

Mount Druitt Hospital

Climate Change Risk Assessment and Adaptation Plan



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Revision

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3	02/10/2025	Final Issue- Respond to HI's comments	MPM	IS

Disclaimer

This Climate Change Adaptation and Resilience Plan provides an estimate of the risks to the building as a result of climate change. The climate change impacts adopted in the plan are from the Climate Change in Australia website or 'Site' (URL <http://www.climatechangeinaustralia.gov.au/>). These were developed through the Centre for Australian Weather and Climate Research and were supported by funding from the Commonwealth of Australia. The Climate Change Adaptation and Resilience Plan represents an interpretation of the potential impacts on the building only.

No guarantee or warrantee of building performance in practice can be based on these risk projections alone.



Glossary

ARI	Annual Recurrence Interval i.e., a 1:100-year flood event has a probability of 1% of occurring in any given year
Likelihood	The likelihood (probability and frequency) of an event occurring
Consequence	The consequence of an event (Financial, OH&S, Environmental, and Regulatory)
CMIP	Coupled Model Intercomparison Project
Driver	The main climate forcing contributing to the risk (Extreme rainfall, Extreme wind, Temperature etc.)
Site	The geographic area
Site Details	Key infrastructure on site
Consequence Descriptor	The likely consequence resulting from occurrence of risk event
Approximate Projected ARI	The design ARI
Risk Level	The risk level is the product of likelihood and consequence. See Section 5: Risk Rating Guide
Adaptation Option	The broad level of options in terms of establishing responses to the identified risks
Adaptation Action	The specific actions to undertake in terms of mitigating the identified risks
Benefit to Building Objectives	The ability of the control / adaptation to mitigate the identified risk and fulfill the objectives of the building
Timeframe	The timeframe for implementing control / adaptation as determined by the organisation
Risk Owner	The person or organisation responsible for implementing the control/Adaptation

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1 Executive Summary

Climate change in Australia has potential impacts on the ability for the built environment to continue providing the current levels of amenity into the future. Natural disasters such as bushfires, floods or cyclones constitute real threats to buildings in operation, and the long-term effects of climate change are likely to increase the frequency of these events. Rychetnik, L et.al. (2018) identified several climate change risks facing Sydney's metropolitan health districts. This report builds on Rychetnik's paper to identify building-specific risks and adaptation measures.

The Climate Change Risk Assessment and Adaption Plan is intended to:

- Identify any risks to the site posed by climate change, and
- Determine possible risk mitigation actions.

The Mount Druitt Hospital expansion project is located at 75 Railway Street, Mt Druitt, NSW 2770. The proposed development was assessed for its exposure to current and future climate related hazards. The representative concentration pathway (RCP) of 8.5 for the years 2030 and 2090 are the selected climate change scenarios for this risk assessment. The projected climate impacts for these two scenarios were used to identify potential risks to the site using best-practice climate change risk assessment methodologies.

This report highlights the risk considerations, site constraints, and strategies employed to reduce the site's climate risk profile. Based on the climate risks identified in this report, the proposed development was determined to have an **EXTREME** risk rating across the selected climate change scenarios, before mitigatory actions.

1.1 Extreme-Risk Items

Risk ID	Business Area/ Risk Owner	Risk Description	Proposed adaptation measures (Design and construction stage)
Increased intensity and frequency of heatwave and extreme heat events leading to:			
1b	Electrical	Increased instances of energy and telecommunications network failure (e.g. blackouts/brownouts, etc.) impacting operations	Electrical- Emergency backup will be available from emergency backup generators from the existing hospital. Two essential distribution boards will be provided on each level, providing power for lighting and equipment.
1c	Mechanical	Increased stress on vital equipment and services (e.g. HVAC and other plant) leading to greater maintenance demands	Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. The average temperature increase has been incorporated into the design conditions and modelled to assess the resulting system capacities. This adjustment resulted in an increase of approximately 10–15 kW across all Fan Coil Units and condenser units within the project. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.

1.2 High-Risk Items

Risk ID	Business Area/ Risk Owner	Risk Description	Proposed adaptation measures (Design and construction stage)
Increased intensity and frequency of heatwave and extreme heat events leading to:			
1a	Architectural, Mechanical	impacts to the thermal performance levels of buildings leading to reduced comfort levels for building occupants and health concerns	Architectural- High performing building envelope has been specified as per Section J requirements. Thermally broken, double glazed windows will be installed. Elements that are beyond Section J requirements will also be incorporated in the envelope such as the use of a thermal break tape. A combination of brick and metal cladding will be used for the facade. Colour palette for exterior material finishes will be light such as grey. A three-year Solar Reflectance Index (SRI) of minimum 64 or an initial SRI of minimum 82 should be considered for roof finish materials. Passive shading measures incorporated through 2m deep eaves. Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. A 1 deg. increase due to climate change has been allowed for. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.
1d	Hydraulic	Increased energy and water demand across the site resulting in higher operational costs	Hydraulics- Water efficient sanitary fixtures and fittings (taps, toilets, showers) with high WELS rating will be installed.
1e	Architectural	Greater instances of material degradation to facades, structures, and surfaces, resulting in higher replacement and maintenance costs	Architectural- The proposed façade will be of brick and metal cladding. These materials are hardy, have a long life and have good resilience against external weather conditions.
1g	LHD	Increased stress on vital equipment and services (for example, elevators and plant) leading to greater response demands	Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. The longevity of systems has been taken into account. Electrical- Emergency backup will be available from emergency backup generators from the existing hospital.

Increasing intensity and frequency of bushfire events leading to:			
2b	Mechanical	Reduced air quality within internal areas, impacting occupant's health	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control. Bushfire filtration will require additional filters.
2d	Mechanical	Smoke and embers impacting ventilation and air-conditioning systems	The use of higher-efficiency filters (e.g., bushfire filters) will result in increased pressure drop across the system. This has been acknowledged in the design of the VRV systems. The increased resistance will have implications for fan sizing, energy consumption, and maintenance frequency, all of which have been considered in the system specification. Outside air supply meets ESG requirements for provision of consistent levels of outdoor air.
Increasing intensity of extreme rainfall events leading to:			
3a	Hydraulic	Roof drainage not providing sufficient capacity	Hydraulics- Hydraulic design has been done for 1:100 ARI event with an additional 10% allowance for climate change. The maintenance plan for gutters will be typical and ensures that they are free of debris.
3d	Civil	Drainage capacity issues for buildings and hard landscaping resulting in damage to buildings and equipment	Civil- An OSD tank has been proposed. The capacity has not yet been finalized. The tank will be designed for a 1:100 ARI event. Predicted impacts of climate change will be factored into the design of the OSD. Further direction on the climate change factor to be used is required from the Council. MUSIC model has been done to present water quality.
Increasing intensity and frequency of extreme rainfall resulting in flooding events leading to:			
4c	Civil	Drainage capacity issues for buildings and hard landscaping	Civil- An OSD tank has been proposed. The capacity has not yet been finalized. The tank will be designed for a 1:100 ARI event. Predicted impacts of climate change will be factored into the design of the OSD. Further direction on the climate change factor to be used is required from the Council. MUSIC model has been done to present water quality.
4f	Civil	Disruption of sewerage services	Civil- The stormwater system does not connect to the sewer system, they are 2 separate systems and no cross over is allowed. For the existing stormwater system - the OSD is reducing the existing stormwater discharge affecting the site and as such - is reducing the stormwater discharge to the system.
4g	LHD	Increased demand on the building as a designated 'safer place' or evacuation centre	Mechanical- Mechanical equipment have been oversized in account of predicted increase in temperatures and hence will be able to serve the increased demand during designated periods of 'safer place' or evacuation centre.

Increasing intensity and frequency of drought and reduced average rainfall leading to:			
5c	Hydraulic	Decreased availability of potable water for service delivery	Hydraulics- Metering strategy will be in place for monitoring water use. Water efficient sanitary fixtures and fittings (taps, toilets, showers) with high WELS rating will be installed.
Increased extreme storms and cyclones (including increased wind speeds, hail, dust and sand) leading to:			
6a	Structural, Architectural, Mechanical	Increased storm and hail damage to building structure and façade	Architectural- Roofing material will be Class 4 impact -rated Colorbond steel (0.42 BMT) which offers protection against hailstones up to 50mm in diameter. Solar panels are made with tempered glass which enhance their ability to resist hail impacts. Mechanical- All equipment provided shall be specified to comply with relevant Australian Standards, with external condensers located within a dedicated, screened plant area. It is acknowledged that, during extreme weather events such as storms or cyclones, equipment may be subject to damage and rendered inoperable—similar to other building elements exposed to such conditions in comparable installations
6f	LHD	Increased demand on the building as a place of refuge and/or as a designated evacuation centre	Mechanical- Mechanical equipment have been oversized in account of predicted increase in temperatures and hence will be able to serve the increased demand during designated periods of 'safer place' or evacuation centre. Fan coil units will be used, which will have G4 filters which are suitable for general air quality control.
Increase in humidity leading to:			
8c	Architectural, Mechanical	Increased energy demand for HVAC in order to maintain thermal comfort for building users and occupants	Architectural- High performing building envelope has been specified as per Section J requirements. Thermally broken, double glazed windows will be installed. Elements that are beyond Section J requirements will also be incorporated in the envelope such as the use of a thermal break tape. A combination of brick and metal cladding will be used for the facade. Colour palette for exterior material finishes will be light such as grey. Passive shading measures incorporated through 2m deep eaves. Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. A 1 deg. increase due to climate change has been allowed for. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.

2 Introduction

The purpose of this Climate Change Risk Assessment and Adaption Plan is to assess the risks associated with climate change and the external surroundings in the proposed Mount Druitt Hospital development located at 75 Railway Street, Mt Druitt, NSW 2770. Based on the current and projected climate conditions of the site, several risks specific to the project are identified and are evaluated using methods from recognised standards. Ultimately, recommendations are developed to address these risk items through potential design responses (i.e., to improve its resilience to climate hazards and be considered climate adaptive).

This assessment is developed to address the NSW Health Infrastructure's (HI) ESD Framework which aims to encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.

The following diagram depicts the process of undertaking this assessment as documented in this Climate Change Risk Assessment and Adaption Plan.



3 Project Information

3.1 General Overview

Blacktown and Mount Druitt Hospitals (BMDH) operate across two campuses within the Blacktown LGA and are part of Western Sydney Local Health District (WSLHD), located approximately 10km apart by road.

Mount Druitt Hospital is located at 75 Railway Street, Mt Druitt, NSW 2770. The scope for Mount Druitt Hospital comprises of the expansion of existing medical short stay services to include for an additional 20 acute medical and 10 acute surgical short stay service beds (30 beds in total).

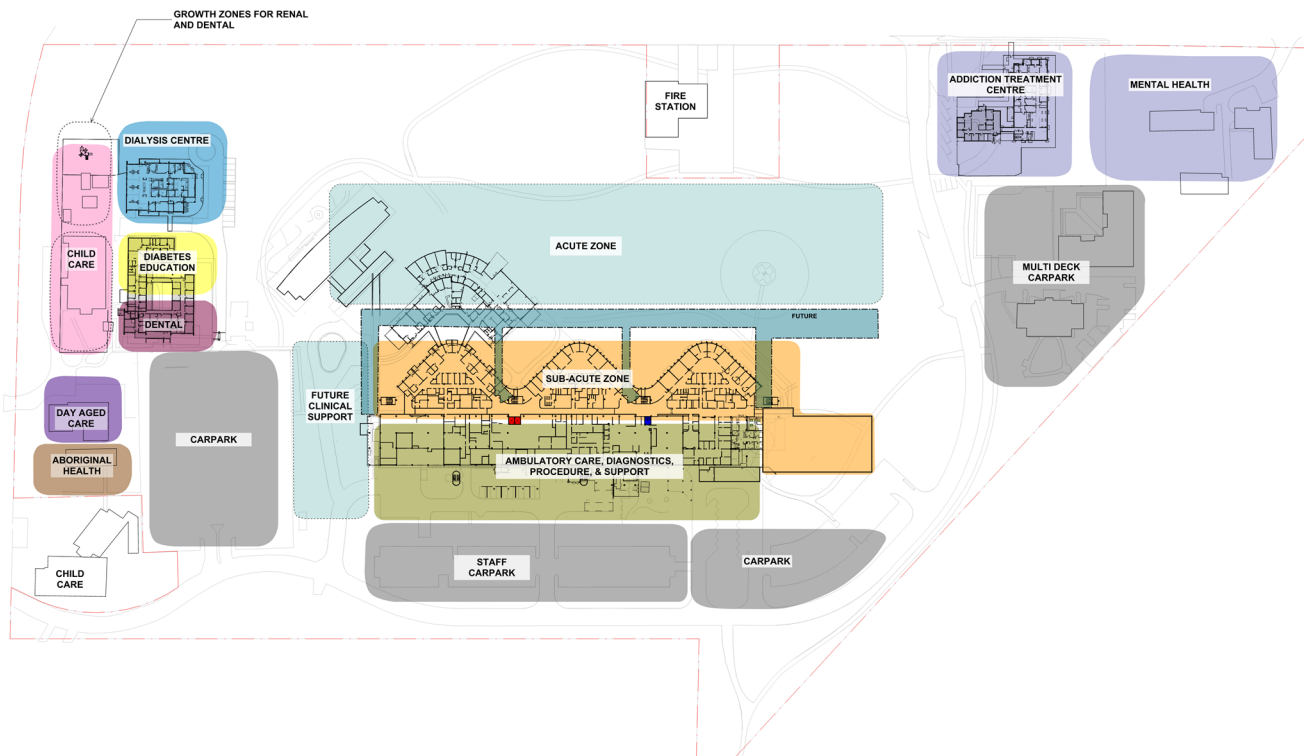


Figure 1 Zonal Masterplan (Source: Jacobs)

In pursuit of ESD design principles across the development, the Project will pursue Ecologically Sustainable Development (ESD) excellence benchmarks to deliver a sustainable project outcome.

These include best practice design initiatives from:

- NSW Environmental Planning and Assessment Regulation 2021
- NSW Government Resource Efficiency Policy
- National Construction Code (NCC) 2022
- Health Infrastructure Design Guidance Note No.058- Environmentally Sustainable Development
- Health Infrastructure ESD Evaluation Tool
- Blacktown Development Control Plan (DCP) 2015

By achieving these sustainability objectives, the project aspires to target Australian best practice in energy and environmental performance and generate operational savings compared to a standard reference educational development.

Please refer to Appendix A which further summarizes the project characteristics (site, location, climatic characteristics).

3.2 Site Location

Mount Druitt Hospital is located at 75 Railway Street, Mt Druitt, NSW 2770. The project site is shown in the figure below:



Figure 2 Mount Druitt Hospital (Source: Six Maps)

3.3 Current Climate Exposures

3.3.1 Current Climate Assessment

The project is located at Mount Druitt, NSW. The climate data of Prospect Reservoir (site number- 067019, sourced from the Bureau of Meteorology) has been selected to closely describe the project's climate characteristics and is used to determine the potential future climate risks. Prospect Reservoir bureau station is the closest comparable site with reliable and robust climate data as it is located approximately 9.3km from the project site.

Table 1 presents the annual means of key drivers of the local climate conditions such as temperature and rainfall, using recent observations across the years 1991 to 2020 for Prospect Reservoir weather station (Bureau of Meteorology, 2021).

Table 1 Current Climate Exposures for Prospect Reservoir (Source: Bureau of Meteorology, 2021)

Climate Drivers	Annual Average (2011 – 2023)
Mean Maximum Temperature (°C)	23.8°C (Summer: 29.3°C; Winter: 17.2°C)
Mean Minimum Temperature (°C)	12.3°C (Summer: 18°C; Winter: 6.1°C)
Mean number of days over 30°C	52.4
Mean number of days below 2°C	3.3
Mean annual rainfall	845 mm
Mean number of days of rain	115.9
Mean number of days of rain ≥ 10mm	24.3

3.3.2 Extreme Temperature (Current)

As indicated in Table 1, the local temperatures of Prospect Reservoir have historically experienced a rise in mean annual temperatures which translates to more frequent and hotter days (with temperatures beyond 30°C) peaking up to 45°C. The Bureau of Meteorology has reported that year 2021 has been Australia's warmest year on record to date (Bureau of Meteorology, 2021).

Thermal mapping of City of Blacktown as shown in Figure 3 demonstrates that urban heat island effect is experienced in and around the site. This is as a result of higher density of infrastructure, including concrete, asphalt pavement and buildings absorbing heat during the day and releasing it back into the surrounding environment at night. This effect results in warmer temperatures during both day and nighttime periods for the asset and its surroundings. Therefore, the site may experience elevated local temperatures which may be considered in the design of mechanical systems or building fabric for this project.

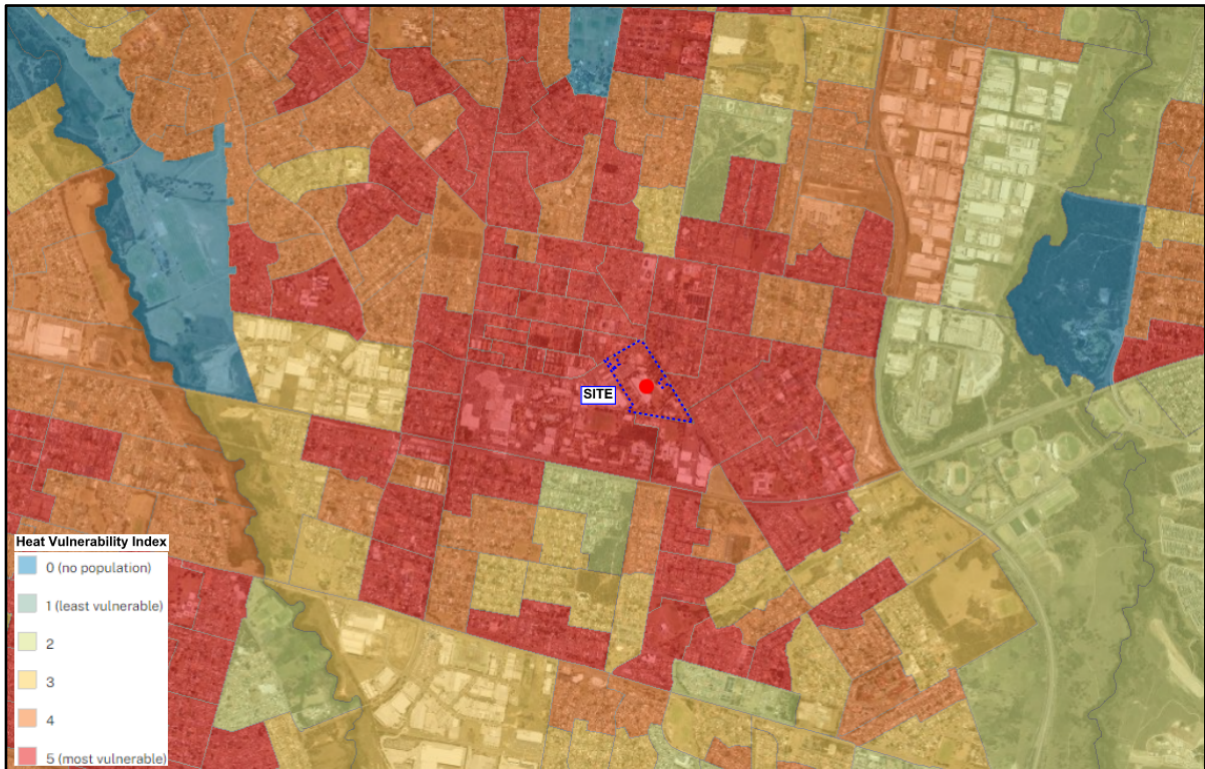


Figure 3 Heat Vulnerability Index Map (SEED NSW 2016)

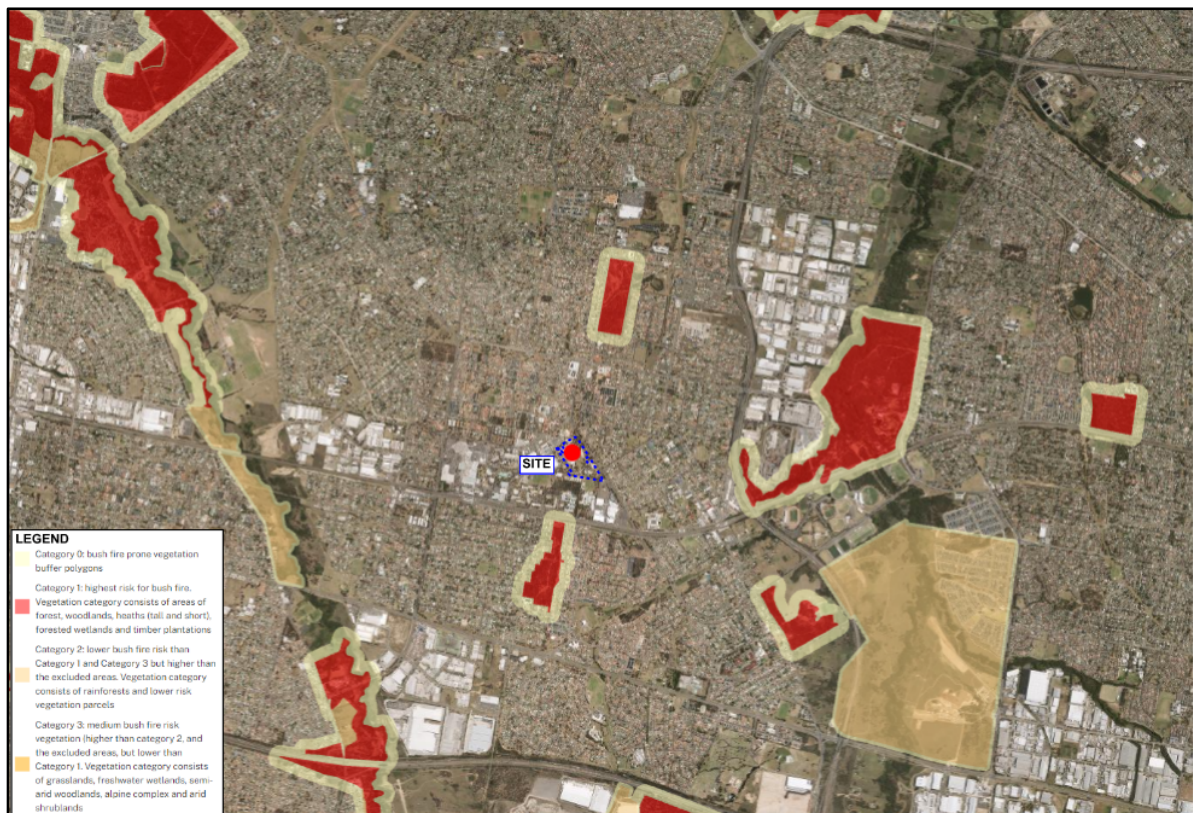


Figure 4 Bush Fire Prone Land (SEED NSW 2016)

3.3.3 Extreme Rainfall (Current)

Over the recent years, most of Australia has progressively received less annual rainfall which has led to drier climates as illustrated in Table 1. The Bureau of Meteorology has reported that year 2019 was Australia's driest year on record since 1900 with national total rainfalls being 40% below the 1961 – 1990 average (Bureau of Meteorology, 2020c). That being said, the likelihood for moderate and/or heavy rainfalls remains unchanged. Therefore, flood-affected regions induced by intense rainfalls will likely expect to experience the same level of severity of flood impacts.

3.3.4 Extreme Floods (Current)

NSW has recently experienced periods of heavy rainfall. Figure 5 and Figure 6 show the modelled flood hazard conditions for the existing case scenarios from the Flood Impact and Risk Assessment prepared by Northrop. Hazard categories are based on latest ARR2019 guidelines (based on work prepared by Smith et al, 2014).

Figure 5 shows the Existing Case hazard conditions in the vicinity of the proposed extension during the 1% AEP are generally H1 with small patches of H2 and H3. Typical H1 is safe for pedestrians and vehicles. A large ponding zone is observed in the access driveway with a relatively large portion of H2 observed as well. This suggests the entrance driveway has the potential to become non-trafficable for small vehicles under existing conditions, during the 1% AEP (Flood Impact and Risk Assessment, Northrop).

During the Probable Maximum Flood (PMF), Figure 6 shows hazard conditions in the vicinity of the proposed extension increase to H3 and H4 which are unsafe for pedestrians and vehicles. Hazard conditions of up to H3 are observed in the access driveway, suggesting the road is no longer trafficable for small and large vehicles (Flood Impact and Risk Assessment, Northrop).

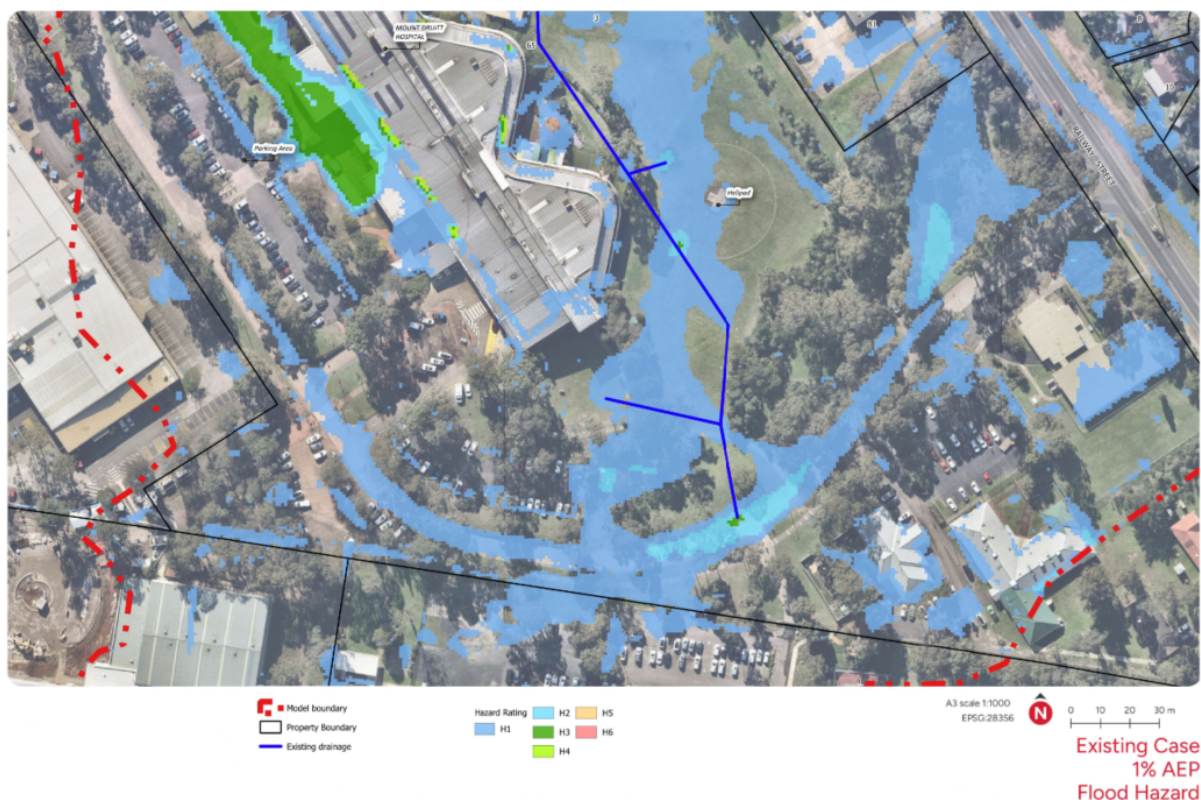


Figure 5 Existing Case 1% AEP Flood Hazard (Source: Flood Impact and Risk Assessment, Northrop)

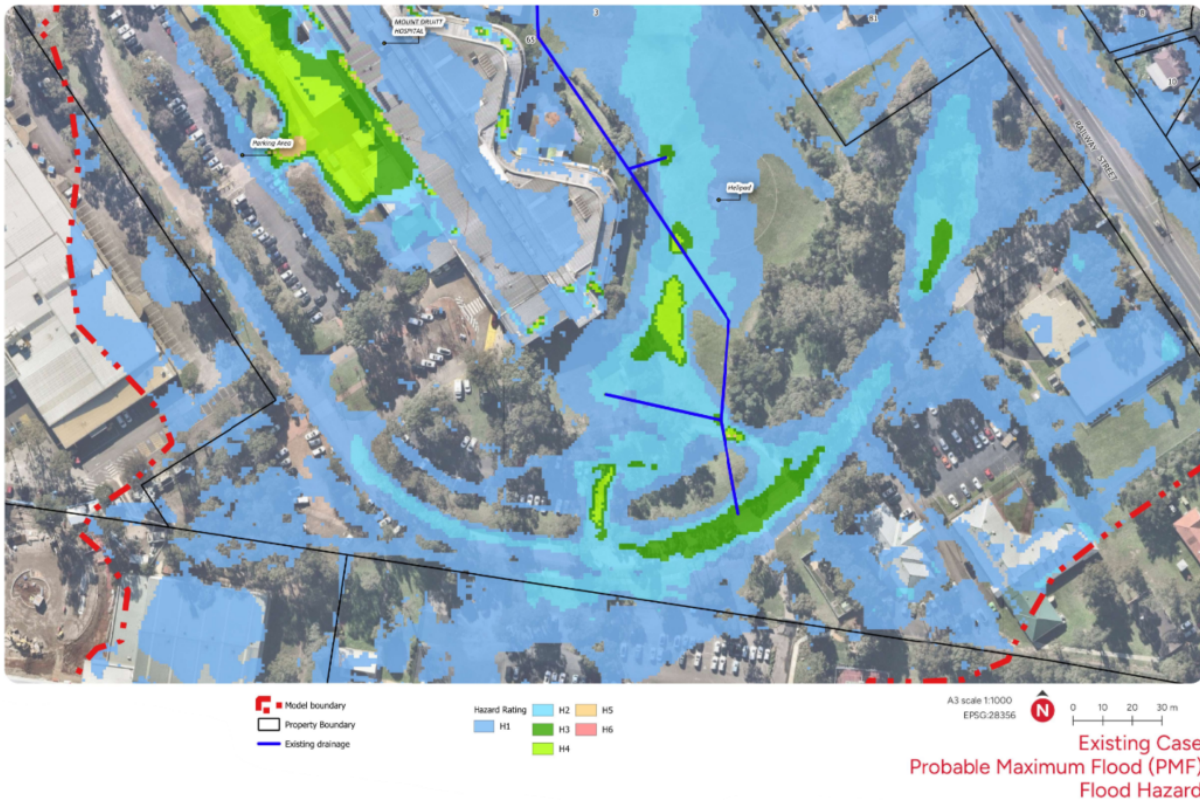


Figure 6 Existing Case Probable Maximum Flood (PMF) Flood Hazard (Source: Flood Impact and Risk Assessment, Northrop)

3.3.5 Current Climate Assessment

Based on the current climate conditions as well as the sensitivity of its geographical area, it is determined that:

- The location of the project is deemed to have a **LOW** risk rating.
- The exposure to current hazards is deemed to carry a **LOW** risk rating.
- The overall exposure and hazard rating is deemed to be **LOW**.

These risk ratings indicate the climate risk that the project is under based on the sensitivity of its geographical location and its exposure to current climate hazards. Each risk item of consideration is scored based on the likelihood of the risk occurring for the key climate variables, which will contribute to determining the overall risk level of the project site itself.

Please refer to Appendix B which assesses the likelihood of risks associated with the key climate variables.

3.4 Projected Climate Change

3.4.1 Projected Scenarios

According to the IPCC Sixth Assessment Report (IPCC, 2021), Australia is already experiencing impacts from recent climate change, including greater frequency and severity of extreme weather events. Therefore, it is important to understand the climate change impacts under the 'most likely' and 'worst' case for the proposed development.

Two future timescales have been adopted for this climate adaptation plan, 2030 and 2090. These timescales have been chosen based on the expected lifespan of a building of 60 years, which should fall within these two years. The East Coast Cluster climate projections, developed by CSIRO and the Bureau of Meteorology, presents future climate projects across these two timescales for the development assessed in this report (CSIRO and BOM, 2015).

The greenhouse gas emissions discussed are those influenced by human activities (anthropogenic). Anthropogenic greenhouse gas emissions could be increased, reduced, or remain constant into the future. The scenarios are called Shared Socio-economic Pathways (SSP) (IPCC, 2021) or Representative Concentration Pathways (RCP) (IPCC, 2014). These reflect different concentrations of global greenhouse gas emissions and socio-economic trajectories. Although no particular scenario is deemed more likely than the others, this report focuses on the SSP5-8.5 (high emissions) scenario, which is the trajectory that current GHG emissions are tracking closest to.

SSP5-8.5 – a future with little curbing of emissions, with a CO₂ concentration continuing to rapidly rise, reaching 940 ppm by 2100. Equivalent to RCP8.5 in the IPCC Fifth Assessment Report (IPCC, 2014).

SSP3-7.0 – a high greenhouse gas emissions scenario where the 1.5°C global warming level is likely to be exceeded in the near term (2021-2040) (IPCC, 2021).

RCP6.0 – lower emissions, achieved by application of some mitigation strategies and technologies. CO₂ concentration rising less rapidly (than RCP8.5), but still reaching 660 ppm by 2100 and total radiative forcing stabilising shortly after 2100.

SSP2-4.5 - CO₂ concentrations are slightly above those of RCP6.0 until after mid-century, but emissions peak earlier (around 2040), and the CO₂ concentration reaches 540 ppm by 2100. Compared to 1850–1900, global surface temperature averaged over 2081–2100 is very likely to be higher by 2.1°C to 3.5°C. Equivalent to RCP4.5 in the IPCC Fifth Assessment Report (IPCC, 2014).

SSP1-2.6 - the most ambitious mitigation scenario, with emissions peaking early in the century (around 2022), then rapidly declining. Such a pathway would require early participation from all emitters, including developing countries, as well as the application of technologies for actively removing carbon dioxide from the atmosphere. The CO₂ concentration reaches 440 ppm by 2040 then slowly declines to 420 ppm by 2100. Equivalent to RCP2.5 in the IPCC Fifth Assessment Report (IPCC, 2014).

SSP1-1.9 – Compared to 1850–1900, global surface temperature averaged over 2081–2100 is very likely to be higher by 1.0°C to 1.8°C. The 1.5°C global warming level is more likely than not to be reached. Furthermore, it is more likely than not that global surface temperature would decline back to below 1.5°C toward the end of the 21st century, with a temporary overshoot of no more than 0.1°C above 1.5°C global warming (IPCC, 2021).

There are many Global Circulation Models, which provide climate projections based on the above RCPs (results from global circulation models based on the SSPs have not yet been released by CSIRO). Variations between models may be attributed to the use of different global data sets, or the ability to represent certain interactions, such as those between the ocean, atmosphere, and land. The Global Circulation Models applied in this report are from the fifth Climate Model Intercomparison Project (CMIP5), which form part of the Fifth IPCC Assessment Report (IPCC, 2014).

Future emissions cause future additional warming, with total warming dominated by past and future CO₂ emissions.

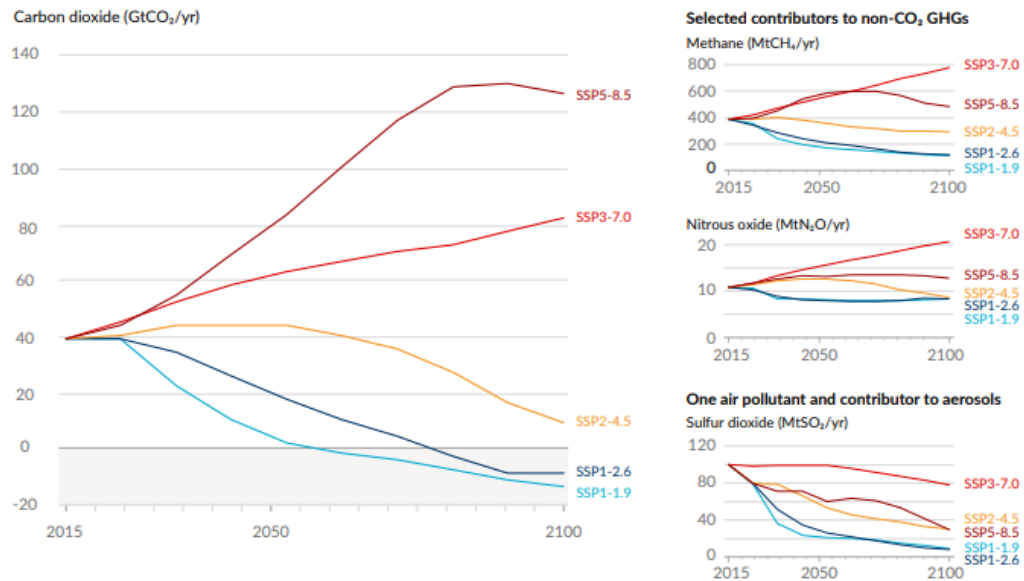


Figure 7 Future annual emissions of CO₂ (left) and of a subset of key non-CO₂ drivers (right), across five illustrative scenarios (IPCC, 2021)

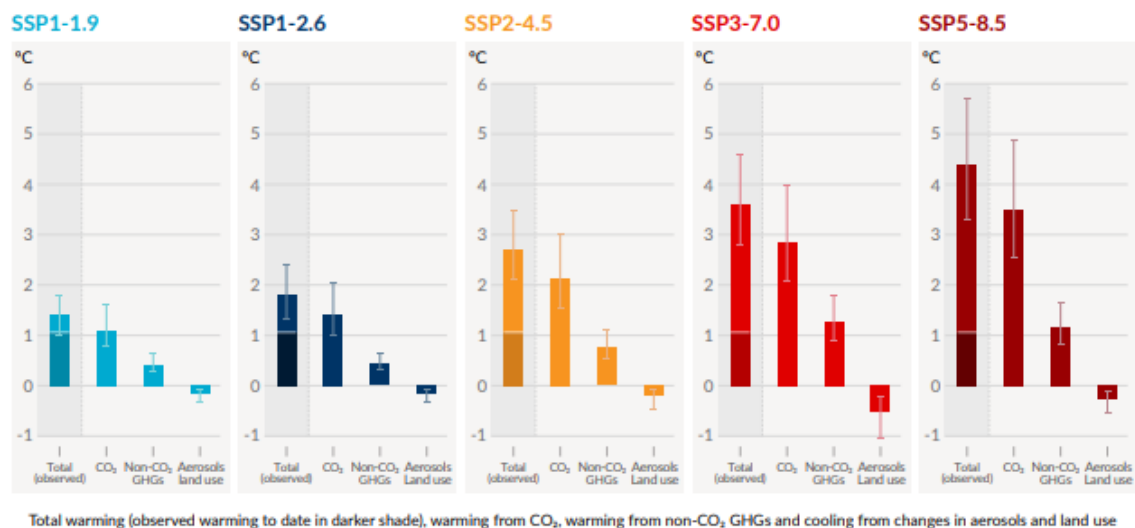


Figure 8 Contribution to global surface temperature increase from different emissions, with a dominant role of CO₂ emissions (IPCC, 2021)

3.4.2 Climate Projections

Climate Futures Tool Projections

Table 2 summarizes the projected impacts of climate change across two timelines for RCP 8.5: the near future 2030 and far future 2090. These projections are generalized for the East Coast Cluster (East Coast South) region as defined by the CSIRO and BOM (2015) and is taken as the most representative of the proposed site's future climate-change enhanced conditions.

Table 2 Projected climate change across 2030 & 2090, Mean and range based on one standard deviation (Climate Futures Tool, 2021)

Climate Variable	Climate Projections (change relative to 1986 – 2005 baseline)	
	2030 (RCP 8.5)	2090 (RCP 8.5)
Mean temperature (°C)	1 (0.7 to 1.3)	3.7 (2.9 to 4.6)
Maximum daily temperature (°C)	1.1 (0.7 to 1.4)	3.8 (3 to 4.9)
Minimum daily temperature (°C)	1 (0.7 to 1.2)	3.8 (2.9 to 4.7)
Extreme temperature (days per year over 35°C)	Substantial increase in intensity and frequency of extreme temperature days	
Mean annual rainfall change (%)	-1 (-11 to 6)	-3 (-20 to 16)
Extreme rainfall	Extreme rainfall events to increase in intensity	
Drought	Time spent in drought conditions to increase	
Bushfire weather (Number of severe fire danger days; FFDA > 50)	Severity of fire-weather climate to increase	
Solar radiation (%)	0.8 (-0.7 to 2.7)	1.3 (-1.2 to 3.4)
Relative humidity (% absolute)	-0.6 (-1.4 to 0.9)	-1.5 (-3.8 to 1.3)
Wind Speed (%)	-0.5 (-2.3 to 1.9)	-1.1 (-6.9 to 4.2)
Sea level pressure (hPa)	0.4 (-0.1 to 0.9)	1 (0.3 to 1.9)

New South Wales and Australian Regional Climate Modelling (NARClIM) Projections

Table 3 summarizes the projected impacts of climate change across two timelines for RCP 4.5 and RCP 8.5: the near future 2050 and far future 2090. These projections are generalized for New South Wales and is presented relative to the historical climate baseline of 1990-2009.

Table 3 Projected climate change across 2050 & 2090, Ensemble average and ensemble range (NARClIM2.0, 2024)

Climate Variable	Unit	Emission Scenario 1 (RCP 4.5)		Emission Scenario 2 (RCP 8.5)	
		2050	2090	2050	2090
Mean Temperature	°C	1.2 (0.6 – 1.7)	1.3 (0.6 – 2.1)	2.0 (1.0 – 2.9)	4.0 (2.7 – 5.5)
Maximum Temperature	°C	1.3 (0.6 - 1.8)	1.4 (0.6 - 2.2)	2.0 (1.1 - 3.0)	3.9 (2.8 - 5.6)
Minimum Temperature	°C	1.1 (0.6 - 1.6)	1.3 (0.7 - 1.9)	1.9 (0.9 - 2.6)	3.9 (2.6 - 5.4)
No. of Hot Days > 35°C	days	14.8 days (4.5 to 24.2 days)	15.9 days (6.4 to 28.5 days)	23.1 days (8.4 to 35.7 days)	45.5 days (27.6 to 69.1 days)
Average Rainfall Percentage Change	%	-10.2% (-21.9% to +6.7%)	-10.1% (-20.0% to +14.4%)	-15.5% (-32.8% to +2.7%)	-11.6% (-38.6% to +35.6%)
Severe Fire Weather Days (FFDI above 50)	days	3.2 days (-0.3 to 6.7 days)	3.5 days (0.3 to 8.6 days)	5.3 days (1.5 to 11.3 days)	9.4 days (3.4 to 18.7 days)

Mean temperature

With very high confidence, air temperatures are projected to increase due to continued substantial warming from a mean warming of around 1°C by 2030 relative to the climate of 1986-2005 (CSIRO and BOM, 2015). This projection is in line with the current rising trend of local mean temperatures as described in Section 3.3 which has resulted in the year 2021 being Australia's warmest year on record (Bureau of Meteorology, 2020b). This warming is expected to continue and, as a result, temperatures in Greater Sydney will also increase.

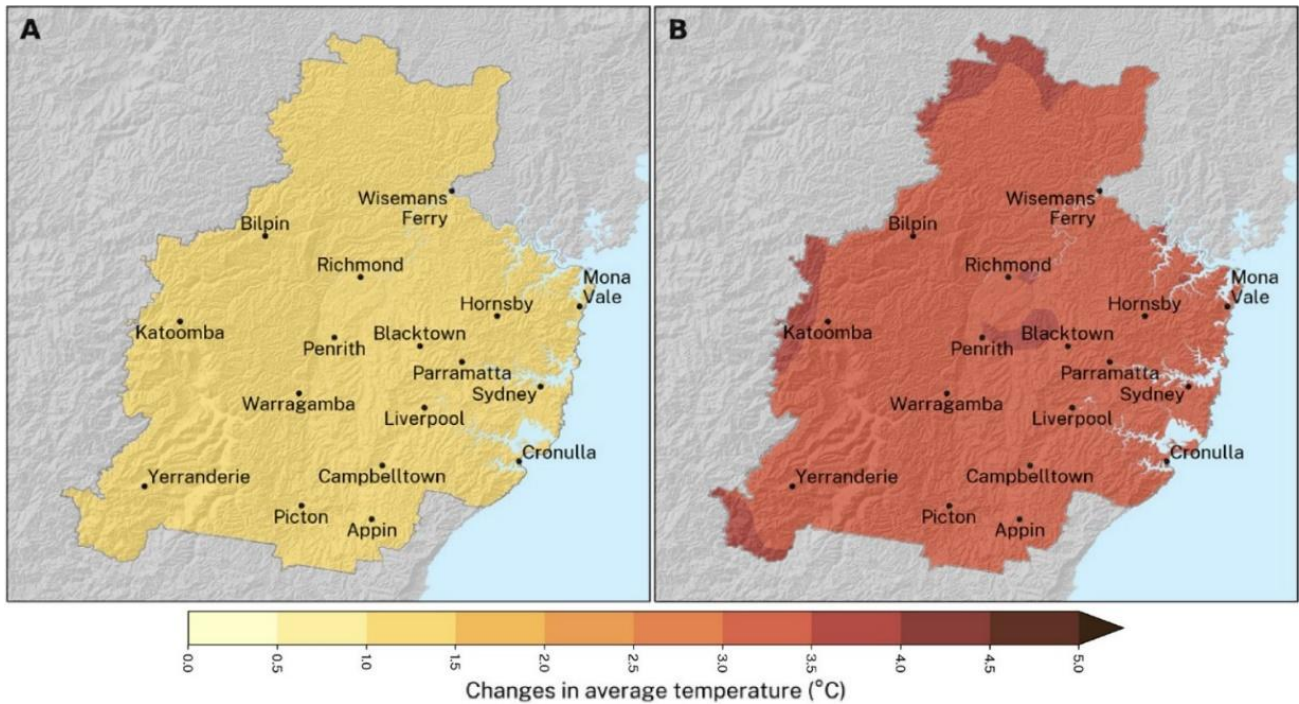


Figure 9 Projected change in average temperature by 2090 for Metropolitan Sydney under A) a low-emissions scenario and B) a high-emissions scenario (Source: NARClm 2.0)

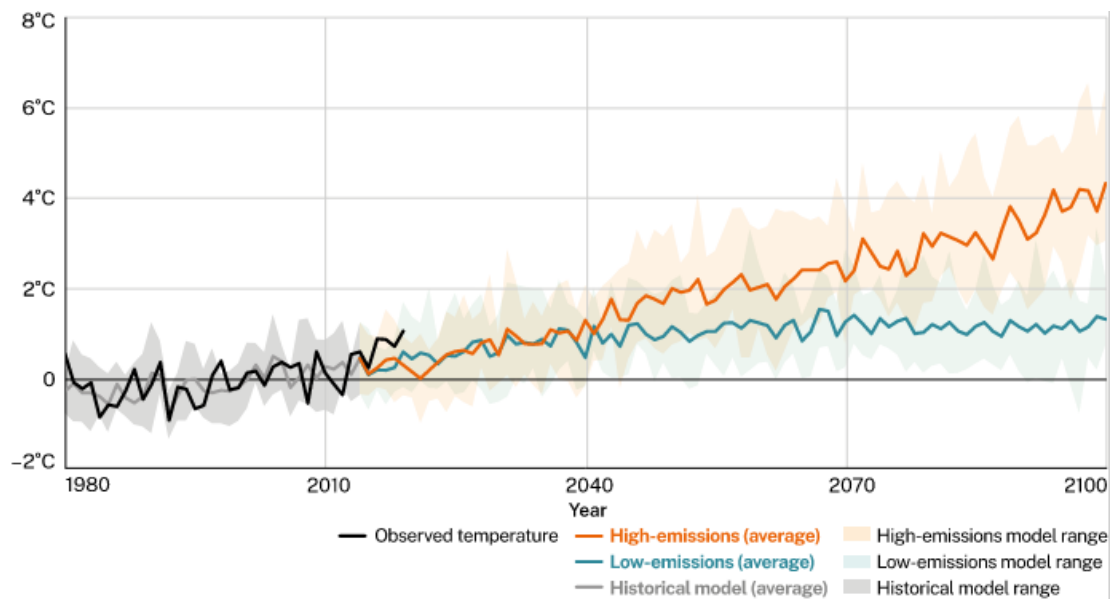


Figure 10 Historical and projected average temperature range- Metropolitan Sydney (Source: NARClm 2.0)

Extreme temperature

As a consequence of rising temperatures, peak temperature events will become more frequent whereby the number of days above 35°C are expected to nearly triple under RCP8.5 by 2090 (CSIRO and BOM, 2015). The number of hot days is projected to increase across spring, summer and autumn, with the largest increase in summer. Under a low-emissions scenario, there is a minimal increase in the number of hot days between 2050 and 2090, with less than 1 additional day per year projected across the region. However, an increase of 10.7 additional hot days per year is projected under a high-emissions scenario during the same period (NARClm 2.0, 2024).

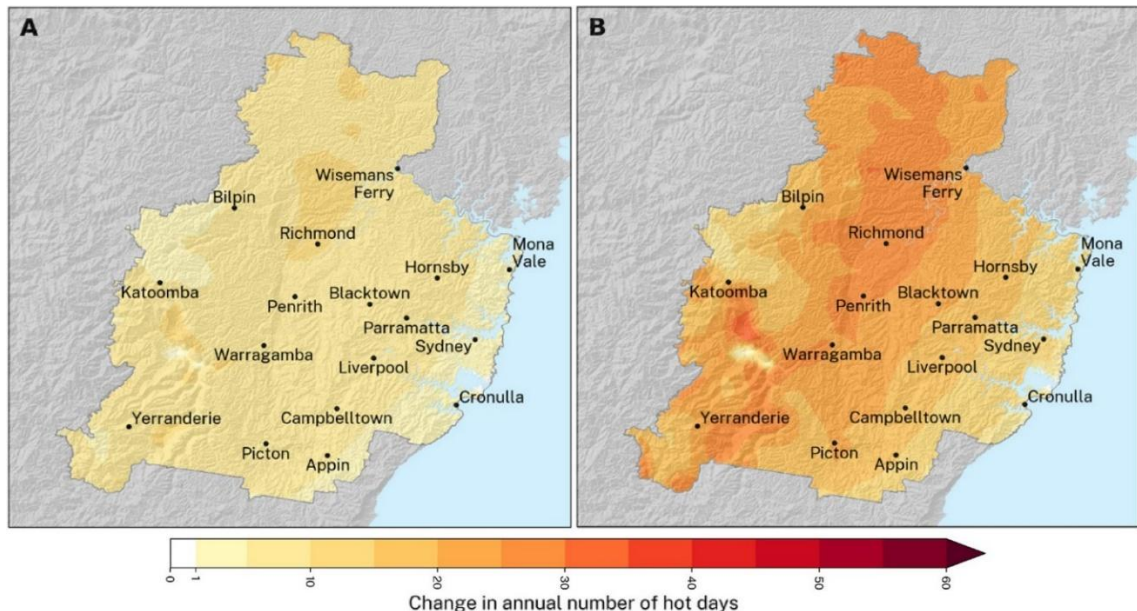


Figure 11 Projected change in annual number of hot days by 2090 for Metropolitan Sydney under A) a low-emissions scenario and B) a high-emissions scenario (Source: NARClm 2.0)

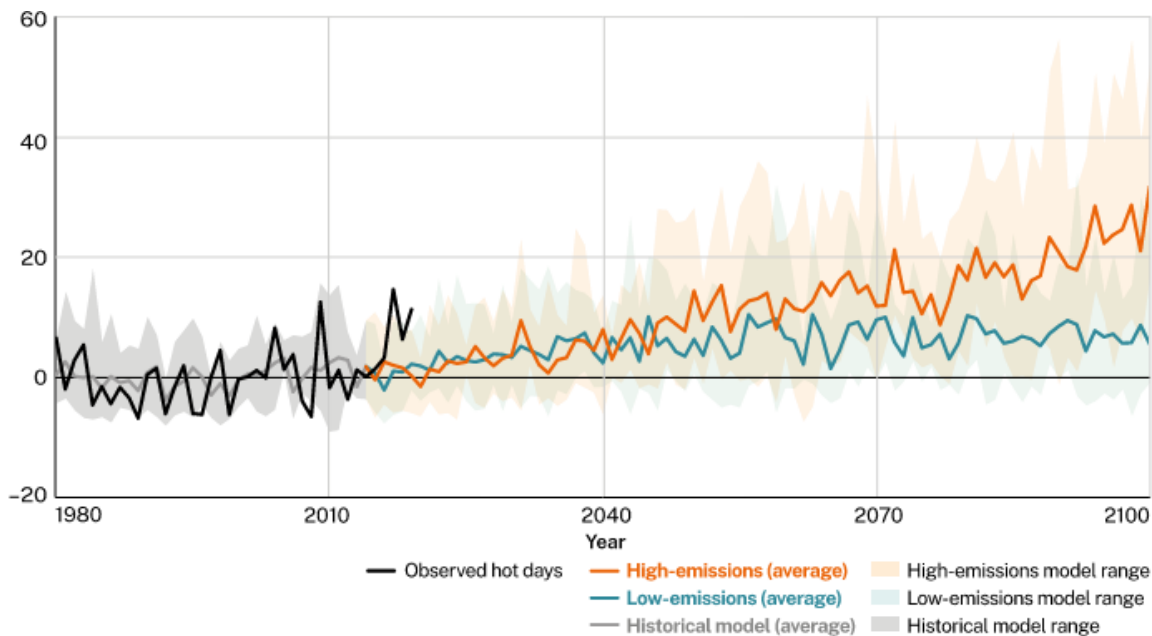


Figure 12 Historical and projected change in annual number of hot days- Metropolitan Sydney (Source: NARClm 2.0)

Solar radiation

The intensification of peak temperature events will result in the solar radiation showing a significant increase across the two timeframes of consideration (CSIRO and BOM, 2015).

Relative humidity

The increase in extreme rainfall events will result in the relative humidity levels doubling across the two timeframes under consideration (CSIRO and BOM, 2015).

Mean rainfall

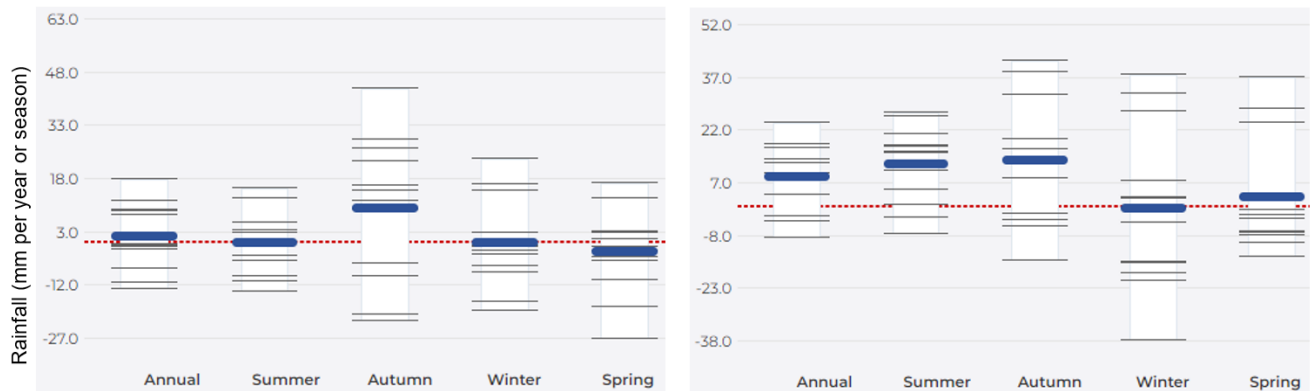


Figure 13 Annual Rainfall Chart 2020-39 & 2060-79 (Change, 2021)

CSIRO and BOM (2015) anticipate with high confidence that the natural climate variability will be the key driver of rainfall changes in the next few decades as it has been in recent past. More rainfall by 2080 is forecasted for summer and spring with high confidence. As for autumn and winter, there is a low degree of confidence to reliably determine the direction of rainfall projections due to inconsistencies in results, thus, highlighting the potential need to consider the risk of both drier and wetter climate in the impact assessment (CSIRO and BOM, 2015).

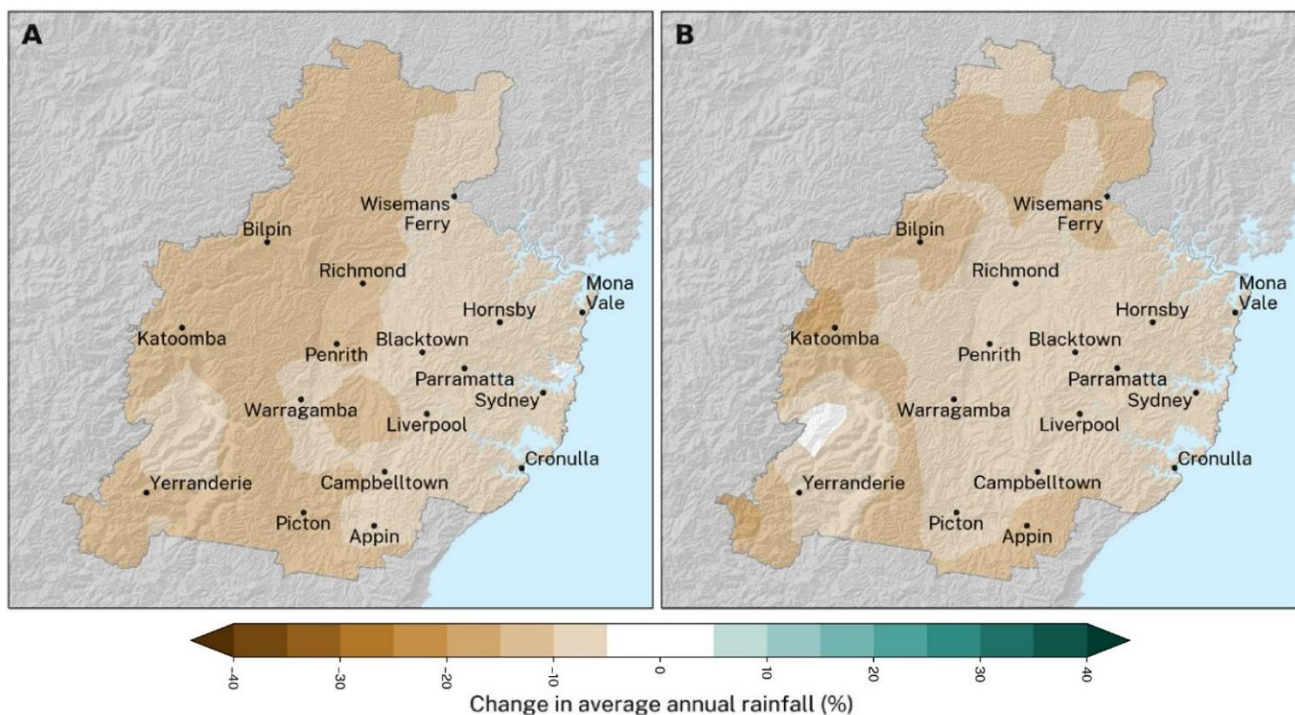


Figure 14 Projected change average rainfall by 2090 for Metropolitan Sydney under A) a low-emissions scenario and B) a high-emissions scenario (Source: NARclim 2.0)

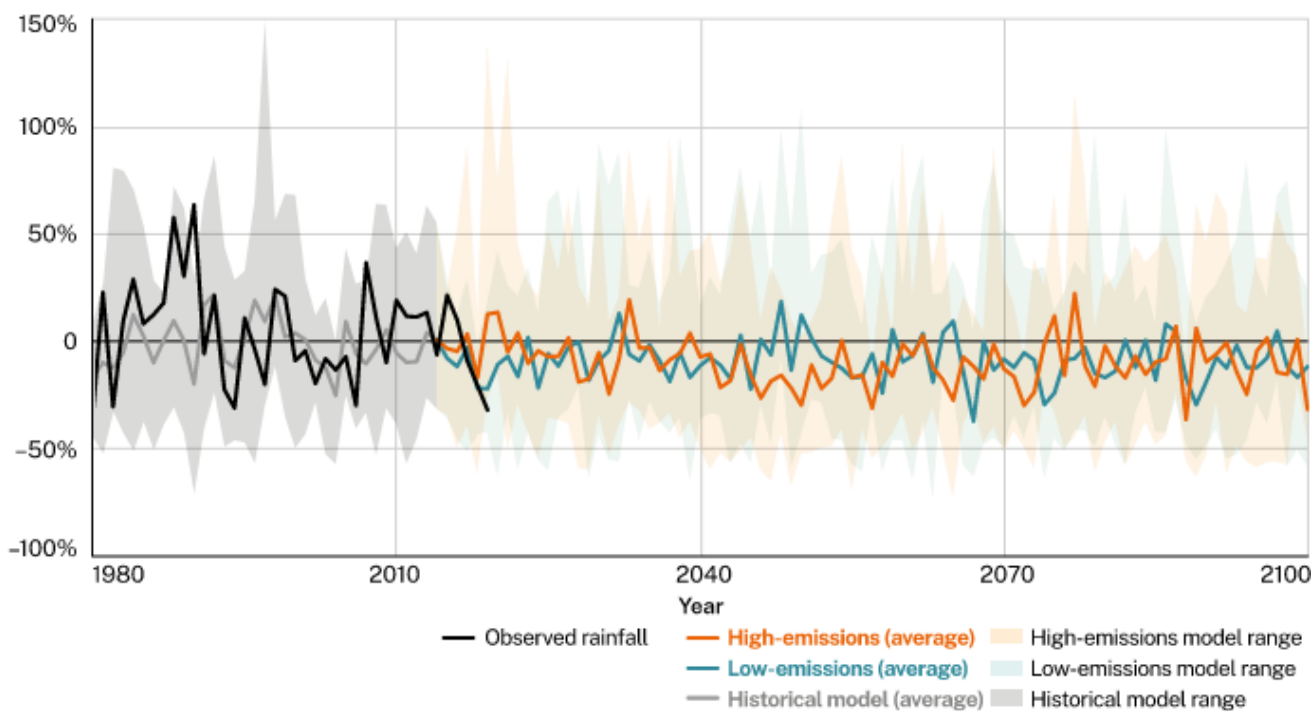


Figure 15 Historical and projected change to average rainfall- Metropolitan Sydney (Source: NARclim 2.0)

Extreme rainfall & flooding

Heavy rainfall events are expected to intensify, however, the magnitude of change and the time when any change may be evident against natural variability cannot be reliably estimated (CSIRO and BOM, 2015). As a result of climate change, shorter but more intense storms are forecasted. These storms produce a high volume of rainfall in a short period of time

causing higher probability of riverbank erosion from sudden high flow rates where typically low flow rates occur. In addition, as weather becomes more extreme, the site will become more susceptible to floods.

Based on the Flood Impact and Risk Assessment Report prepared by Northrop, the Developed Case 1% AEP design storm event indicates a flood level of 61.46m Australian Height Datum (AHD) at the south-western corner of the proposed building, which decreases to approximately 61.05m AHD around the eastern side of the building (Figure 16).

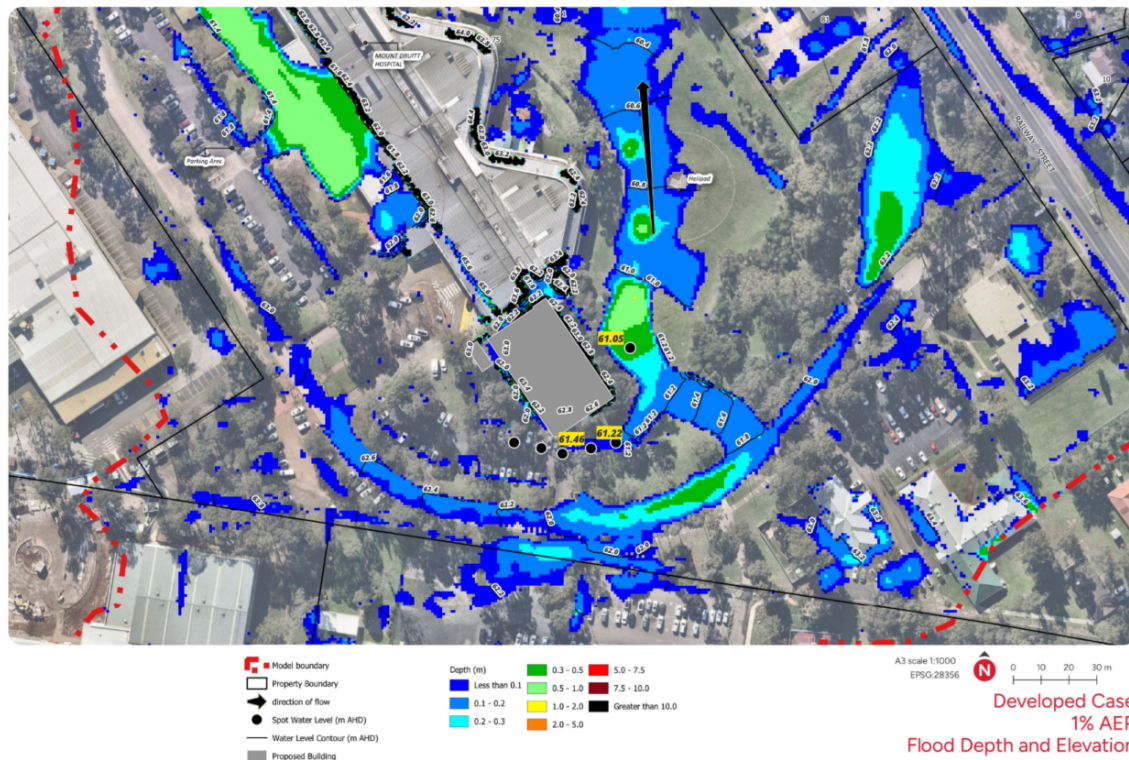


Figure 16 Developed Case 1% AEP Flood Depth and Elevation (Source: Flood Impact and Risk Assessment Report, Northrop)

Drought & bushfire weather

The frequency and duration of harsher fire-weather climate and drought events could possibly increase under RCP8.5 but will be heavily dictated by the amount of rainfall events (CSIRO and BOM, 2015). With Year 2019 being Australia's driest year on record since 1900 (Bureau of Meteorology, 2020b), droughts & bushfire events are anticipated to become more frequent, even under RCP4.5, based on the amount of annual rainfalls received over the recent years as described in Section 3.3.

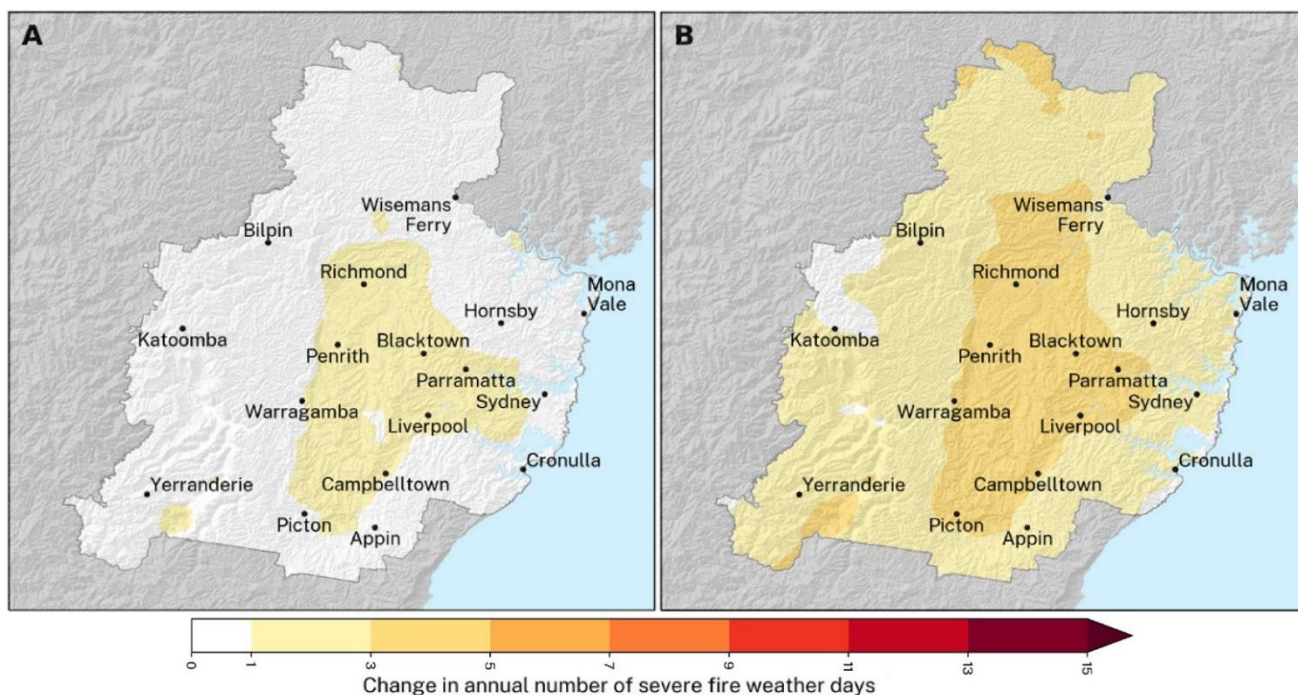


Figure 17 Projected change to annual number of severe fire weather days by 2090 for Metropolitan Sydney under A) a low-emissions scenario and B) a high-emissions scenario (Source: NARClm 2.0)

Storm events, wind and hail

Wind speeds along the East Coast South region are expected to remain the same under all RCPs by 2030 and may decrease during the winter period by 2090 under RCP8.5. According to global and regional studies, tropical cyclones are foreseen to become less frequent but with increases in the proportion of the most intense storms (CSIRO and BOM, 2015).

Sea level rise

Sea levels will continue to rise during the 21st century. In the near future, the projected range of sea level rise at the coastline is 0.08 to 0.18 m above the 1986 – 2005 level, with only minor differences between RCPs. As the century progresses, the projections are sensitive to RCPs. By 2090 RCP8.5 gives a rise of 0.45 to 0.88 m. (CSIRO and BOM, 2015).

Based on the above prediction, flooding of the building solely due to rising sea levels (even under the worst-case emissions scenario of RCP 8.5 2080) is highly improbable as the project site will be developed inland and elevated, away from the immediate coastline.

4 Climate Change Risk Assessment

A risk assessment has been undertaken using HI's Climate Risk Assessment Tool to identify the possible risks associated with the Project due to climate change and its external surroundings. Based on the current and projected climate conditions of the site, several risks specific to the project are identified and assessed using the following relevant standards and guidelines:

- The risk management of climate change as well as the implementation of plans for suitable and effective adaptation in accordance with *AS 5334:2013 Climate change adaptation for settlements and infrastructure*.
- The risk assessment approach set out in *ISO 31000:2009 Risk management – Principles and Guidelines* to assess climate change risks.
- The climate change risks to the project have been assessed in line with the methods recommended in the Australian Greenhouse Office (AGO) *Climate Change Impacts and Risk Management: A Guide for Business and Government*.

The identification of the risk level for each risk item specific to the project is dictated by the likelihood of the risk occurring, which is mainly influenced by the impacts of worsened climate conditions, as well as the severity of the risks if it were to occur. Once identified, the risk level is determined using HI's risk assessment criteria to indicate the level of attention a risk requires to be addressed. Upon completion of the risk assessment, a climate action plan is developed to provide recommended adaptation design to respond to the climate hazards and improve the project's resilience to climate change.

For more details about the Risk Assessment Criteria, please refer to Appendix C and D.

5 Risk Assessment

This section identifies the possible risks that the Mount Druitt Hospital site may be subjected to across two timeframes (2030 and 2090). Risk items are evaluated based upon the likelihood of the risk occurring and the severity of the risk if it were to occur. These results are combined using the AGO's Risk Assessment Criteria, to determine the risk level for a given risk item and the level of attention it requires to address this risk. For more details about the Risk Assessment Criteria, please refer to Appendix C and D. Maximum consequence reflects the Consequence Descriptors in Appendix C, a description of the potential impact of the risk is provided in the Comments column.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
FACILITY										
1. Increasing intensity and frequency of heatwave and extreme heat events leading to:										
1a	Impacts to the thermal performance levels of buildings leading to reduced comfort levels for building occupants and health concerns	Work Health & Safety	Architect, Mechanical	Likely	Moderate	High	Almost certain	Moderate	High	Temperature extremes can cause heat stress to the occupants and resulting in the spaces being un-inhabitable. Architecture impacts internal heat loads and the operation of air-conditioning systems.
1b	Increased instances of energy and telecommunications network failure (e.g. blackouts/ brownouts, etc.) impacting operations	Service delivery	Electrical	Likely	Major	Extreme	Almost certain	Major	Extreme	Power outage will cause HVAC system and essential services to shut off, compromising the health and safety of patients.
1c	Increased stress on vital equipment and services (e.g. HVAC and other plant) leading to greater maintenance demands and higher frequency/ higher scope replacement requirements	Service delivery	Mechanical	Likely	Major	Extreme	Almost certain	Major	Extreme	Increased temperatures will lead to increased demand on HVAC systems, increasing the risk of these systems breaking down. Should the AC systems need to be replaced prior to the scheduled replacement at the end of their life expectancy, it would have significant economic consequences.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
1d	Increased energy and water demand across the site resulting in higher operational costs	Financial Management	Hydraulic	Likely	Moderate	High	Almost certain	Moderate	High	Electricity prices will depend on energy policy and infrastructure, among other factors and are thus difficult to predict with certainty. Rising electricity prices may increase the operational costs of the hospital leading to reductions in other services provided by the hospital.
1e	Greater instances of material degradation to facades, structures, and surfaces, resulting in higher replacement and maintenance costs	Financial Management	Architectural	Likely	Moderate	High	Almost certain	Moderate	High	Wear of building elements can cause additional financial impact on the building and aesthetic issues.
1f	Impacts to landscaping and plantings, reducing the amenity of the site	Service delivery	Landscape	Likely	Minor	Medium	Almost certain	Minor	Medium	Damage to green landscaping may incur replacement costs.
1g	Increased stress on vital equipment and services (for example, elevators and plant) leading to greater response demands	Service delivery	LHD	Possible	Major	High	Possible	Major	High	Temperature extremes can overburden hospital infrastructure, causing frequent malfunctions in critical systems like elevators and HVAC units. This increases maintenance demands and can disrupt patient care and emergency response times.
2. Increasing intensity and frequency of bushfire events leading to:										
2a	Full or partial damage to buildings, infrastructure, assets and public spaces (e.g. buildings, telecommunications)	Financial Management	LHD	Unlikely	Minor	Low	Unlikely	Minor	Low	May result in serious health consequences or potential loss of lives. The site is not subject to bushfires based on its location.
2b	Reduced air quality within internal areas, impacting occupant's health.	Service delivery	Mechanical	Possible	Major	High	Possible	Major	High	Poor indoor air quality due to ingress of smoke pollution in the building can cause health issues to the occupants and can result in some of the internal spaces becoming un-inhabitable.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
2c	Leading to a loss of cultural heritage sites.	Governance and Performance	LHD	Rare	Minimal	Low	Unlikely	Minimal	Low	Bushfires may damage heritage building assets. The site is not subject to bushfires based on its location.
2d	Smoke and embers impacting ventilation and air-conditioning systems.	Service delivery	Mechanical	Possible	Major	High	Possible	Major	High	Smoke and embers from bushfire may damage HVAC equipment impacting its operation.
2e	An accumulation of ash in roof drainage leading to drainage and structural concerns.	Infrastructure	Hydraulic, Structural	Rare	Minor	Low	Unlikely	Minor	Low	Accumulation of ash on the roof can lead to increased structural loads and clogging of drainage.
2f	Increased demand on the building as a designated 'safer place' or evacuation centre	Health of the Population	LHD	Rare	Major	Medium	Rare	Major	Medium	Bushfire events can lead to surges in people seeking refuge, placing unexpected strain on hospital space, resources, and staffing. This can compromise routine operations and emergency preparedness.
3. Increasing intensity and frequency of extreme rainfall events leading to:										
3a	Roof drainage not providing sufficient capacity.	Service delivery	Hydraulic	Likely	Moderate	High	Almost certain	Moderate	High	Gutters and drains being blocked could cause flooding or overflow that may damage the appearance or integrity of the façade and other building elements.
3b	Drainage capacity issues for buildings and hard landscaping resulting in damage to buildings and equipment.	Infrastructure	Hydraulic	Possible	Moderate	Medium	Likely	Moderate	High	Extreme rainfall can overwhelm drainage systems, leading to water ingress that damages hospital buildings, equipment, and essential services. This disrupts clinical operations and increases recovery and repair costs.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
4. Increasing intensity and frequency of extreme rainfall resulting in flooding events leading to:										
4a	Full or partial damage to buildings, infrastructure, assets, equipment and public spaces.	Infrastructure	LHD	Possible	Moderate	Medium	Possible	Moderate	Medium	Flooding can cause partial or total damage to hospital infrastructure, disrupting essential services and access routes. This hampers patient care delivery and may require costly repairs and emergency relocations.
4b	Increased levels of rain/ moisture penetration in the building and facades affecting durability and functionality.	Infrastructure	Architectural	Possible	Moderate	Medium	Possible	Moderate	Medium	Moisture ingress can degrade building materials and compromise facade integrity, leading to reduced durability and increased maintenance. This can affect internal environments, impacting patient comfort and equipment reliability.
4c	Drainage capacity issues for buildings and hard landscaping	Infrastructure	Hydraulic	Possible	Moderate	Medium	Likely	Moderate	High	Poor drainage capacity can lead to surface flooding and water pooling around hospital buildings, damaging hard landscaping and foundations. This increases safety risks and disrupts access to critical areas.
4d	Floodwater intrusion increasing degradation of building materials (for example, foundations)	Infrastructure	Structural	Possible	Moderate	Medium	Possible	Moderate	Medium	Floodwater intrusion accelerates deterioration of foundational materials, compromising structural integrity and safety. This can lead to costly repairs and disrupt hospital operations and patient services.
4e	Higher frequency repair or replacements for assets and equipment	Financial Management	LHD	Possible	Moderate	Medium	Possible	Moderate	Medium	Frequent exposure to climate stressors can shorten the lifespan of hospital assets and equipment, leading to increased repair or replacement cycles. This raises operational costs and risks service interruptions.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
4f	Disruption of sewerage services	Service Delivery	Civil	Possible	Major	High	Possible	Major	High	Disruption of sewerage services can lead to sanitation issues, unpleasant conditions, and potential health risks within the hospital. This can compromise infection control and force partial service shutdowns.
4g	Increased demand on the building as a designated 'safer place' or evacuation centre	Health of the Population	LHD	Possible	Major	High	Possible	Major	High	Extreme rainfall events can lead to increased use of hospitals as emergency shelters, straining capacity, utilities, and staffing. This can disrupt routine healthcare services and emergency response readiness.
4h	Interrupted access to site due to road closures	Service Delivery	LHD	Possible	Moderate	Medium	Possible	Moderate	Medium	Flood Emergency Response Management Plan to be developed as a control.
4i	Patients being unable to enter hospital to access hospital services due to inundation of hospital building entry	Infrastructure	LHD	Possible	Moderate	Medium	Possible	Moderate	Medium	Architecture- The surrounding site is currently being modelled for options by the flood engineer to mitigate floodwater intrusion into the building.
5. Increasing intensity and frequency of drought and reduced average rainfall leading to:										
5a	Degraded building foundations and other below-ground infrastructure (e.g. wiring) as a result of decreased soil moisture.	Infrastructure	Structural	Possible	Moderate	Medium	Possible	Moderate	Medium	Wear of foundations is unlikely to happen as the soil is relatively free from acid, salinity and moisture.
5b	Degraded integrity of building materials (e.g. adhesives, wiring) as a result of warmer and drier conditions.	Infrastructure	Electrical, Mechanical	Possible	Moderate	Medium	Possible	Moderate	Medium	Wear of building materials can cause additional financial impact on the building and aesthetic issues.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
5c	Decreased availability of potable water for service delivery.	Service delivery	Hydraulic	Possible	Moderate	Medium	Likely	Moderate	High	Actual water shortages in the area is possible. Water shortages would have consequences on HVAC and drinking water availability, as well as fire safety.
5d	Reduced access to water leading to potential restrictions, particularly affecting irrigation	Service delivery	Landscape	Possible	Minor	Medium	Likely	Minor	Medium	Reduced water availability during droughts can lead to irrigation restrictions, affecting hospital landscaping and cooling systems. This may impact outdoor patient areas and increase heat stress around the facility.
5e	Loss or damage to plants within landscaped areas	Service delivery	Landscape	Possible	Minor	Medium	Likely	Minor	Medium	Loss or damage to plants in landscaped areas can reduce shade, increase heat exposure, and degrade outdoor environments.
5f	Increased need for irrigation for landscaped areas	Service delivery	Landscape, Hydraulics	Possible	Moderate	Medium	Possible	Moderate	Medium	Higher temperatures and reduced rainfall increase irrigation needs for hospital landscaping, raising water consumption and operational costs. This can strain water resources and affect sustainability targets.
6. Increased extreme storms and cyclones (including increased wind speed, hail, dust and sand) leading to:										
6a	Increased storm and hail damage to building structure and façade	Infrastructure	Structural, Architectural, Mechanical	Possible	Major	High	Possible	Major	High	Severe storms and cyclones can cause structural and façade damage to hospital buildings, leading to safety hazards and costly repairs. This may disrupt healthcare services and compromise building resilience.
6b	Increased levels of rain/moisture penetration	Infrastructure	Architectural	Possible	Moderate	Medium	Possible	Moderate	Medium	Rain and moisture penetration can compromise the building envelope, leading to internal dampness, mould growth, and material degradation. This affects indoor air quality, equipment reliability, and patient comfort.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
6d	Greater strain or loss on building fixtures, fittings and fastenings	Infrastructure	Architectural	Unlikely	Minor	Low	Unlikely	Minor	Low	Damage or strain on fixtures, fittings, and fastenings can compromise the safety and functionality of hospital spaces. This may lead to increased maintenance needs and potential disruptions to clinical operations.
6e	Reduced air quality within internal areas	Health of the Population	Mechanical	Rare	Major	Medium	Rare	Major	Medium	Reduced internal air quality can affect patient recovery and staff wellbeing, especially in sensitive areas like operating theatres and ICUs. It may also impair the performance of medical equipment and ventilation systems.
6f	Increased demand on the building as a place of refuge and/or as a designated evacuation centre	Health of the Population	LHD	Unlikely	Major	High	Unlikely	Major	High	Extreme storms and cyclones can lead to a surge in people seeking shelter at hospitals, increasing pressure on space, utilities, and staff. This can disrupt routine healthcare services and strain emergency response capacity.
6g	Dust and sand affecting ventilation and air-conditioning systems	Service Delivery	Mechanical	Rare	Major	Medium	Rare	Major	Medium	Dust and sand infiltration can clog hospital ventilation and air-conditioning systems, reducing air quality and system efficiency. This can impact patient comfort, equipment performance, and increase maintenance needs.
7. Sea level rise and increased frequency of coastal erosion and inundation leading to: *THE BELOW RISKS ARE NOT APPLICABLE TO PROJECT SITE AS THE SITE IS LOCATED AWAY FROM COASTAL ZONES AND HENCE IS NOT SUBJECT TO COASTAL EROSION AND INUNDATION.										
7a	Increasing levels of localised flooding, limiting access to construction sites and impacting on service delivery									
7b	full or partial damage to buildings, infrastructure, assets, equipment and public spaces									

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
7c	Costs for acquisition of new land and replacement of stranded health assets currently located in increasingly hazard prone areas									
7d	More frequent and higher storm surges, including localised flooding causing damage to assets and higher maintenance costs									
7e	Increased coastal erosion impacting on building foundations									
7f	Drainage capacity issues for buildings and hard landscaping									
7g	Increased levels of moisture penetration									
7h	Saltwater intrusion into groundwater, increasing degradation of building materials (for example, foundations, drainage infrastructure)									
8. Increase in humidity leading to:										
8a	Greater instances of material degradation to facades, structures, and surface	Infrastructure	Architectural	Possible	Minor	Medium	Possible	Minor	Medium	Material degradation due to climate stressors can weaken hospital facades and structural elements, leading to safety risks and increased maintenance. This affects building longevity and may disrupt healthcare delivery during repairs.
8b	Build-up of mould and condensation leading to increased operations and maintenance requirements and costs	Financial Management	Architectural	Possible	Moderate	Medium	Possible	Moderate	Medium	Increased humidity can lead to mould and condensation buildup, degrading indoor air quality and building materials. This raises operational costs due to more frequent cleaning, repairs, and HVAC system maintenance.

Risk ID	Risk Description	Risk Category	Business Area/ Risk Owner	Worst case risk rating based on 2030 climate change projections			Worst case risk rating based on 2090 climate change projections			Comments
				Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	
8c	Increased energy demand for HVAC in order to maintain thermal comfort for building users and occupants	Service Delivery	Architectural, Mechanical	Likely	Moderate	High	Likely	Moderate	High	Higher temperatures and humidity levels increase HVAC energy demand to maintain thermal comfort, especially in sensitive hospital zones. This raises operational costs and can strain energy infrastructure during peak periods.

6 Climate Action Plan

Based on the climate risks identified in Section 5, the proposed development was determined to have an **EXTREME** risk rating across the selected climate change scenarios. This project specific Climate Action Plan below outlines the adaptation actions that are integrated into the project design to address each corresponding climate risk items. The adaptation measures were proposed by the design and services team during the Climate Risk workshop held on 6th June for all risks identified to be of medium, high and extreme level.

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
1. Increasing intensity and frequency of heatwave and extreme heat events leading to:				
1a	Impacts to the thermal performance levels of buildings leading to reduced comfort levels for building occupants and health concerns.	High	High	Architectural- High performing building envelope has been specified as per Section J requirements. Thermally broken, double glazed windows will be installed. Elements that are beyond Section J requirements will also be incorporated in the envelope such as the use of a thermal break tape. A combination of brick and metal cladding will be used for the facade. Colour palette for exterior material finishes will be light such as grey. A three-year Solar Reflectance Index (SRI) of minimum 64 or an initial SRI of minimum 82 should be considered for exterior material finishes. Passive shading measures incorporated through 2m deep eaves. Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. A 1 deg. increase due to climate change has been allowed for. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.
1b	Increased instances of energy and telecommunications network failure (e.g. blackouts/brownouts, etc.) impacting operations	Extreme	Extreme	Electrical- Emergency backup will be available from emergency backup generators from the existing hospital. Required electrical infrastructure will be provided in the proposed extension to connect to the existing emergency backup generator. Two essential distribution boards will be provided on each level, providing power for lighting and equipment.
1c	Increased stress on vital equipment and services (e.g. HVAC and other plant) leading to greater maintenance demands and higher frequency/ higher scope replacement requirements	Extreme	Extreme	Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. The average temperature increase has been incorporated into the design conditions and modelled to assess the resulting system capacities. This adjustment resulted in an increase of approximately 10–15 kW across all Fan Coil Units and condenser units within the project. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
1d	Increased energy and water demand across the site resulting in higher operational costs	High	High	Hydraulics- Water efficient sanitary fixtures and fittings (taps, toilets, showers) with high WELS rating will be installed. Recommended WELS ratings are as follows: • Taps: 5 star • Urinals: 5 star • Toilets: 4 star • Showers: 3 star (>4.5 but <=6.0L/min) • Clothes Washers: 4 star • Dishwashers: 5 star
1e	Greater instances of material degradation to facades, structures, and surfaces, resulting in higher replacement and maintenance costs	High	High	Architectural- The proposed façade will be of brick and metal cladding. These materials are hardy, have a long life and have good resilience against external weather conditions.
1f	Impacts to landscaping and plantings, reducing the amenity of the site.	Medium	Medium	Architectural/ Landscaping- Plant species will be native/low water use species with automatic time-controlled drip irrigation system with moisture sensors.
1g	Increased stress on vital equipment and services (for example, elevators and plant) leading to greater response demands	High	High	Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. The longevity of systems has been taken into account. Electrical- Emergency backup will be available from emergency backup generators from the existing hospital. Required electrical infrastructure will be provided in the proposed extension to connect to the existing emergency backup generator.
2. Increasing intensity and frequency of bushfire events leading to:				
2a	Full or partial damage to buildings, infrastructure, assets, equipment and public spaces	Low	Low	

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
2b	Reduced air quality within internal areas, impacting occupant's health.	High	High	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control. Bushfire filtration will require additional filters. The use of higher-efficiency filters (e.g., bushfire filters) will result in increased pressure drop across the system. This has been acknowledged in the design of the VRV systems. The increased resistance will have implications for fan sizing, energy consumption, and maintenance frequency, all of which have been considered in the system specification. Outside air supply meets ESG requirements for provision of consistent levels of outdoor air.
2c	Leading to a loss of cultural heritage sites.	Low	Low	
2d	Smoke and embers impacting ventilation and air-conditioning systems.	High	High	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control. Bushfire filtration will require additional filters. The use of higher-efficiency filters (e.g., bushfire filters) will result in increased pressure drop across the system. This has been acknowledged in the design of the VRV systems. The increased resistance will have implications for fan sizing, energy consumption, and maintenance frequency, all of which have been considered in the system specification. Outside air supply meets ESG requirements for provision of consistent levels of outdoor air.
2e	An accumulation of ash in roof drainage leading to drainage and structural concerns.	Low	Low	
2f	Increased demand on the building as a designated 'safer place' or evacuation centre	Medium	Medium	Mechanical- Mechanical equipment have been oversized in account of predicted increase in temperatures and hence will be able to serve the increased demand during designated periods of 'safer place' or evacuation centre. Fan coil units will be used, which will have G4 filters which are suitable for general air quality control.

3. Increasing intensity of extreme rainfall events leading to:

3a	Roof drainage not providing sufficient capacity.	High	High	Hydraulics- Hydraulic design has been done for 1:100 ARI event with an additional 10% allowance for climate change. The maintenance plan for gutters will be typical and ensures that they are free of debris.
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Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
3b	Drainage capacity issues for buildings and hard landscaping resulting in damage to buildings and equipment	Medium	High	Civil- An OSD tank has been proposed. The capacity has not yet been finalized. The tank will be designed for a 1:100 ARI event. Predicted impacts of climate change will be factored into the design of the OSD. Further direction on the climate change factor to be used is required from the Council. MUSIC model has been done to present water quality.

4. Increasing intensity and frequency of extreme rainfall resulting in flooding events leading to:

4a	Full or partial damage to buildings, infrastructure, assets, equipment and public spaces	Medium	Medium	Mechanical- All equipment provided shall be specified to comply with relevant Australian Standards, with external condensers located within a dedicated, screened plant area. It is acknowledged that, during extreme weather events such as storms or cyclones, equipment may be subject to damage and rendered inoperable—similar to other building elements exposed to such conditions in comparable installations. Architectural- A Deemed to Satisfy (DTS) solution is proposed per F3D1 of NCC 2022. Performance Requirement F3P1 is satisfied by complying with F3D2 to F3D5. F3D2: The proposed building roof is a metal sheet roofing complying with AS 1562.1. F3D3: Sarking specified for both the roof and walls will comply with AS 4200.1 and AS 4200.2. F3D4: Glazed assemblies in all external walls will comply with AS 2047. F3D5: The building facade comprises metal cladding which complies with AS 1562.1 and masonry which complies with AS 3700.
4b	Increased levels of rain/moisture penetration in the building and facades affecting durability and functionality	Medium	Medium	Architectural- A Deemed to Satisfy (DTS) solution is proposed per F3D1 of NCC 2022. Performance Requirement F3P1 is satisfied by complying with F3D2 to F3D5. F3D2: The proposed building roof is a metal sheet roofing complying with AS 1562.1. F3D3: Sarking specified for both the roof and walls will comply with AS 4200.1 and AS 4200.2. F3D4: Glazed assemblies in all external walls will comply with AS 2047. F3D5: The building facade comprises metal cladding which complies with AS 1562.1 and masonry which complies with AS 3700.
4c	Drainage capacity issues for buildings and hard landscaping	Medium	High	Civil- An OSD tank has been proposed. The capacity has not yet been finalized. The tank will be designed for a 1:100 ARI event. Predicted impacts of climate change will be factored into the design of the OSD. Further direction on the climate change factor to be used is required from the Council. MUSIC model has been done to present water quality.
4d	Floodwater intrusion increasing degradation of building materials (for example, foundations)	Medium	Medium	Structural- Resolution of the flood mitigation measures are ongoing as part of the flood impact assessment being undertaken by Northrop. Current proposal is to direct the flood waters away and around the building to ensure there are not impacts on the hospital operations, along with the structure. Consideration of a free board above the PMF levels is also being included in the flooding assessment to prevent the risk of climate change and risk of higher frequency and levels of the floods. Architecture- The surrounding site is currently being modelled for options by the flood engineer to mitigate floodwater intrusion into the building. Proposed finished floor level will be above the predicted flood levels.

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
4e	Higher frequency repair or replacements for assets and equipment	Medium	Medium	Mechanical- No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.
4f	Disruption of sewerage services	High	High	Civil- The stormwater system does not connect to the sewer system, they are 2 separate systems and no cross over is allowed. For the existing stormwater system - the OSD is reducing the existing stormwater discharge affecting the site and as such - is reducing the stormwater discharge to the system.
4g	Increased demand on the building as a designated 'safer place' or evacuation centre	High	High	Mechanical- Mechanical equipment have been oversized in account of predicted increase in temperatures and hence will be able to serve the increased demand during designated periods of 'safer place' or evacuation centre.
4h	Interrupted access to site due to road closures	Medium	Medium	Flood Emergency Response Management Plan to be developed as a control.
4i	Patients being unable to enter hospital to access hospital services due to inundation of hospital building entry	Medium	Medium	Architecture- The surrounding site is currently being modelled for options by the flood engineer to mitigate floodwater intrusion into the building.
5. Increasing intensity and frequency of drought and reduced average rainfall leading to:				
5a	Degraded building foundations and other below-ground infrastructure (e.g. wiring) as a result of decreased soil moisture	Medium	Medium	Structural- Current structural design is a piled solution down to the underlying bedrock which will not be impacted by the seasonal fluctuations in soil moisture content.

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
5b	Degraded integrity of building materials (e.g. adhesives, wiring) as a result of warmer and drier conditions	Medium	Medium	Electrical and Mechanical- Adhesives and materials shall be specified in accordance with relevant Australian Standards and selected to withstand the required environmental and operational conditions. Final selections are to be proposed by the contractor, with technical submissions provided for review and approval prior to procurement.
5c	Decreased availability of potable water for service delivery	Medium	High	Hydraulics- Metering strategy will be in place for monitoring water use. Water efficient sanitary fixtures and fittings (taps, toilets, showers) with high WELS rating will be installed.
5d	Reduced access to water leading to potential restrictions, particularly affecting irrigation	Medium	Medium	Architectural/ Landscaping- Plant species will be native/low water use species with automatic time-controlled drip irrigation system with moisture sensors.
5e	Loss or damage to plants within landscaped areas	Medium	Medium	Architectural/ Landscaping- Plant species will be native/low water use species that are resilient to adverse conditions.
5f	Increased need for irrigation for landscaped areas	Medium	Medium	Architectural/ Landscaping- Plant species will be native/low water use species with automatic time-controlled drip irrigation system with moisture sensors.

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
6. Increased extreme storms and cyclones (including increased wind speeds, hail, dust and sand) leading to:				
6a	Increased storm and hail damage to building structure and façade	High	High	Architectural- Roofing material will be Class 4 impact -rated Colorbond steel (0.42 BMT) which offers protection against hailstones up to 50mm in diameter. Solar panels are made with tempered glass which enhance their ability to resist hail impacts. Mechanical- All equipment provided shall be specified to comply with relevant Australian Standards, with external condensers located within a dedicated, screened plant area. It is acknowledged that, during extreme weather events such as storms or cyclones, equipment may be subject to damage and rendered inoperable—similar to other building elements exposed to such conditions in comparable installations
6b	Increased levels of rain/moisture penetration	Medium	Medium	Architectural- The surrounding site is currently being modelled for options by the flood engineer to mitigate floodwater intrusion into the building.
6d	Greater strain or loss on building fixtures, fittings and fastenings	Low	Low	
6e	Reduced air quality within internal areas	Medium	Medium	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control.
6f	Increased demand on the building as a place of refuge and/or as a designated evacuation centre	High	High	Mechanical- Mechanical equipment have been oversized in account of predicted increase in temperatures and hence will be able to serve the increased demand during designated periods of 'safer place' or evacuation centre. Fan coil units will be used, which will have G4 filters which are suitable for general air quality control.
6g	Dust and sand affecting ventilation and air-conditioning systems	Medium	Medium	Mechanical- Each outside air system is equipped with a dedicated filter located upstream of the fan, and the system intake is fitted with a weatherproof louvre to ensure protection against environmental exposure. Additionally, each Fan Coil Unit is provided with its own set of filters to ensure adequate system-wide air filtration.

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
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7. Sea level rise and increased frequency of coastal erosion and inundation leading to:

7a	Increasing levels of localised flooding, limiting access to construction sites and impacting on service delivery			NOT APPLICABLE
7b	full or partial damage to buildings, infrastructure, assets, equipment and public spaces			NOT APPLICABLE
7c	Costs for acquisition of new land and replacement of stranded health assets currently located in increasingly hazard prone areas			NOT APPLICABLE
7d	More frequent and higher storm surges, including localised flooding causing damage to assets and higher maintenance costs			NOT APPLICABLE
7e	Increased coastal erosion impacting on building foundations			NOT APPLICABLE
7f	Drainage capacity issues for buildings and hard landscaping			NOT APPLICABLE
7g	Increased levels of moisture penetration			NOT APPLICABLE

Risk ID	Risk	Risk Level 2030	Risk Level 2090	Proposed adaptation measures (Design and construction stage) (Responses based on Climate Risk Workshop held on 6 th June 2025)
7h	Saltwater intrusion into groundwater, increasing degradation of building materials (for example, foundations, drainage infrastructure)			NOT APPLICABLE
8. Increase in humidity leading to:				
8a	Greater instances of material degradation to facades, structures, and surface	Medium	Medium	Architectural- The proposed façade will be of brick and metal cladding. These materials are hardy, have a long life and have good resilience against external weather conditions. A Deemed to Satisfy (DTS) solution is proposed per F3D1 of NCC 2022. Performance Requirement F3P1 is satisfied by complying with F3D2 to F3D5. F3D2: The proposed building roof is a metal sheet roofing complying with AS 1562.1. F3D3: Sarking specified for both the roof and walls will comply with AS 4200.1 and AS 4200.2. F3D4: Glazed assemblies in all external walls will comply with AS 2047. F3D5: The building facade comprises metal cladding which complies with AS 1562.1 and masonry which complies with AS 3700.
8b	Build-up of mould and condensation leading to increased operations and maintenance requirements and costs	Medium	Medium	Architectural- Use of a suitable vapour barrier, insulation, thermal break tapes to avoid thermal bridges, double glazed external windows will be incorporated to reduce condensation.
8c	Increased energy demand for HVAC in order to maintain thermal comfort for building users and occupants	High	High	Mechanical- Predicted increase in ambient temperatures and humidity have been taken into account in the sizing of mechanical systems. A 1 deg. increase due to climate change has been allowed for. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan are in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.

7 Conclusion

This report presents a Climate Change Risk Assessment and Adaption Plan for the Mount Druitt Hospital located at 75 Railway Street, Mt Druitt, NSW 2770, to support the HI ESD strategy for the project and is anticipated to inform the ongoing development of the project's design and operation.

The proposed development was assessed for its exposure to current and future climate related hazards. 2030 (RCP8.5) and 2090 (RCP8.5) are the selected climate change scenarios for this risk assessment. These projected climate impacts were used to identify potential risks to the site using best-practice climate change risk assessment methodologies. This report highlights the risk consideration, site constraints and strategies employed to reduce the site's climate risk profile.

Based on the climate risks identified in this report, the proposed development was determined to have an **EXTREME** risk rating across the selected climate change scenarios.

As a result, to improve the project's resilience to climate hazards, the project team has provided climate adaptation design solutions presented in 6 Climate Action Plan. The proposed climate adaptation design solutions have been finalised following a workshop with the project and design team and this has resulted in achieving a LOW residual risk rating through the implementation of climate resilient design responses.

8 References

Bureau of Meteorology. 2021. Annual climate statement 2020_Rainfall. [online] Available at: <<http://www.bom.gov.au/climate/current/annual/aus/#tabs=Rainfall>>.

Bureau of Meteorology. 2021. Annual climate statement 2020_Temperature. [online] Available at: <<http://www.bom.gov.au/climate/current/annual/aus/#tabs=Temperature>>.

Climatechangeinaustralia.gov.au. 2021. Climate Futures Tool. [online] Available at: <<https://www.climatechangeinaustralia.gov.au/en/projections-tools/climate-futures-tool/detailed-projections/>>.

Coastalrisk.com.au. 2021. Coastal Risk Australia. [online] Available at: <<https://www.coastalrisk.com.au/viewer>>.

Edis.dpi.nsw.gov.au. 2021. Department of Primary Industries - Enhanced Drought Information Systems Web Portal. [online] Available at: <<https://edis.dpi.nsw.gov.au/>>.

Ipcc.ch. 2021. Climate Change 2021 Sixth Assessment Report of the Intergovernmental Panel on Climate Change. [online] Available at: <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf>.

Metropolitan Sydney Climate Change Snapshot. 2024. NARClm. [online] Available at: <<https://www.climatechange.environment.nsw.gov.au/sites/default/files/2024-08/NARClm2-Snapshot-Sydney.pdf>>

Appendix A Project Characteristics

Site Location	
Street Address	75 Railway Street
City	Mount Druitt
State	NSW 2770
GPS Coordinates	-33.7657, 150.8296

Climate Characteristics	
BCA Climate Zone	Zone 5- Warm Temperate

Building Sector	Hospital
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Building Objectives	Social (Type, use, function)	The scope for Mount Druitt Hospital comprises of the expansion of existing medical short stay services to include for an additional 20 acute medical and 10 acute surgical short stay service beds (30 beds in total). The development includes following: • Acute zone • Sub-acute zone • Ambulatory care • Diagnostics • Addiction treatment centre • Mental health • Dialysis centre • Child care • Diabetes education • Dental • Day aged care • Aboriginal health • Future clinical support
	Environmental	The usability of the building is not to be affected by predicted environmental factors. The development will have a high regard for environmentally sustainable outcomes through management of energy, water, indoor air quality, landscape and construction. The sustainable framework helps this project achieve best practice, by targeting the following sustainability and energy efficiency targets: • NSW Environmental Planning and Assessment Regulation 2021 • NSW Government Resource Efficiency Policy • National Construction Code (NCC) 2019 Amendment 1 • Health Infrastructure Design Guidance Note No.058- Environmentally Sustainable Development • Health Infrastructure (HI) ESD Evaluation Tool • Blacktown Development Control Plan (DCP) 2015
	Economic	The hospital will be economically viable for the residents of the Blacktown. This facility will enhance the public health infrastructure of the community. The hospital will be economically viable for the residents of the Blacktown. This facility will enhance the public health infrastructure of the community.
Services and quality	Blacktown and Mount Druitt Hospitals (BMDH) operate across two campuses within the Blacktown LGA and are part of Western Sydney Local Health District (WSLHD), located approximately 10km apart by road. The hospital will serve the Blacktown community.	
Is the continuity of the service of this building during an extreme climate event critical for the community?		Yes
Is the project's success critically dependent on the climate?		No
Project expected building lifetime.		60 years

Appendix B Current Climate Assessment

Is the Project located in any of the following types of sensitive geographical areas?		Score No = 0 Yes = 2	Source of Information
Coastal regions	No	0	https://www.coastalrisk.com.au/viewer
Flood plains	No	0	https://maps.blacktown.nsw.gov.au/
Mountainous region with steep slopes	No	0	https://en-au.topographic-map.com/
TOTAL		0/6	

Is the anticipated outcome of the Project likely to be exposed to the following current climate hazards?		Source of Information	
Legend: Not at all = 0 A little = 1 Somewhat = 2 A lot = 3			
Sea - Sea level rise	0/3	https://www.coastalrisk.com.au/viewer	
Sea - Storm surge and storm tide	0/3	https://www.coastalrisk.com.au/viewer	
Rainfall - Extreme rainfall events (flooding)	1/3	http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_displ_type=dataGraph&p_stn_num=066011&p_nccObsCode=139&p_month=13	
Rainfall - Drought	1/3	https://www.agriculture.gov.au/agriculture-land/farm-food-drought/drought/assistance/fmd/fmd-rainfall-analyser	
Temperature - Extreme temperature events	1/3	http://www.bom.gov.au/climate/history/temperature/	
Temperature - Solar radiation	1/3	http://www.bom.gov.au/jsp/ncc/climate_averages/solar-exposure/index.jsp?period=an#maps	
Wind - Gales and extreme wind events	2/3	http://www.bom.gov.au/jsp/ncc/climate_averages/solar-exposure/index.jsp?period=an#maps	
Wind - Storms (snow, hail, dust, lightning)	1/3	https://en.wikipedia.org/wiki/Severe_storm_events_in_Sydney	
Wind - Cyclones	0/3	https://en.wikipedia.org/wiki/Severe_storm_events_in_Sydney	
Relative Humidity - Annual average humidity	0/3	http://www.bom.gov.au/jsp/ncc/climate_averages/relative-humidity/index.jsp?maptype=3&period=an#maps	
Soil - Moisture	0/3	http://www.bom.gov.au/climate/drought/#tabs=Soil-moisture	
Soil - Salinity	0/3	https://geo.seed.nsw.gov.au/Public_Viewers/index.html?viewer=Public_Viewers&locale=en-AU&runWorkflow=AppendLayerCatalog&CatalogLayer=SEED_Catalog.337	
Bush fire risk - Fire danger index	0/3	https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection/bush-fire-prone-land/check-bfpl	

Assessment matrix					
Do the hazards above significantly endanger the achievement of the project outcome?	Total Score	Low	Medium	High	Score
Sensitive Location	0	0 to 2	3 to 4	Over 5	LOW
Exposure to current hazards	18%	Less than or equal to 33% of total potential score	Between 33% and 66% of total potential score	Greater than or equal to 66% of total potential score	LOW
Overall Exposure & Hazard Rating					LOW

Appendix C Consequence Descriptors

The following table outlines which consequence categories were considered in this report. Risks are a combination of the consequences and are rated according to the impact each risk was expected to have on each consequence. Risks were rated with the ratings in the left-hand column.

Consequence and success criteria	Catastrophic	Major	Moderate	Minor	Insignificant
Clinical Care and Patient Safety	Unexpected multiple patient deaths unrelated to the natural course of the illness.	Unexpected patient death or permanent loss/reduction of bodily function unrelated to the natural course of the illness.	Unexpected temporary reduction of patient's bodily function unrelated to the natural course of the illness which differs from the expected outcome.	Enter Patient's care level has increased unrelated to the natural course of the illness.	First Aid provided to patient unrelated to the natural course of the illness.if required
Health of the Population	Large numbers of serious injuries or loss of lives. An increase in the prevalence of known conditions contributing to chronic diseases across the state-wide population health KPI categories currently measured by NSW Health and or an increase of more than 10% in one or more category.	Isolated instances of serious injuries or loss of lives. Failure to materially reduce the prevalence of known conditions contributing to chronic disease across the majority of the state-wide population health KPI categories measured by NSW Health and or an increase of more than 5% up to 10% in one or more category.	Small numbers of injuries. Failure to materially reduce the prevalence of more than one of the known conditions contributing to chronic disease from the statewide population KPI categories measured by NSW Health and or an increase of more than 2% and up to 5% in one or more category.	Serious near misses or minor injuries. Failure to reduce the prevalence of one of the known conditions contributing to chronic disease from the state-wide population health KPI categories measured by NSW Health or an increase of up to 2% in one or more category.	Appearance of a threat but no actual harm. A preventative Health program has not demonstrably met planned objectives, but the prevalence of known condition is continuing to decrease in line with KPI targets.

Consequence and success criteria	Catastrophic	Major	Moderate	Minor	Insignificant
Service Delivery- Management and Community Expectation (including legal)	Failure to meet critical priority KPI's included in the service's performance agreement. Significant loss of public confidence, loss of reputation and/or media interest across NSW Legal judgement, claim, non-compliance with legislation resulting in indeterminate or prolonged suspension of service delivery.	Failure to meet a significant number of priority KPI's included in the service's performance agreement. Sustained adverse publicity at a state-wide level leading to the requirement for external intervention. Systemic and sustained loss of public support/opinion across a service. Legal judgement, claim, non-compliance with legislation resulting in medium term suspension of service delivery.	Failure to meet a number of priority KPI's included in the services' performance agreement. Increasing and broadening adverse publicity at a local level, loss of consumer confidence, escalating patient/consumer complaints. Extended loss of public support/opinion for a Facility/ Service. Legal judgement, claim, non-compliance with legislation resulting in medium term but temporary suspension to services.	Failure to meet one or more of the KPI's (excluding priority KPI's) included in the service's performance agreement. Periodic loss of public support. Legal judgement, claim, non-compliance with legislation resulting in short term disruption to services.	Minimal impact on local operations, local management review and occasional adverse local publicity. Legal judgement, claim or legislative change but no impact on service delivery.
Workforce/ WHS	Unplanned cessation of a critical State-wide program or service or multiple programs and services. Multiple deaths or life-threatening injuries or illness to non-patients.	Unplanned cessation of a service or program availability within a Service Area with possible flow on to other locations. Death or life-threatening injury or illness causing hospitalisation of non-patients.	Unplanned restrictions to services and programs in multiple locations or a whole hospital or community service. Serious harm, injury or illness causing hospitalisation or multiple medical treatment cases for non-patients.	Unplanned service delivery or program delays localised to department or community service. Minor harm, injury or illness to a non-patient where treatment or First Aid is required. Harm, injury or illness not requiring immediate medical treatment.	Minimal effect on service delivery. Minor harm, injury or illness to a non-patient where treatment or First Aid is required. Harm, injury or illness not requiring immediate medical treatment.
Emergency Management	Cessation of services due to loss, damage or unauthorised	Prolonged service disruption or suspension of	Temporary suspension of services due to the	Localised disruption to services.	Minimal effect on services. No loss or damage to

Consequence and success criteria	Catastrophic	Major	Moderate	Minor	Insignificant
	access to property, assets, records and information. Property becomes uninsurable	services due to the loss, damage or unauthorised access to property, assets, records and information. Major increase in insurance premiums.	loss, damage or unauthorised access to property, assets, records and information. Moderate increase in insurance premiums.	Minor loss, damage or authorised access to property, assets, records and information. Minor increase in insurance premiums.	property, assets, records or information No impact on insurance premiums.
Environment and Sustainability	More than 5% over budget NOT recoverable within the current or following financial year. Unable to pay staff or finance critical services.	Up to 5% over budget or a material overrun NOT recoverable within the current financial year. Unable to pay creditors within MOH benchmark.	Up to 5% over budget but recoverable within current financial year.	Up to 1% temporarily over budget and recoverable within current financial year	Less than 1% over budget. Temporary loss of or unplanned expenditure related to individual program or project but no net impact on budget.
Community and Lifestyle	State-wide system dysfunction resulting in total shutdown of service delivery or operations	Services compromised as service providers are unable to provide effective support and other areas of NSW Health are known to be affected	Disruption of a number of services within a location with possible flow on to other locations in the area	Some disruption within a location but manageable by altering operational routine	No interruption to services

Appendix D Risk Rating Guide

The Risk Rating Guide explains the likelihood rating given to each of the identified risks and the final risk level which is a combination of the likelihood of the risk, and most severe consequence of the risk.

Likelihood Matrix

Rating	Recurrent Risks	Single events
Almost certain	Could occur several times per year	More Likely than not - Probability greater than 50%
Likely	May arise about once per year	As likely as not - 50/50 chance
Possible	May arise once in ten years	Less likely than not but still appreciable - Probability less than 50% but still quite high
Unlikely	May arise once in ten years to 25 years	Unlikely but not negligible - Probability low but noticeably greater than zero
Rare	Unlikely during the next 25 years	Negligible - Probability very small, close to zero

Risk Level

Likelihood	Consequences				
	Catastrophic	Major	Moderate	Minor	Insignificant
Almost certain	A	D	J	P	S
Likely	B	E	K	Q	T
Possible	C	H	M	R	W
Unlikely	F	I	N	U	X
Rare	G	L	O	V	Y

Risk Interpretation- **Extreme**, **High**, **Medium**, **Low**

Design with **community** in mind

Appendix E Stakeholder List

The purpose of a stakeholder list and engagement is to raise awareness of the current and future climate risks associated with the site itself. Based on the climate risk assessment, these issues have been addressed through a variety of design implementations with a focus in making the project become climate resilient.

The list below provides examples of stakeholders to consider engaging through the climate risk assessment process.

Stakeholder	Stakeholder representative	Engagement Objectives	Key items to consult upon	Communication channels (e.g. workshops, emails, newsletter)
LHD team members				
Local Health District Sustainability team member		Consult	Incorporation of any existing LHD Climate Risk Assessment/Adaptation Requirements. Operational adaptation measures/controls	
Local Health District Disaster Planner/Emergency Plan Coordinator		Consult	Existing Site Business Continuity Plans (BCPs), Hospital/Facility Emergency Management Plans and entity level hazard subplans (for bushfire etc). Disaster and emergency related adaptation measures	
LHD Redevelopment Lead		Inform		
LHD Enterprise Risk Manager		Inform		
HI Project Team members				
HI Project Director	Scott McKnight	Consult	Integration of any residual risks into project risk register	
HI Sustainability Team Member			Optional to include in project climate risk assessment meetings. Review of Climate Risk Assessment Tool including Climate Adaptation Plan	
Project Team Consultants/Contractors				
Project Manager	Isabelle Stephens, Mostyn Copper	Collaborate	Ensuring requirements are conveyed to any subcontractors	
Project Architect	Julianne Nee, Jacobs	Involve	Incorporating adaptation measures and controls into design and ensuring requirements are conveyed to any subcontractors	
Project Civil Engineer	Greg Lylell, ACOR Consultants	Involve	Civil Design/Site Masterplan	
Project Electrical Engineer	Moien Rashidi, JHA Consulting Engineers	Involve	Electrical Design	
Project Landscape Designer		Involve	Landscape Design	
Project ICT Consultant		Involve	ICT Design and BMCS Design	
Project Mechanical Engineer	Bartosz Wojtynski, JHA Consulting Engineers	Involve	Mechanical Design	
Project Hydraulic Consultant	Caitlin Price, Arup	Involve	Hydraulic Design	
Project Fire Consultant		Involve	Fire Engineering Design	
Project Structural Engineer	Greg Trainor, ACOR Consultants	Involve	Structural Design	
Project ESD Consultant	Ingrid Segovia, Stantec Madhu Muthumalai, Stantec	Involve	ESD specifications	
Project Façade Designer		Involve	Façade Design	
Project Climate Change Risk Consultant (if different to ESD consultant)			This tool, overseeing Climate Risk workshops	
Project Cost Planner	Alan Fox, Altus Group	Inform	Ensuring any adaptation measures with material budget implications are incorporated into cost plan	
Project main works contractor		Inform	Any design updates and construction works	
External Stakeholders				
Local Government				
Emergency Services				
Electricity Network provider				
Water Utility provider				
Transport for NSW				
Resilience NSW				

Appendix F Risk and Adaptation Register

Project Name:	BMDH- Mount Druitt Hospital
Project Address/GPS Coordinates:	-33.7857, 150.8296
Risk Register Owner Name:	
Risk Register Owner:	

Updated by Name:	Madhu Muthumalai
Last Update Date:	26-09-25

When should section be updated: Parts 2-8

Parts 3-8. Note that Climate Adaptation Plan is only required if inherent climate risks rated medium or above are identified in Part 2 or later stages.

Parts 2-8

CLIMATE RISK ASSESSMENT														CLIMATE ADAPTATION PLAN										FURTHER INFORMATION						
Risk ID	Risk description	Business area/ Risk owner	Date last assessed DD/MM/YY	Area of Impact	Risk category	Natural hazards (climate related)						Inherent risk level based on 2050 climate change projections			Inherent risk level based on 2070 climate change projections			Control effectiveness	Proposed adaptation measures (Design and Construction Stage) Stakeholder responses from Climate Risk Workshop held on 6th June 2025	Responsibility	Residual risk level based on 2050 climate projections			Residual risk level based on 2070 climate projections			Evidence to be provided	Comments		
						Bus life	Extreme rainfall	Flooding	Changes in temperature including extreme heat	Drought	Sea level rise related coastal inundation and erosion	Increased humidity	Extreme storms and cyclones	Likelihood	Consequence	Risk rating	Likelihood				Consequence	Risk rating	Likelihood	Consequence	Risk rating					
Unique Identifier	Note that the climate risk register has been pre-filled with example risks to consider and update as relevant for the project context. Refer also to Tab 1 for Guidance, and Tab 7 - Example Climate Risks for more examples.	Who is responsible for managing the risk			e.g. infrastructure, service delivery, work health and safety	e.g. map against natural hazards to help understand how many risks relate to specific natural hazards and/or identify any gaps						The risk if the current control strategy fails completely, based on the risk assessment criteria outlined by HI's enterprise risk management framework including:			The risk if the current control strategy fails completely, based on the risk assessment criteria outlined by HI's enterprise risk management framework including:			Select level of effectiveness from drop-down list	Design related adaptation measures must be listed for all climate risks rated above medium from Part 3 onwards. Refer to example 'Tab 9-Example Adaptation Measures'		Expected level of risk remaining after adaptation actions are implemented			Expected level of risk remaining after adaptation actions are implemented			List supporting evidence (e.g. document name/document reference number)	Uncertainties or sensitivities, potential impact on organisational objectives, resources required (financial, physical, human resources, knowledge)		
1. Increasing intensity and frequency of heatwave and extreme heat events leading to:																														
1a	impacts to the thermal performance levels of buildings leading to reduced comfort levels for building occupants and health concerns	Architect, Mechanical		Internal equipment (mechanical, electric, hydraulic)	Work Health & Safety		Yes						Likely	Moderate	High	Almost certain	Moderate	High	Select	Architecture- High performing building envelope has been specified as per Section J requirements. Thermally broken, double glazed windows will be installed. Elements that are beyond Section J requirements will also be incorporated in the envelope such as the use of a thermal break tape. A combination of brick and metal cladding will be used for the facade. Colour palette for exterior material finishes will be light such as grey. A three-year Solar Reflectance Index (SRI) of minimum 64 or an initial SRI of minimum 82 should be considered for exterior material finishes. Passive shading measures incorporated through 2m deep eaves. Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. A 1 deg. increase due to climate change has been allowed for. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is	Possible	Minimal	Low	Possible	Minimal	Low	1. External finishes schedule 2. Architectural drawings highlighting passive design strategies 3. Section J Report 4. Mechanical equipment schedule 5. Mechanical equipment datasheets			
1b	increased instances of energy and telecommunications network failure (e.g. blackouts/brownouts, etc.) impacting operations	Electrical			Service delivery		Yes						Likely	Major	Extreme	Almost certain	Major	Extreme	Select	Electrical- Emergency backup will be available from emergency backup generators from the existing hospital. Required electrical infrastructure will be provided in the proposed extension to connect to the existing emergency backup generator. Two essential distribution boards will be provided on each level, providing power for lighting and equipment.	Unlikely	Minor	Low	Unlikely	Minor	Low	2. Electrical drawings showing generator and distribution boards			
1c	increased stress on vital equipment and services (e.g. HVAC and other plant) leading to greater maintenance demands and higher frequency/higher scope replacement requirements	Mechanical			Service delivery		Yes						Likely	Major	Extreme	Almost certain	Major	Extreme	Select	Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. The average temperature increase has been incorporated into the design conditions and modelled to assess the resulting system capacities. This adjustment resulted in an increase of approximately 10-15kW across all Fan Coil Units and condenser units within the project. VRV systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is	Possible	Minimal	Low	Possible	Minimal	Low	1. Mechanical equipment schedule 2. Mechanical equipment datasheets 3. Mechanical drawings			
1d	increased energy and water demand across the site resulting in higher operational costs	Hydraulic			Financial Management		Yes						Likely	Moderate	High	Almost certain	Moderate	High	Select	Hydraulics- Water efficient sanitary fixtures and fittings (taps, toilets, showers) with high WELS rating will be installed. Recommended WELS ratings are as follows: > Taps: 5 star > Urinals: 5 star > Toilets: 4 star > Showers: 3 star (>4.5 but <=6.0L/min) > Clothes Washers: 4 star > Dishwashers: 5 star	Possible	Minimal	Low	Possible	Minimal	Low	1. Sanitary Fixtures and Fittings (FFE) Schedule			
1e	greater instances of material degradation to facades, structures, and surfaces, resulting in higher replacement and maintenance costs	Architectural			Financial Management		Yes						Likely	Moderate	High	Almost certain	Moderate	High	Select	Architecture- The proposed facade will be of brick and metal cladding. These materials are hardy, have a long life and have good resilience against external weather conditions.	Possible	Minimal	Low	Possible	Minimal	Low	1. External finishes schedule			
1f	impacts to landscaping and plantings, reducing the amenity of the site	Landscape			Service delivery		Yes						Likely	Minor	Medium	Almost certain	Minor	Medium	Select	Architecture/ Landscaping- The landscaping design and specification is still being progressed but species will be native/low water use species with automatic time controlled drip irrigation system with moisture sensors.	Possible	Minimal	Low	Possible	Minimal	Low	1. Planting schedule			
1g	increased stress on vital equipment and services (for example, elevators and plant) leading to greater response demands	LHD			Service delivery		Yes						Possible	Major	High	Possible	Major	High	Select	Mechanical- Predicted increase in ambient temperatures have been taken into account in the sizing of mechanical systems. The longevity of systems has been taken into account. Electrical- Emergency backup will be available from emergency backup generators from the existing hospital.	Possible	Minimal	Low	Possible	Minimal	Low	1. Mechanical equipment schedule 2. Mechanical equipment datasheets 3. Mechanical drawings 4. Electrical drawings showing generator			
													Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A				
													Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A				

Increasing intensity and frequency of bushfire events leading to:																																
2a	full or partial damage to buildings, infrastructure, assets, equipment and public spaces	LHD			Financial Management	Yes							Unlikely	Minor	Low	Unlikely	Minor	Low	Select						Unlikely	Minor	Low	Unlikely	Minor	Low		
2b	reduced air quality within internal areas, impacting occupant's health	Mechanical			Service delivery	Yes							Possible	Major	High	Possible	Major	High	Select	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control. Bushfire filtration will require additional filters. The use of higher-efficiency filters (e.g., bushfire filters) will result in increased pressure drop across the system. This has been acknowledged in the design of the VRV systems. The increased resistance will have implications for fan sizing, energy consumption, and maintenance frequency, all of which have been considered in the system specification. Outside air supply meets ESG requirements for provision of consistent levels of outdoor air.			Possible	Minimal	Low	Possible	Minimal	Low		1. Mechanical equipment schedule 2. Mechanical equipment datasheets 3. Mechanical drawings		
2c	leading to a loss of cultural heritage sites	LHD			Governance and Performance	Yes							Rare	Minimal	Low	Unlikely	Minimal	Low	Select	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control. Bushfire filtration will require additional filters. The use of higher-efficiency filters (e.g., bushfire filters) will result in increased pressure drop across the system. This has been acknowledged in the design of the VRV systems. The increased resistance will have implications for fan sizing, energy consumption, and maintenance frequency, all of which have been considered in the system specification. Outside air supply meets ESG requirements for provision of consistent levels of outdoor air.			Rare	Minimal	Low	Unlikely	Minimal	Low				
2d	smoke and embers impacting ventilation and air-conditioning systems	Mechanical			Service delivery	Yes							Possible	Major	High	Possible	Major	High	Select	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control. Bushfire filtration will require additional filters. The use of higher-efficiency filters (e.g., bushfire filters) will result in increased pressure drop across the system. This has been acknowledged in the design of the VRV systems. The increased resistance will have implications for fan sizing, energy consumption, and maintenance frequency, all of which have been considered in the system specification. Outside air supply meets ESG requirements for provision of consistent levels of outdoor air.			Possible	Minimal	Low	Possible	Minimal	Low		1. Mechanical equipment schedule 2. Mechanical equipment datasheets 3. Mechanical drawings		
2e	an accumulation of ash in roof drainage leading to drainage and structural concerns	Hydraulic, Structural			Infrastructure	Yes							Rare	Minor	Low	Unlikely	Minor	Low	Select						Rare	Minor	Low	Unlikely	Minor	Low		
2f	Increased demand on the building as a designated 'safer place' or evacuation centre	LHD			Health of the Population	Yes							Rare	Major	Medium	Rare	Major	Medium	Select						Rare	Minor	Low	Rare	Minor	Low		1. Mechanical equipment schedule 2. Mechanical equipment datasheets 3. Mechanical drawings
													Select	Select	N/A	Select	Select	N/A	Select						Select	Select	N/A	Select	Select	N/A		
													Select	Select	N/A	Select	Select	N/A	Select						Select	Select	N/A	Select	Select	N/A		
3. Increasing intensity of extreme rainfall events leading to:																																
3a	roof drainage not providing sufficient capacity	Hydraulic			Service delivery	Yes							Likely	Moderate	High	Almost certain	Moderate	High	Select	Hydraulics- Hydraulic design has been done for 1:100 ARI event with an additional 10% allowance for climate change. The maintenance plan for gutters will be typical and ensures that they are free of debris.				Unlikely	Minor	Low	Unlikely	Minor	Low		1. Hydraulic drawings 2. Hydraulic specification	
3b	drainage capacity issues for buildings and hard landscaping resulting in damage to buildings and equipment	Hydraulic			Infrastructure	Yes							Possible	Moderate	Medium	Likely	Moderate	High	Select	Civil- An OSD tank has been proposed. The capacity has not yet been finalized. The tank will be designed for a 1:100 ARI event. Predicted impacts of climate change will be factored into the design of the OSD. Further direction on the climate change factor to be used is required from the Council. MUSIC model will be done to present water quality.			Unlikely	Minor	Low	Unlikely	Minor	Low		1. Civil drawings 2. MUSIC Modelling Report		
													Select	Select	N/A	Select	Select	N/A	Select						Select	Select	N/A	Select	Select	N/A		
													Select	Select	N/A	Select	Select	N/A	Select						Select	Select	N/A	Select	Select	N/A		

Increasing intensity and frequency of extreme rainfall resulting in flooding events leading to:																						
4a	full or partial damage to buildings, infrastructure, assets, equipment and public spaces	LHD	Infrastructure	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Mechanical- All equipment provided shall be specified to comply with relevant Australian Standards, with external condensers located within a dedicated, screened plant area. It is acknowledged that, during extreme weather events such as storms or cyclones, equipment may be subject to damage and rendered inoperable—similar to other building elements exposed to such conditions in comparable installations. Architectural- A Deemed to Satisfy (DTS) solution is proposed per F3D1 of NCC 2022. Performance Requirement F3P1 is satisfied by complying with F3D2 to F3D5. F3D2: The proposed building roof is a metal sheet roofing complying with AS 1562.1. F3D3: Sarking specified for both the roof and walls will comply with AS 4200.1 and AS 4200.2. F3D4: Glazed assemblies in all external walls will comply with AS 2047. F3D5: The building facade comprises metal cladding which complies with AS 1562.1 and masonry which complies with AS 3700.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Flood Impact Assessment Report			
4b	Increased levels of rain/moisture penetration in the building and facades affecting durability and functionality	Architectural	Infrastructure	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Architectural- A Deemed to Satisfy (DTS) solution is proposed per F3D1 of NCC 2022. Performance Requirement F3P1 is satisfied by complying with F3D2 to F3D5. F3D2: The proposed building roof is a metal sheet roofing complying with AS 1562.1. F3D3: Sarking specified for both the roof and walls will comply with AS 4200.1 and AS 4200.2. F3D4: Glazed assemblies in all external walls will comply with AS 2047. F3D5: The building facade comprises metal cladding which complies with AS 1562.1 and masonry which complies with AS 3700.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. External finishes schedule			
4c	Drainage capacity issues for buildings and hard landscaping	Hydraulic	Infrastructure	Yes	Possible	Moderate	Medium	Likely	Moderate	High	Select	Civil- An OSD tank has been proposed. The capacity has not yet been finalized. The tank will be designed for a 1:100 ARI event. Predicted impacts of climate change will be factored into the design of the OSD. Further direction on the climate change factor to be used is required from the Council.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Civil drawings			
4d	Floodwater intrusion increasing degradation of building materials (for example, foundations)	Structural	Infrastructure	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Structural- Resection of the flood mitigation measures are on going as part of the flood impact assessment being undertaken by Northrop. Current proposal is to direct the flood waters away and around the building to ensure there are not impacts on the hospital operations, along with the structure. Consideration of a free board above the PMF levels is also being included in the flooding assessment to prevent the risk of climate change and risk of higher frequency and levels of the floods. Architecture- The surrounding site is currently being modelled for options by the flood engineer to mitigate floodwater intrusion into the building. Downward finished floor level will be above the predicted flood levels.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Flood Impact Assessment Report			
4e	Higher frequency repair or replacements for assets and equipment	LHD	Financial Management	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select		Select	Select	N/A	Select	Select	N/A				
4f	Disruption of sewerage services	Civil	Service Delivery	Yes	Possible	Major	High	Possible	Major	High	Select	Civil- The stormwater system does not connect to the sewer system, they are 2 separate systems and no cross over is allowed. For the existing stormwater system - the OSD is reducing the existing stormwater discharge affecting the site and as such - is reducing the stormwater discharge to the system.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Civil drawings 2. Civil Report			
4g	Increased demand on the building as a designated 'safer place' or evacuation centre	LHD	Health of the Population	Yes	Possible	Major	High	Possible	Major	High	Select	Mechanical- Mechanical equipment have been oversized in account of predicted increase in temperatures and hence will be able to serve the increased demand during designated periods of 'safer place' or evacuation centre.	Possible	Minimal	Low	Possible	Minimal	Low	1. Mechanical equipment schedule 2. Mechanical equipment datasheets 3. Mechanical drawings			
4h	Interrupted access to site due to road closures	LHD	Service Delivery	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Flood Emergency Response Management Plan to be developed as a control.	Select	Select	N/A	Select	Select	N/A				
4i	Patients being unable to enter hospital to access hospital services due to inundation of hospital building entry	LHD	Infrastructure	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Architecture- The surrounding site is currently being modelled for options by the flood engineer to mitigate floodwater intrusion into the building.	Select	Select	N/A	Select	Select	N/A				
5. Increasing intensity and frequency of drought and reduced average rainfall leading to:																						
5a	degraded building foundations and other below-ground infrastructure (e.g. wiring) as a result of decreased soil moisture	Structural	Infrastructure	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Structural- Current structural design is a piled solution down to the underlying bedrock which will not be impacted by the seasonal fluctuations in soil moisture content.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Structural drawings			
5b	degraded integrity of building materials (e.g. adhesives, wiring) as a result of warmer and drier conditions	Electrical, Mechanical	Infrastructure	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Electrical and Mechanical- Adhesives and materials shall be specified in accordance with relevant Australian Standards and selected to withstand the required environmental and operational conditions. Final selections are to be proposed by the contractor, with technical submissions provided for review and approval prior to procurement.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Mechanical O&M manual showing wiring selections and datasheets 2. Electrical O&M manual showing wiring selections and datasheets			
5c	decreased availability of potable water for service delivery	Hydraulic	Service delivery	Yes	Possible	Moderate	Medium	Likely	Moderate	High	Select	Hydraulics- Metering strategy will be in place for monitoring water use. Architects to specify high WELS rated sanitary fittings and fixtures.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Hydraulic drawings showing meters 2. Building Monitoring Strategy Report 3. Sanitary FF Schedule			
5d	Reduced access to water leading to potential restrictions, particularly affecting irrigation	Landscape	Service delivery	Yes	Possible	Minor	Medium	Likely	Minor	Medium	Select	Architectural Landscaping- Plant species will be native/low water use species with automatic time-controlled drip irrigation system with moisture sensors.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Planting schedule 2. Irrigation drawings 3. Irrigation specification			
5e	Loss or damage to plants within landscaped areas	Landscape	Service delivery	Yes	Possible	Minor	Medium	Possible	Minor	Medium	Select	Architectural Landscaping- Plant species will be native/low water use species that are resilient to adverse conditions.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Planting schedule			
5f	Increased need for irrigation for landscaped areas	Landscape, Hydraulics	Service delivery	Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Architectural Landscaping- Plant species will be native/low water use species with automatic time-controlled drip irrigation system with moisture sensors.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Planting schedule			
					Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A				
					Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A				

Increased extreme storms and cyclones (including increased wind speeds, hail, dust and sand) leading to:																						
6a	Increased storm and hail damage to building structure and facade	Structural, Architectural, Mechanical	Infrastructure				Yes	Possible	Major	High	Possible	Major	High	Select	Mechanical- All equipment provided shall be specified to comply with relevant Australian Standards, with external condensers located within a dedicated, screened plant area. It is acknowledged that, during extreme weather events such as storms or cyclones, equipment may be subject to damage and rendered inoperable—similar to other building elements exposed to such conditions in previous cyclone incidents.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. External finishes schedule 2. Architectural drawings highlighting passive design strategies 3. Section J Report 4. Mechanical equipment schedule 5. Mechanical equipment datasheets 6. Mechanical drawings
6b	Increased levels of rain/moisture penetration	Architectural	Infrastructure				Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Architecture- The surrounding site is currently being modelled for options by the flood engineer to mitigate floodwater intrusion into the building.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Flood Modelling Report
6d	Greater strain or loss on building fixtures, fittings and fastenings	Architectural	Infrastructure				Yes	Unlikely	Minor	Low	Unlikely	Minor	Low	Select		Unlikely	Minor	Low	Unlikely	Minor	Low	
6e	Reduced air quality within internal areas	Mechanical	Health of the Population				Yes	Rare	Major	Medium	Rare	Major	Medium	Select	Mechanical- Fan coil units will be used, which will have G4 filters which are suitable for general air quality control.	Rare	Minor	Low	Rare	Minor	Low	1. Mechanical equipment schedule 2. Mechanical equipment datasheets
6f	Increased demand on the building as a place of refuge and/or as a designated evacuation centre	LHD	Health of the Population				Yes	Unlikely	Major	High	Unlikely	Major	High	Select	Mechanical- Mechanical equipment have been oversized in account of predicted increase in temperatures and hence will be able to serve the increased demand during designated periods of 'safer place' or evacuation centre.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. Mechanical equipment schedule 2. Mechanical equipment datasheets 3. Mechanical drawings
6g	Dust and sand affecting ventilation and air-conditioning systems	Mechanical	Service Delivery				Yes	Rare	Major	Medium	Rare	Major	Medium	Select	Mechanical- Each outside air system is equipped with a dedicated filter located upstream of the fan, and the system intake is fitted with a weatherproof louvre to ensure protection against environmental exposure. Additionally, each Fan Coil Unit is provided with its own set of filters to ensure adequate system-wide air filtration.	Rare	Minor	Low	Rare	Minor	Low	1. Mechanical equipment schedule 2. Mechanical equipment datasheets
							Select	Select	N/A	Select	Select	N/A	Select			Select	Select	N/A	Select	Select	N/A	
7. Sea level rise and increased frequency of coastal erosion and inundation leading to:																						
*BELOW RISKS ARE NOT APPLICABLE TO PROJECT SITE AS THE SITE IS LOCATED AWAY FROM COASTAL ZONES AND HENCE IS NOT SUBJECT TO COASTAL EROSION AND INUNDATION.																						
7a	Increasing levels of localised flooding, limiting access to construction sites and impacting on service delivery		Service Delivery				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
7b	Full or partial damage to buildings, infrastructure, assets, equipment and public spaces		Infrastructure				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
7a	Costs for acquisition of new land and replacement of stranded health assets currently located in increasingly hazard prone areas		Financial Management				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
7b	More frequent and higher storm surges, including localised flooding causing damage to assets and higher maintenance costs		Infrastructure				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
7a	Increased coastal erosion impacting on building foundations		Infrastructure				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
7b	Drainage capacity issues for buildings and hard landscaping		Infrastructure				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
7a	Increased levels of moisture penetration		Infrastructure				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
7b	Saline intrusion into groundwater, increasing degradation of building materials (for example, foundations, drainage infrastructure)		Infrastructure				Yes	Select	Select	N/A	Select	Select	N/A	Select		Select	Select	N/A	Select	Select	N/A	
							Select	Select	N/A	Select	Select	N/A	Select			Select	Select	N/A	Select	Select	N/A	
							Select	Select	N/A	Select	Select	N/A	Select			Select	Select	N/A	Select	Select	N/A	
8. Increase in humidity leading to:																						
8a	Greater instances of material degradation to facades, structures, and surface	Architectural	Infrastructure				Yes	Possible	Minor	Medium	Possible	Minor	Medium	Select	Architecture- The proposed facade will be of brick and metal cladding. These materials are hardy, have a long life and have good resilience against external weather conditions. A Deemed to Satisfy (DTS) solution is proposed per F3D1 of NCC 2022. Performance Requirement F3P1 is satisfied by complying with F3D2 to F3D5. F3D2: The proposed building roof is a metal sheet roofing complying with AS 1562.1. F3D3: Sarking specified for both the roof and walls will comply with AS 4200.1 and AS 4200.2. F3D4: Glazed assemblies in all external walls will comply with AS 2047. F3D5: The building facade comprises metal cladding which complies with AS 1562.1 and masonry which complies with AS 3700.	Unlikely	Minor	Low	Unlikely	Minor	Low	1. External finishes schedule
8b	Build-up of mould and condensation leading to increased operations and maintenance requirements and costs	Architectural	Financial Management				Yes	Possible	Moderate	Medium	Possible	Moderate	Medium	Select	Architecture- Use of a suitable vapour barrier, insulation, thermal break tapes to avoid thermal bridges, double glazed external windows will be incorporated to reduce condensation.	Possible	Minimal	Low	Possible	Minimal	Low	1. Architectural drawings 2. Window specification
8c	Increased energy demand for HVAC in order to maintain thermal comfort for building users and occupants	Architectural, Mechanical	Service Delivery				Yes	Likely	Moderate	High	Likely	Moderate	High	Select	Architecture- High performing building envelope has been specified as per Section J requirements. Thermally broken, double glazed windows will be installed. Elements that are beyond Section J requirements will also be incorporated in the envelope such as the use of a thermal break tape. A combination of brick and metal cladding will be used for the facade. Mechanical- Predicted increase in ambient temperatures and humidity have been taken into account in the sizing of mechanical systems. A 1 deg. increase due to climate change has been allowed for. VRF systems will be installed. The longevity of systems have been taken into account. No services and maintenance plan is in place yet for equipment maintenance and replacement. This will happen once the head contractor is on board.	Possible	Minimal	Low	Possible	Minimal	Low	1. External finishes schedule 2. Architectural drawings highlighting passive design strategies 3. Section J Report 4. Mechanical equipment schedule 5. Mechanical equipment datasheets
							Select	Select	N/A	Select	Select	N/A	Select			Select	Select	N/A	Select	Select	N/A	
							Select	Select	N/A	Select	Select	N/A	Select			Select	Select	N/A	Select	Select	N/A	



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