boundary adjustments, design changes, new sediment basin locations, utility works, property access changes and property adjustments; approved in September 2023.
- M12 West Minor Consistency Assessment for the demolition of structures at 752 Luddenham Road required to address the need for the demolition of structures within Ancillary Facility 11. Whilst this ancillary facility is already located within the construction footprint and was previously assessed in the M12 Motorway Amendment Report, the demolition and disposal of structures in this location required assessment; approved in September 2023.
- M12 East AF9 Power Supply Minor Consistency Assessment required to address a minor temporary amendment to the construction footprint in order to provide permanent site power to the construction ancillary facility 9 (AF9); approved in October 2023.
- M12 East Cecil Road Laydown Area Minor Consistency Assessment required to address temporary amendment to the construction boundary to facilitate the installation of a DN150 Steel Secondary Gas main within Cecil Road; approved in October 2023.

- M12 East Temporary Construction Signage Minor Consistency Assessment required to address temporary traffic signage installed prior to the start of temporary barriers on the M7 Motorway; approved in October 2023.
- M12 East Site 48, 50 and 51 Boundary Changes Minor Consistency Assessment addressed the required amendments to the construction footprint in three locations as a result of temporary traffic control measures, pavement build up and resurfacing; approved in December 2023.
- M12 Central Water Tower Access Road Minor Consistency Assessment addressed changes to the construction boundary to facilitate the construction of concrete slabs over the Sydney Water main, the construction of a temporary access road to the existing water tower and radar tower, and the subsequent reinstatement of this temporary access road to pre-construction conditions; approved in January 2024.

The Project must be carried out generally in accordance with the EIS, Submissions Report, AR, ARSR and the ARSR - Amendment, M12 West and Central CA, Sydney Water CA, Design Boundary Change CA, Minor CA, Devonshire Road Temporary Roundabout CA, Elizabeth Drive Connections CA, M12 West Demolition of Structures at 752 Luddenham Road CA, M12 East AF9 Power Supply CA, M12 East Cecil Road Laydown Area CA, M12 East Temporary Construction Signage CA, M12 East Sites 48, 50 and 51 CA and M12 Central Water Tower Access Road CA in accordance with NSW CoA A1. These documents are collectively referred to as the Environmental Assessment Documentation (EAD). The CSSI must also be carried out in accordance with all procedures, commitments, preventative actions, performance outcomes and mitigation measures set out in the Environmental Assessment Documentation EAD as required by NSW CoA A2.

REMMs were provided within the AR and further updated in the ARSR. Where applicable, the REMMs from the ARSR have been included in this CCMAMF. Further, design development has progressed, providing additional environmental assessment, and where relevant, this detail has been included within this CCMAMF.

Additionally, the M12 East Stage is being delivered as part of the M7-M12 Integration Project which includes the M7 Motorway Widening Project (MOD 6 Widening (SSI-663-MOD 6)) (referred to herein as M7 Widening) delivered by Western Sydney Orbital Company (WSO Co). Additional assessments were undertaken as a part of the EAD for this project.

A detailed description of the Project is provided in Section 2 of the OCEMP.

1.3 Scope of this Framework

The scope of this Framework is to describe the climate change monitoring and adaptive management measures to be adopted for the Project during construction in accordance with REMM CC02.

As defined by the NSW Environment and Heritage Group (EHG), “Adaptive management is a procedure for implementing management while learning about which management actions are most effective at achieving specified objectives. Adaptive management is often referred to as structured ‘learning by doing’.”¹ This concept has been applied throughout the Framework.

This Framework does not consider climate change monitoring and adaptive management measures for design and operation.

¹ Adaptive Management definition sourced from NSW DPE <https://www.environment.nsw.gov.au/research/adaptive-management.htm>

1.4 Environmental Management System overview

The overarching Environmental Management System (EMS) for the Project is described in Section 3 of the OCEMP. The Construction Contractor delivering the Project will have an EMS consistent with the overarching EMS described in the OCEMP and will develop stage-specific CCMAMFs in accordance with the OCEMP, the Environmental Protection Licence (EPL) and their EMS.

This overarching CCMAMF forms part of the environmental management framework for the Project, as described in Section 3 of the OCEMP.

The Construction Contractor will be required to develop, as part of their stage-specific CCMAMFs, detailed procedures and plans to address specific requirements of the REMMs identified in this overarching CCMAMF.

EWMS will be prepared by the Construction Contractor's Environmental Site Representative (ESR) and reviewed by the TfNSW Environment and Sustainability Manager (ESM) (or delegate) and independent Environmental Representative (ER) prior to the commencement of the construction activities to which they apply. Construction personnel undertaking a task governed by an EWMS will undertake the activity in accordance with the mitigation and management measures identified in the EWMS.

Used together, the OCEMP, strategies, procedures and EWMS form management guides that clearly identify required environmental management actions for reference by TfNSW and its Construction Contractor.

1.4.1 CCMAMF preparation, endorsement and approval

This overarching CCMAMF has been prepared to satisfy REMM CC02 to detail the adaptive management approach to climate change during construction and was reviewed and approved by the TfNSW Senior Project Manager and the TfNSW ESM.

Refer to Section 1.12 of the OCEMP that details the overall revision process of OCEMP and Sub-plans.

1.4.2 Interactions with other management plans

This Framework forms part of the OCEMP to be prepared for the Project and has the following interrelationships with other management plans and documents:

- M12 Sustainability Strategy (TfNSW, 2021) which outlines the sustainability objectives and targets and Infrastructure Sustainability Council of Australia (ISCA) rating tool credit requirements. The Sustainability Strategy will be developed in accordance with REMM SU01 and NSW CoA E91 and E92 and implemented during detailed design and construction. Targets to reduce greenhouse gas emissions during construction will also be detailed in the Sustainability Strategy.
- M12 Motorway West Package 100% Detailed Design Report: Climate change monitoring and adaptive management framework (WSP, 2021)
- M12 Motorway Central Package 100% Detailed Design Report: Climate change monitoring and adaptive management framework (GHD, 2021)
- M12 Motorway – West Package Detailed Design, Sustainability Management Plan (WSP, 2021)

- M12 Motorway – Central Package Detailed Design, Sustainability Management Plan (GHD, 2021)
- The Overarching Construction Environmental Management Plan (OCEMP) specifically relating to management measures and monitoring requirements during construction
- Construction Flora and Fauna Management Plan (CFFMP) including the minimisation of vegetation removal
- Construction Soil and Water Management Plan (CSWMP) including site inspection prior, during and following storm events
- Construction Waste and Resources Management Plan (CWRMP) specifically addressing greenhouse gas emissions and resource and energy use
- Construction Air Quality Management Plan (CAQMP) specifically monitoring vehicle and plant emissions during construction
- Construction Flood Management Plan (FMP) addresses flood management protocols and response
- Site Establishment Management Plan (SEMP) addresses the construction of ancillary facilities away from high risk areas
- The Workplace Health and Safety Management Plan will apply an adaptive management approach to workplace health and safety during construction
- The Risk Management Plan will consider climate change risks and adaptive management measures.

2 Purpose and objectives

2.1 Purpose

This CCMAMF provides an overarching management framework to enable TfNSW and the Construction Contractors to establish and maintain best practice controls to manage potential climate change impacts during construction of the Project. The strategies defined in this CCMAMF have been developed to address the REMM CC02. This CCMAMF includes general requirements for implementation, monitoring and auditing which will be applied to, and further developed in, the stage specific Construction Contractors' CCMAMFs. Implementing this CCMAMF effectively will enable the Project to meet regulatory and policy requirements in a systematic manner and continually improve climate change performance.

The CCMAMF provides:

- An overview of the Project's existing climate and relevant climate change projections
- Climate change impacts related to construction phase of the Project
- Climate change control measures during construction
- Monitoring procedures and criteria to evaluate effectiveness of climate change control measures during construction
- Procedures for periodic review of the Climate Change Risk Assessment (CCRA) and CCMAMF.

This CCMAMF and stage-specific Construction Contractors' CCMAMFs will be available to all site personnel and sub-contractors via the Project document control management system and onsite.

2.2 Objectives

The key objective of this CCMAMF is to ensure that all relevant requirements related to climate change mitigation and adaptive management are described, scheduled and assigned responsibility.

2.3 Targets

Targets for climate change mitigation and adaptive management during construction of the Project have been established to enable compliance with Project requirements and include:

- Ensure project personnel are informed via toolbox talks and the Project induction of this framework
- Manage extreme events during the construction of the Project through the implementation of feasible and reasonable management measures, such as those detailed in Section 5.

3 Environmental Requirements

3.1 Relevant legislation and guidelines

Legislation, guidelines and policies relevant to the development of this Framework include:

- *Environmental Planning and Assessment Act, 1979*
- United Nations Sustainable Development Goals
- Transport Environment and Sustainability Policy Framework and Statement (TfNSW)
- TfNSW Sustainable Design Guidelines Version 4.0
- Infrastructure Sustainability rating tool Version 1.2 (Infrastructure Sustainability Council of Australia)
- Commonwealth Direct Action Plan including the Emissions Reduction Fund and Safeguard Mechanism
- National Climate Resilience and Adaptation Strategy
- NSW Climate Change Policy Framework
- Climate Change Fund Strategic Plan 2017-2022
- NSW Future Transport Strategy 2056
- A Metropolis of Three Cities – the Greater Sydney Region Plan (Greater Sydney Commission)
- Western City District Plan (Greater Sydney Commission)
- NSW Government Resource Efficiency Policy
- NSW Waste Avoidance and Resource Recovery Strategy 2014-21
- Technical Guide for Climate Change Adaptation for the State Road Network
- Australian Standard AS 5334-2013 *Climate change adaptation for settlements and infrastructure – A risk-based approach*
- Australian and New Zealand Standard AS/NZ ISO 31000:2018 *Risk Management – Guidelines*.

3.2 NSW and Federal Conditions of Approval

There are no requirements under the NSW or Federal Conditions of Approval (CoA) to prepare and implement a climate change monitoring and adaptive management framework.

3.3 Revised Environmental Management Measures

The primary REMM relevant to the development of this Framework is listed in Table 3-1. Secondary REMMs relevant to this Framework have been listed in Appendix A. A cross reference is also included to indicate where the REMM is addressed in this document or other Project management documents.

Table 3-1: Primary REMMS relevant to this Framework

REMM No.	Requirement	Document Reference
CC02	A climate change monitoring and adaptive management framework will be prepared and implemented for the Project.	This CCMAMF
	The framework will incorporate performance monitoring criteria and measures	Section 4.3 Section 5
	The framework will incorporate the requirement for periodic review of the climate change risk assessment and framework against updated climate data to ensure currency.	Section 4.2 Section 7.2

3.4 TfNSW design documentation

Design development has progressed, providing additional environmental assessment, and where relevant, it has been included within this Framework. Specific documentation related to this Framework includes the following documents:

- M12 Motorway West Package 100% Detailed Design Report: Climate Change Risk Assessment (CCRA), monitoring and adaptive management framework (WSP, 2021a)
- M12 Motorway Central Package 100% Detailed Design Report: Climate Change Risk Assessment (CCRA), monitoring and adaptive management framework (GHD, 2021a)
- M12 Motorway – West Package Detailed Design, Sustainability Management Plan (WSP, 2021b)
- M12 Motorway – Central Package Detailed Design, Sustainability Management Plan (GHD, 2021b)
- M12 Motorway – Elizabeth Drive Connection, Climate Change Assessment, Monitoring and Adaptive Framework (WSP, 2022). M12 Motorway - Elizabeth Drive Connection Sustainability Management Plan (WSP 2022)
- M7-M12 Integration Project Climate Change Risk Assessment Report (JHG 2024)

3.5 Infrastructure Sustainability Council of Australia

The Project is targeting an 'Excellent' rating under the Infrastructure Sustainability (IS) Rating Scheme, administered by the Infrastructure Sustainability Council of Australia (ISCA). The IS Rating is an assessment of a Project's sustainability performance across a number of categories, including climate change.

The two climate change related IS rating credits requirements, specifically Level 2 for Cli-1 'Climate change risk assessment', and Level 2 for Cli-2 'Adaptation measures' are identified in Table 3-2.

Table 3-2: IS Rating climate change risk assessment credit criteria

IS credit	Level	Criteria
Cli-1 Climate change risk assessment	Level 1	<p>A readily available climate change projection is identified and adopted for the asset region over the forecast useful life of the asset.</p> <p>AND</p> <p>Direct climate change risks to the asset over the forecast useful life are identified and assessed.</p>
Cli-1	Level 2	<p>The requirements of Level 1 are achieved.</p> <p>AND</p> <p>A number of readily available climate change projections are identified and adopted for the asset region over the forecast useful life of the asset.</p> <p>AND</p> <p>The climate change risk assessment also considered indirect climate change risks to the asset.</p> <p>AND</p> <p>A multi-disciplinary team participated in identifying climate change risks and issues.</p>
Cli-1	Level 3	<p>The requirements of Level 2 are achieved.</p> <p>AND</p> <p>Modelling is undertaken to characterise the likely impacts of the projected climate change for all High and Extreme priority climate change risks.</p> <p>AND</p> <p>A comprehensive set of affected external stakeholders participated in identifying climate change risks and issues.</p>
Cli-2 Adaption measures	Level 1	<p>Adaptation options to treat all extreme and high priority climate change risks are identified, assessed and appropriate measures implemented</p> <p>AND</p> <p>After treatment there are no extreme priority residual climate change risks.</p>
Cli-2	Level 2	<p>The requirements of Level 1 are achieved.</p> <p>AND</p> <p>Adaptation options to treat 25-50% of all medium priority climate change risks are identified, assessed and appropriate measures implemented.</p>

IS credit	Level	Criteria
Cli-2	Level 3	<p>The requirements of Level 2 are achieved.</p> <p>AND</p> <p>The optimal scale and timing of options is addressed (which may be triggered by when a specific climate threshold is likely to be achieved).</p> <p>AND</p> <p>Adaptation options to treat at least 50% of all medium priority climate change risks are identified, assessed and appropriate measures implemented.</p> <p>AND</p> <p>After treatment there are no high priority residual climate change risks.</p>

4 Existing Environment

Greenhouse gases (GHG) are gases that when released into the atmosphere effectively trap heat influencing global temperatures. The release of GHGs into the atmosphere is caused by both natural processes (such as bushfires) and human activities (e.g. burning fossil fuels and land clearing).

GHG (measured in parts per million (ppm)) have been rapidly increasing since the industrial revolution leading to an increase in the earth's average surface temperature and has contributed to the phenomenon of 'climate change'.

The term 'climate' refers to the typical weather conditions for a specific geographical area, usually averaged over at least 30 years. Climate variability represents the 'normal' day to day seasonal and year to year variability in the components of climate (e.g. temperature, rainfall). However, climate variability may also generate extreme conditions such as flooding, heatwaves and hail which require management.

Climate change is likely to bring about changes in both average climate conditions and the frequency and severity of extreme events. This progressive change has implications for sea levels, ocean temperatures and the functionality of natural ecosystems. Climate change also means that asset owners and managers can no longer rely on prevailing assumptions that climate will be more or less the same as it was over the past 50 or 100 years.

The EIS summarised the key findings on climate change as outlined in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). The findings include:

- Warming of the climate is unequivocal; the atmosphere and oceans have warmed, the amounts of snow and ice have diminished, and sea level has risen
- Surface temperature is projected to rise over the 21st century. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent. The ocean will continue to warm and acidify, and global mean sea level will rise
- In urban areas, climate change is projected to increase risks for people, economies and ecosystems, including risks from heat stress, storms, extreme rainfall, flooding, water scarcity, sea level rise, and storm surges
- Australia is currently experiencing the effects of climate change, including extreme temperatures, changes to rainfall, frequency and intensity of storm events, increases in bushfire weather, ocean warming and acidification, and sea level rise

Building adaptive capacity is crucial for effective selection and implementation of adaptation options.

In March 2023, the IPCC Sixth Assessment Report (AR6) was released (IPCC, 2023). This Framework has been reviewed upon the release of the AR6. The outcomes of the first part of the AR6 report contained similar climate change outcomes as AR5, with the following additions:

- There has been widespread and rapid changes to the atmosphere, ocean, cryosphere and biosphere with human-caused climate change leading to adverse impacts to nature and people. The most affected groups are vulnerable communities that have had the least impact upon climate change. These groups will continue to be the most vulnerable to climatic hazards.
- Climate change has resulted in considerable losses of species in terrestrial, freshwater, cryospheric, and coastal and open ocean ecosystems.

- Climate change has adversely affected food production and water security.
- Climate and weather extremes have resulted in increase to human mortality and morbidity with increases in climate related disease, increasing temperatures, trauma from extreme events, loss of livelihood and culture, and displacement of communities.
- Economic impact have been detected including individual impacts as well as impacts to largest sectors such as agriculture, forestry, fishery, energy and tourism.

The Construction Contractor will update their stage specific CCMAMFs based on this Framework. The update and amendment of this Framework is further detailed in Section 7.2.

4.1 Climate change projections

As per AS 5334:2013, *Climate change adaptation for settlements and infrastructure – A risk based approach*, the climate change projections selected include a medium-term moderate emissions scenario and a long-term high emissions scenario. They include a 2050 projection under Representative Concentration Pathway (RCP) 4.5 and a 2090 projection under a more extreme RCP 8.5. AS 5334 states, this is preferable to provide a range in the data to guide the risk assessment. For comparison, all climate risks were also assessed using the climate baseline data collected from Prospect Reservoir Weather Station.

The RCPs are described according to atmospheric CO₂ concentration levels (in ppm) and may also be described by anomalies in global mean surface air temperatures for the period 2081-2100 relative to the average period 1986-2005 (refer Table 4-1). A summary of historical annual trends and projected changes to climate variables for each scenario is provided in Appendix B.

Table 4-1: Climate change projection scenarios

Global climate response	RCP scenario	Project increase in global surface temperature by 2081-2100
Slower response, emissions peak around 2040, then decline.	RCP 4.5, atmospheric concentration of CO ₂ projected at approx. 540 ppm by 2100.	Mean projected increase 1.8 °C Anomaly range +1.1 – 2.6 °C
Little curbing of emissions, continuing rapid rise throughout the 21st century.	RCP 8.5, atmospheric concentration of CO ₂ projected at approx. 940 ppm by 2100 and continuing to increase.	Mean projected increase 3.7 °C Anomaly range +2.6 – 4.8 °C

4.2 Climate Change Risk Assessment

Climate Change Risk Assessments (CCRA) have been developed for each detailed design package. These CCRA's built upon the EIS, and updates were made to the selection of climate variables, as well as baseline and projection data and climate change scenarios for each detailed design package; these are collectively referred to as the Project CCRA and incorporate the M12 West (WSP, 2021a), M12 Central (GHD, 2021a) and M12 East CCRA's.

The CCRA's have taken into consideration the requirements of AS 5334:2013, *Climate change adaptation for settlements and infrastructure – A risk based approach* (which follows the risk principles and guidelines of AS 31000:2009, *Risk Management – Principles and guidelines*) and the RMS Technical Guide on *Climate Change Adaptation for the Road Network*.

Each Project CCRA represents a historical trend of weather data obtained from an appropriate nearby weather station, expressed as an average value for different climate variables measured at that station for completeness of data. The Prospect Reservoir Weather Station was used for M12 Central CCRA as the station contained significant climate baseline data and was proximal to the M12 Central. M12 West CCRA utilised Orchard Hill Treatment Works weather station (067084). The M12 East CCRA was assessed as part of the M7-M12 Integration Project CCRA, which opted to use broader-scale weather information from AdaptNSW for Western Sydney as a region.

Climate change risks relevant to the construction of the Project were determined using climate change projections to the year 2050. A total of 52 risks were identified following the CCRA completed for M12 Central. This included 18 new risks, which had not previously been identified during the planning phase risk assessment process in the Environmental Assessment Documentation.

It should be noted that the near-term 2030 RCP 8.5 scenario used in the EIS was replaced with the 2050 RCP 4.5 scenario for M12 Central CCRA. The AS 5334 requires that both a moderate and extreme emissions scenario should be considered (which was lacking from the EIS), in that the usability of the resulting assessment will be minimal in the context of the design life of the asset components and the estimated construction completion year of 2025.

A total of 37 risks were identified following the CCRA completed for M12 West. No 'very high' risks were identified, however two 'high' and 21 'medium' risks were identified based on 2030 scenario.

A total of 32 risks were identified following the CCRA completed for the M7-M12 Integration Project, which considered the 2030, 2070 and 2090 scenarios. Based on the 2030 scenario no 'very high' or 'high' risks were identified, however four 'medium' risks were identified. To 2070 there were still no 'very high' or 'high' risks, with six 'medium' risks identified.

Using the Project CCRA's completed by GHD and WSP three main risks were identified for construction with a moderate or high-risk rating. A further construction risk with a medium risk rating was identified in the JHG CCRA. The risks are outlined in Table 4-2. Adaptation and mitigation measures associated with the identified risks are detailed in Section 5.

Table 4-2: Climate change risks during construction

Risk scenario	Likelihood	Consequence	Risk rating 2050 (GHD, 2021a)	Risk rating 2030 (WSP, 2021a)	Risk rating 2030 (JHG, 2024)
Increased frequency, severity, and duration of extreme temperatures (days exceeding 35°C)	Possible	Serious	Moderate	Medium	Medium

Risk scenario	Likelihood	Consequence	Risk rating 2050 (GHD, 2021a)	Risk rating 2030 (WSP, 2021a)	Risk rating 2030 (JHG, 2024)
leading to adverse health impacts for construction workers and potential health and safety incidents.					
Increased frequency, severity and duration of extreme precipitation events leading to unsuitable and unsafe conditions for construction to proceed, resulting in an increase in 'stop work' days and subsequent delays to the construction program.	Possible	Serious	Moderate	Medium	Medium
Increased frequency and severity of bushfires leading to smoke generation, resulting in potential health effects for construction workers and health and safety incidents, potential increase in 'stop work' days, and subsequent delays to construction program.	Possible	Major	High	Medium	Medium
Increasing wind speeds leading to dust and air quality issues.	Moderate	Unlikely	-	-	Medium

It is noted that the CCRA will be reviewed periodically to ensure currency based on the latest scientific evidence and research. Where required, the CCRA will be updated, and this CCMAMF will be updated in response, as detailed in Section 7.2.

4.3 Performance monitoring criteria

Monitoring of climate change adaptation measures is required to ensure the Project maintains resilience to climate change impacts to minimise adverse impacts on personnel's health during construction and operation, the public's health during operation and delays to construction program.

A list of monitoring activities and evaluation criteria are specified in Table 4-3. These activities and criteria will be supplemented during construction by the measures outlined in the Overarching

Construction Environmental Management Plan (OCEMP) (Section 7.1 and Section 7.2) and relevant Sub-plans, as well the Sustainability Management Plan.

The Construction Contractor will supplement the monitoring measures to manage and evaluate the effectiveness of adaptation measures, implement changes and revise any of the performance monitoring criteria where required.

Table 4-3: Climate change performance monitoring criteria and measures

Performance monitoring criteria	Monitoring measures	Timing	Responsibility
Evaluate effectiveness of communicating upcoming extreme climate to personnel and planning for delays to program	Monitor weather forecast to check for upcoming days with predicted extreme heat, extreme precipitation, and bushfire warnings to enable wet weather procedures or stop works to be enacted	Daily	Construction Contractor ESR Construction Contractor Safety Manager
If construction ancillary facilities have been affected by severe storms, consider relocation or additional weather protection	Site inspection to be undertaken before, during and after rainfall events	Before, during and after rainfall	Construction Contractor ESR Construction Contractor Safety Manager
Determine if the WHS practices are effective in preventing personnel health impacts, if not, implement improved protocols	Monitor effectiveness of workplace health and safety practices, including stop work protocols, to be reviewed after the event of extreme heat days	After days exceeding 35°C	Construction Contractor Safety Manager
Evaluate health and wellbeing of personnel on extreme heat days and determine if additional protocols shall be implemented to minimise health risk	Monitor the health and wellbeing of personnel on high heat days and determine whether stop work protocols should be implemented	Days exceeding 30°C but under 35°C	Construction Contractor Safety Manager

5 Climate Change Adaption and Mitigation Measures

The adaptation and mitigation options have been designed to control and minimise the risk of climate change during construction. These options are based on the relevant construction risk scenarios detailed in identified in the Environmental Assessment Documentation and Project CCRAs. The construction risk scenarios include:

- Extreme heat: Increased frequency, severity, and duration of extreme temperatures (days exceeding 35°C) leading to adverse health impacts for construction workers and potential health and safety incidents.
- Extreme precipitation: Increased frequency, severity and duration of extreme precipitation events leading to unsuitable and unsafe conditions for construction to proceed, resulting in an increase in 'stop work' days and subsequent delays to the construction program.
- Bushfires: Increased frequency and severity of bushfires leading to smoke generation, resulting in potential health effects for construction workers and health and safety incidents, potential increase in 'stop work' days, and subsequent delays to construction program.
- Wind – average wind speed and storm activity: Increased frequency of extreme storms and wind speeds leading to dust and air quality issues resulting in an increase in 'stop work' days and subsequent delays to the construction program.

Table 5-1 details the adaptive management options for workplace health and safety and environmental planning during construction that will be implemented by Construction Contractors and be adopted in stage-specific documentation.

Table 5-1: Climate Change adaptation and mitigation measures during construction

ID	Management Measure	When to implement	Responsibility	Applicability			Reference of source	Evidence of implementation
				M12 West	M12 Central	M12 East		
CC01	In locating ancillary facilities, the Construction Contractor will consider the risk of flood, strong winds, severe storm events and/or bushfires and consider the requirements detailed in NSW CoA A15-A20	Prior to construction	Construction Contractor ESR Construction Contractor Safety Manager	✓	✓	✓	Section 5 CCRA WHS Protocol	Site planning Site Establishment Management Plan
CC02	Prior to attending site, all personnel will undergo induction training detailing the procedures to be undertaken during extreme weather events ²	Prior to construction and during construction	Construction Contractor ESR Construction Contractor Safety Manager	✓	✓	✓	Section 5 CCRA WHS Protocol	Induction material OCEMP WHS Plan
CC03	Weather conditions will be monitored, and the construction program will be adapted wherever feasible during extreme events	During construction	Construction Contractor ESR Construction Contractor Safety Manager	✓	✓	✓	Section 5 CCRA WHS Protocol	Induction material OCEMP WHS Plan

² An extreme event can be referred to as extreme heat, extreme precipitation, severe storm or wind event and/or bushfire

ID	Management Measure	When to implement	Responsibility	Applicability			Reference of source	Evidence of implementation
				M12 West	M12 Central	M12 East		
CC04	Stop work protocols will be incorporated into the Construction Contractor stage specific documentation for extreme events and implemented during construction	During construction	Construction Contractor ESR Construction Contractor Safety Manager	✓	✓	✓	Section 5 CCRA WHS Protocol	Induction material Stage specific CEMP and sub-plans WHS Plan

6 Compliance Management

6.1 Roles and responsibilities

The Project's organisational structure and overall roles and responsibilities are outlined in Section 5.1 of the OCEMP.

Specific responsibilities for the implementation of this Framework are detailed in Section 5.

6.2 Training

To ensure that this Framework is effectively implemented, all site personnel (including sub-contractors) will undergo site induction training that includes climate adaptation and mitigation management.

Training specific to this Framework will be focused on the adaption measures to be implemented including the Adaptive Management Procedure (EHG, 2021) and the Stop Works Procedure.

For further information on training, refer to Section 5.3 of the OCEMP.

6.3 Communication

The Construction Contractor will adhere to the requirements as outlined in the Overarching Communication Strategy (OCS). The OCS identifies opportunities and tools for providing information and consulting with the community and stakeholders during the construction of the Project.

Climate change management information will be communicated to the community and stakeholders in accordance with the principles and procedures outlined in the Community Communication Strategy (CCS) where required.

Further detail about the CCS is provided in Section 5.5 of the OCEMP.

6.4 Monitoring and inspections

The monitoring of climate change adaptation measures is required to ensure the Project maintains resilience to climate change impacts to minimise adverse impacts on the health of personnel during construction and delays to the construction program.

Monitoring performance criteria and measures are addressed in Section 4.3. Environmental inspections are detailed in Section 7.1 of the OCEMP.

6.5 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this CCMAMF, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 6.2.1 of the OCEMP.

6.6 Reporting and identified records

Reporting requirements and responsibilities are documented in Section 7.5 of the OCEMP.



This Framework forms part of the OCEMP, as such the Construction Contractors will be required to maintain accurate records substantiating all construction activities associated with the Project, including measures taken to implement this Framework.

7 Review and improvement

7.1 Continuous improvement

Continuous improvement of this Framework will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement. The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Identify environmental risks not already included in the risk register
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

The Construction Contractor will be responsible for ensuring Project environmental risks are identified and included in the risk register and appropriate mitigation measures implemented throughout the construction of the Project as part of the continuous improvement process. The process for ongoing risk identification and management during construction is outlined in Section 4.1 of the OCEMP.

7.2 Update and amendment

Periodic reviews will be undertaken and implemented for improvements to this Framework during construction. This Framework may be updated following:

- Changes to detailed design or construction methodology that may impact the risks or adaptation measures identified and/or generate new risks to the Project.

The Framework was updated in January 2024 to be consistent with the findings of the IPCC AR6 Synthesis Report (March 2023) identifying new climate change data.

A copy of the updated Project CCRA's identifying changes to the Project's climate change risks and adaptations shall be distributed to all relevant stakeholders. The Construction Contractor will update their stage specific CCMAMFs based on updates of this Framework.

Further detail on periodic review of this Framework can be found within the OCEMP.

Appendix A Secondary CoAs and REMMs

CoA

CoA	Requirement	Reference
E91	A Sustainability Strategy must be prepared to achieve a minimum excellent 'Design' and 'As built' rating under the Infrastructure Sustainability Council of Australia infrastructure rating tool.	Section 1.4.2 Sustainability Strategy
E92	The Sustainability Strategy must be submitted to the Planning Secretary before the commencement of construction and must be implemented throughout construction and operation.	Section 1.4.2 Sustainability Strategy

REMM

REMM No.	Requirement	Document Reference
CC03	An adaptive management approach will be applied to workplace health and safety planning during construction and operation in line with the WHSMP. This will include use of TfNSW Work Health and Safety Procedures.	Section 5 WHS Protocol
SU01	A sustainability management plan for the project will be developed and implemented during detailed design, to give effect to the sustainability strategy for the project. The management plan will detail measures to meet the sustainability objectives and targets and Infrastructure Sustainability rating tool credit requirements.	Sustainability Strategy

Appendix B Climate baseline and projection data

The table below has been sourced from the M12 Central 100% Detailed Design climate change monitoring and adaptive framework report (GHD, 2021).

Variable	Current Climate*		Climate Change Predictions		Source
	Prospect Reservoir Weather Station	Baseline Period	General Trend	M12 Central near term, moderate scenario 2050, RCP 4.5	
Temperature					
Mean maximum daily temperature (°C) – Annual	23.3	1986-2005	↑	+1.3 (1 to 1.9) i.e. 24.6°C (24.3 to 25.2)	1,2
Mean maximum daily temperature (°C) – Summer (DJF)	28.1	1986-2005	↑	+1.3 (0.8 to 2.2) i.e. 29.4°C (28.9 to 30.3)	1,2
Mean minimum daily temperature (°C) – Annual	12.2	1986-2005	↑	+1.3 (0.9 to 1.6) i.e. 13.4°C (13.1 to 13.8)	1,2
Days p.a. over 35°C	10.5	1986-2005	↑	16.3 days	1,2
Days p.a. over 40°C	1.0	1986-2005	↑	2.4 days	1,2
Days p.a. below 2°C	2.5	1986-2005	↓	0.45 days	1,2
Days p.a. below 0°C	0.1	1986-2005	↓	0 days	1,2
Highest temperature for baseline 1986-2005 (°C)	44.7 15 Jan 2001	Discrete event	↑	+1.8 (0.6 to 2.1) i.e. 46.5°C (45.3 to 46.8)	3
Highest temperature for years on record at AWS (°C)	45.3 7 Jan 2018	Discrete event		N/A	
Lowest temperature for baseline 1986-2005 (°C)	-0.5 13 August 2005	Discrete event	↑	+1.2 (0.5 to 1.4) i.e. 0.7°C (0 to 0.9)	3
Lowest temperature for years on record at AWS (°C)	-0.8 30 June 2010	Discrete event		N/A	
Precipitation					
Mean Rainfall (mm) - Annual	879.4	1986-2005	↑↓ Seasonal variation	+0.5% (-11.4 to 7.7) i.e. 883.4 mm (778.9 to 946.7)	1,2
Mean Rainfall (mm) – Spring (SON)	181.1	1986-2005	↓	-0.2% (-18.9 to 12.1) ie 180.7 mm (147 to 203.1)	1,2
Mean Rainfall (mm) – Summer (DJF)	289.5	1986-2005	↑	+4.1% (-9.9 to 19.4) i.e. 301.4 mm (260.8 to 345.6)	1,2

Variable	Current Climate*		Climate Change Predictions		Source
	Prospect Reservoir Weather Station	Baseline Period	General Trend	M12 Central near term, moderate scenario 2050, RCP 4.5	
Mean Rainfall (mm) – Autumn (MAM)	245.1	1986-2005	↓	-2.6% (-17 to 18.3) i.e. 238.7 mm (203.3 to 289.8)	1,2
Mean Rainfall (mm) – Winter (JJA)	163.7	1986-2005	↓	-5% (-19.6 to 8.3) i.e. 155.5 mm (131.7 to 177.3)	1,2
Highest daily rainfall event (mm) for baseline 1986-2005	321.0 06 Aug 1986	1986-2005	↑	+4.4% (-1.5 to 13.5) i.e. 335 mm (316.3 to 364.5)	3
Highest daily rainfall (mm) for years on record at AWS	321.0 06 Aug 1986	Discrete event		N/A	
Maximum 1 day rainfall for a 20 year ARI event	N/A	N/A		+9.8% (-1.7 to 22.9)	3
Extreme events					
Severe fire danger days per year	1.1	1986-2005	↑	1.2 to 1.5 days*	4
Lightning	20-25 thunder days per year	1990-1999	↑	5-6% increase per °C warming i.e. 7% to 8.4% increase in 6,7 lightning frequency	6,7
Soil					
Soil moisture	N/A	1986-2005	↓	-2.1% (-10.2 to 2)%*	1
Daily variables					
Evapotranspiration (%)	N/A	N/A	↑	+5.4% (3 to 6.9)	1
Maximum wind gust speed (km/h) for years 2003-2005	89.0	2003-2005	↑	N/A	5
Avg. 9 am wind speed (km/h)	9.6	1986-2005	↓	-1.3% (-4.6 to 0) i.e. 9.4 km/h (9.1 to 9.6)	1,2
Avg. 3 pm wind speed (km/h)	15.1	1986-2005	↓	-1.3% (-4.6 to 0) i.e. 14.9 km/h (14.4 to 15.1)	1,2
Avg. 9 am relative humidity (%)	73.5	1986-2005	↓	-0.4% (-1.6 to 1.3) i.e. 73.1 % (72.3 to 74.4)	1,2
Avg. 3 pm relative humidity (%)	50.5	1986-2005	↓	-0.4% (-1.6 to 1.3) i.e. 50.3 % (49.7 to 51.2)	1,2
Mean daily solar exposure (MJ/(m*m))	16.4	1990-2005	↑	+0.5% (-0.6 to 2.2) i.e. 16.5 MJ/(m*m) (16.3 to 1, 2 16.7)	1,2

Notes:

- 1 CSIRO BOM 2015, Climate Change in Australia Projections Cluster Report - East Coast, Appendix Table 1c East Coast South
 - 2 CSIRO BOM 2015, Climate Change in Australia Summary Data Explorer, East Coast Cluster Projections
 - 3 CSIRO BOM 2015, Climate Change in Australia Extremes Data Explorer, East Coast Cluster Projections
 - 4 CSIRO BOM 2015, Climate Change in Australia Projections Cluster Report - East Coast, Appendix Table 2, Projections and baseline for Canberra
 - 5 CSIRO BOM 2015, Climate Change in Australia Projections Cluster Report - East Coast, Figure 4.4.2
 - 6 State of NSW and Department of Environment, Climate Change and Water 2010, Impacts of Climate Change on Natural Hazards Profile, Sydney/Central Coast Region
 - 7 IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K.]
- * Projection data was not available for RCP 4.5 2050 therefore RCP 4.5 2030 was used as the closest available proxy
- NB: Severe fire danger days per year based on Forest Fire Danger Index >50. Based on three climate models given as range from lowest to highest value of 3 projections
- NB: Highest temperature recorded in baseline period uses CSIRO projection for 'hottest day' for summer (DJF)
- NB: Highest daily rainfall provides indication of change to most extreme annual rainfall event using CSIRO 'wettest day' projections (annual)
- NB: all projections use global climate models from the IPCC's Fifth Assessment report, excepting hail and lightning projections