CLIMATE CHANGE ASSESSMENT

TRG Bushfire Response and Training Centre Block 45
Section 3 Hume ACT.

Prepared by: Lanterra Consulting

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Abstract

The ACT is committed to setting ambitious greenhouse gas emission reduction targets to achieve its goal of zero emissions by 2045.

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1.0 Introduction

1.1 Overview

This report is an assessment of climate change of the proposed TRG Bushfire Response and Training Centre which includes a helicopter landing site (HLS).

The Environment, Planning and Sustainable Development Directorate (EPSDD) provided a Scoping Document (EIS Scoping Document 202000027 @ March 24, 2021) for the EIS that specifically outlines the specialist study requirements for the EIS.

1.2 Purpose of this report and background

The purpose of the report is to assist with the development assessment of potential hazards and risk impacts of the proposed development and in particular address climate change as part of an Environmental Impact Statement (EIS) in support of a Development Application (DA) on block 43 section 3 Hume ACT.

Table 1 below outlines the specific requirements and where in the report these aspects are addressed in this report.

Table 1: Scoping Document requirements – Hazard and Risk

Scoping Document Requirement	**Requirement Detail**	**Section where requirement is addressed.**
8.1.8 Climate Change and air quality	Impacts from Climate Change	This report
	Air quality Impacts from Operation	Refer to Air Quality Assessment Report

1.3 Project Objective

The objective of this assessment is to determine the impacts of climate change from the proposed development and in particular.

- How the proposal is consistent with associated ACT and national policies on Climate Change and Greenhouse Gas Emissions.
- Describe the proposals contribution to urban heat.

- Describe the potential impact the proposal will have on existing air quality during operation, including dust, emissions and fumes from helicopter exhaust whilst on the ground, taking off and landing (Refer to Air Quality Assessment Conducted by Lanterra Consulting Sept 2021).

1.4 Scope of this report

The EIS Scoping Document requires that the potential impacts of climate change be addressed for the Project. Specifically, the following items are to be addressed as part of the climate change impact assessment:

— how weather conditions for temperatures, precipitation, wind strength/storms and bushfires

— how the Project reduces or mitigates impacts of the above weather events

Moreover, the EIS must include information on how the proposal will reduce the risks from climate change impacts and include proposed adaption measures to reduce vulnerability and increase resilience of the community and the Territory, particularly the extreme events of heatwaves, droughts, storms with flash flooding and bushfires. The impacts must address impacts on the local microclimate and how it will avoid contribution to urban heat and positively contribute to urban cooling measures. The EIS must address requirements for reporting greenhouse gas emissions and meeting the legislated targets for a zero emissions Territory (by 2045 at the latest).

1.5 Documents Consulted.

- Scoping Document Under Division 8.2.2 of the *Planning and Development ACT 2007*, for an Emergency Services, Maintenance and Training Facility, Application number 202000027.
- ACT Government. (2016). *ACT Climate Change Adaptation Strategy* - Living with a warming climate. Canberra.
- ACT Government. (2018). Canberra 100% renewable - Leading innovation with 100% renewable energy by 2020.

2.0 Project Background

2.1 Project Description

The site is identified as Block 45 Section 3 Hume and is located at the southwestern corner of Sheppard Street and Lanyon Drive (Figure 1) and Figure 2 regional map.

Block 45 Section 3 Hume is zoned NUZ1 Broadacre and is subject to the Main Avenues and Approach Routes overlay in the ACT Territory Plan.

The proposed development and use of the site, as described below, are permissible uses in this zone under the Zone Development Table; Emergency Services Facility and Educational Establishment, as well as ancillary use, uses definitions in the Territory Plan.

Figure 1 Development site showing nearest ACT residence - Block 45 Section 3 Hume Source Six maps).

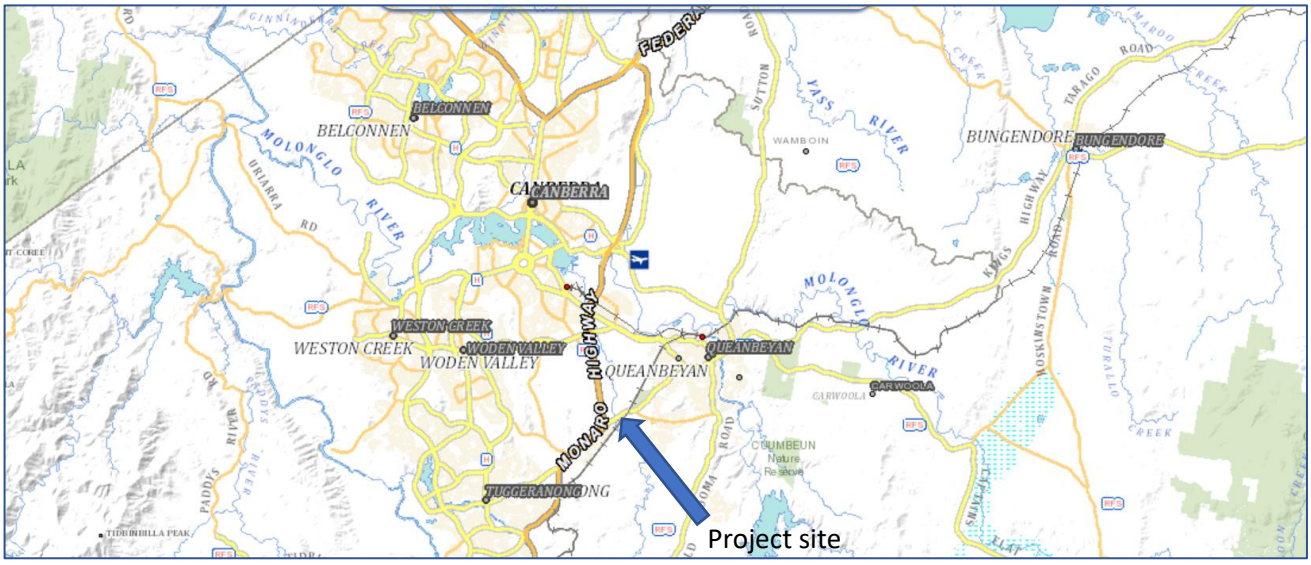


Figure 2 Project Site Regional Map (Source Six maps).

The greenfield site is characterised into two broad categories, being the cleared central parts of the site, and the outer eastern and northern portions of the site which retain a relatively intact native tree canopy as shown below, in Figure 3.

Figure 3 block 45 section 3 (Source Six maps).

Hume Section 3 Block 45 is located at the intersection of Lanyon Drive and Sheppard Street. Under the Territory Plan the block's Land Use Zone is NUZ1: BROADACRE with an overlay Zone: MAAR: Main Avenues and Approach Routes. The block is 3.5163 hectares in area. A Deposited Plan does not yet exist for the block.

The site is partially surrounded by industrial development to the east and south.

The process behind the selection of this site and its suitability for the intended purpose and uses involved finding a site with the following key characteristics:

- Land with the correct zoning and locality to support the operation.
- Direct road access with a strong preference to be located close to a main/arterial road to facilitate good access for support and ground operations.
- Areas to support operational and pilot training (open land capable to support helicopter flight training is paramount)
- Adequate land area, coordination and operations office, hanger space and storage for equipment and land-based assets/resources, landing facilities and the like,
- Central location in relation to the ACT geographically to permit low response time targets,

- Location away from sensitive (primarily residential) receivers to minimise impacts from flight operations (although this is considered a relatively low impact use),

Block 45 Section 3 Hume was found to meet all the above site requirements, being located close to Lanyon Drive and subsequently Monaro Highway, provides sufficient land area with manageable ecological constraints to achieve the site building construction and operational requirements. The site is also considered ideal in that it is located within the outer margins of the Hume Industrial Precinct, with (main) roads on all but one boundary, and therefore the operations are considered unlikely to affect any sensitive nearby users and provide approach-routes that can generally steer clear from build-up sites.

Its central location will also see an opportunity to have a response time of generally less than 10 minutes to the entire urban area of Canberra which is vital for the emergency service roles that are proposed to be operated from the site.

Block 45 Section 3 Hume, subject to the application for a direct sale, is unleased land. It is identified in ACT mapi as being under the custodianship of TCCS for the purpose of City Presentation.

Intended use for Block 45 involves an application to purchase and development land for the purposes of developing infrastructure (Figure 4) to support emergency services for bush fire response activities, training, forestry and related services, including a helicopter landing site and with ancillary uses supporting these functions (equipment maintenance, administration and an aircraft hangar).

Based on a preliminary concept plan for the site (Figure 4), the proposed development would involve the following features (including preliminary estimates of the development footprint for each element): - approx. footprint of 3030 m^2 of buildings for offices, training and associated uses, - approx. 3600m^2 hardstand, for vehicle parking and manoeuvring, - 3,000m^2 storage yard for Forestrack, - 2,000m^2 (or thereabouts) Emergency Services Training Area, - approx. 7,600m^2 identified for future possible development (longer term planning to ensure site remains viable in a changing city, regional and global context).

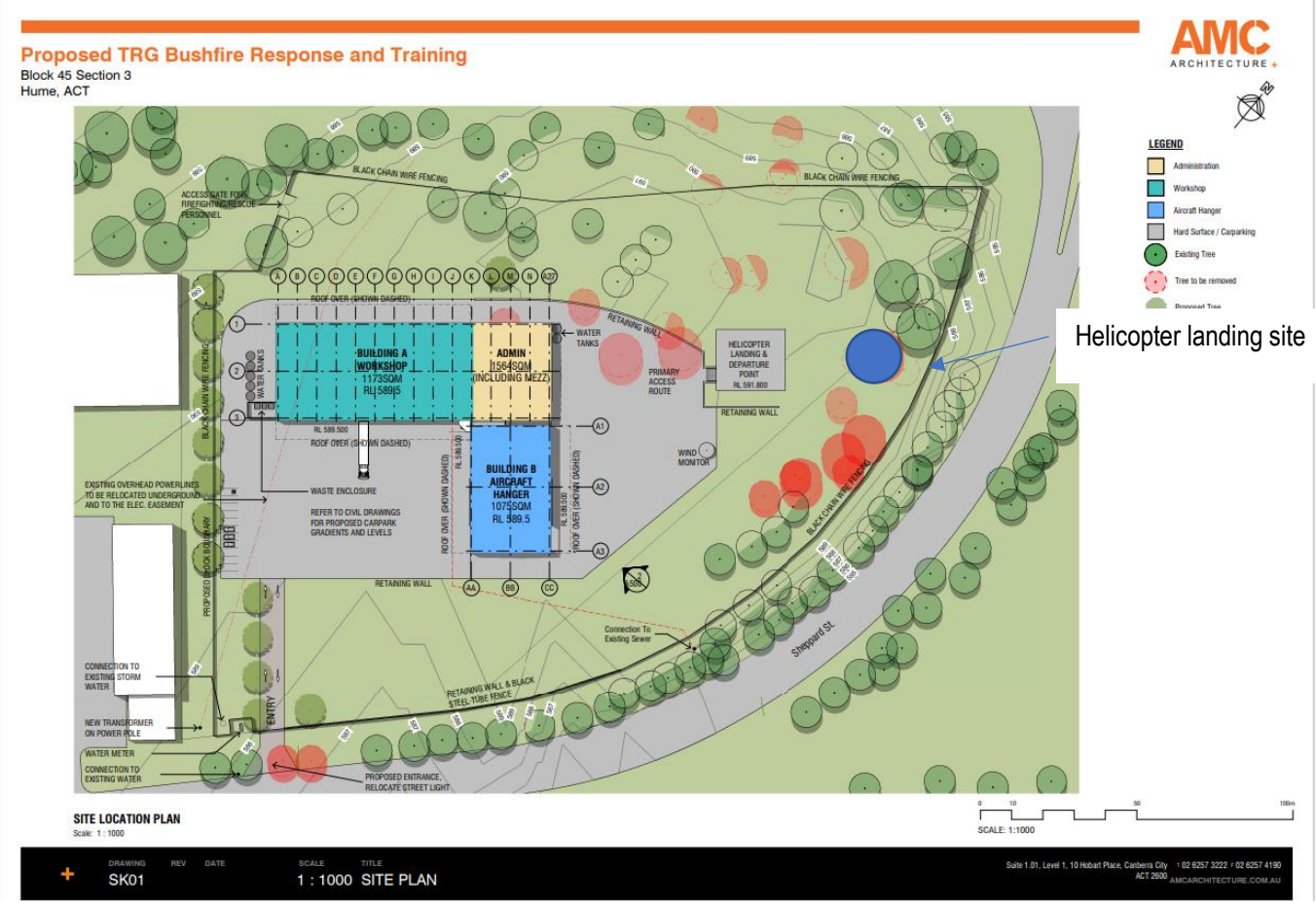
Some of the trees located in the north-eastern portion of the site will likely require removal (figure 5b) to facilitate safe take-off and landing of aircraft, however it is expected that many of the existing trees could be retained.

The proposed HLS shown in figure 4 is located approx. 30m from the site boundary allowing for a managed safety zone in accordance with CASA guidelines. The HLS would have line marking painted on its surface, in the form of broken white lines along the outer edges. The touchdown and lift- off area (TLOF) would be marked by a yellow painted circle. Yellow double headed arrows (approach/departure markings) would be painted onto the HLS surface.

The flying of helicopters in an out of the site for the foreseeable future will primarily be to fly machines in and out for maintenance, refurbishment and deploy personnel / assets. This is expected to be at a maximum of 30-35 flights per month or an average 2 in-and-out flights per day on average.

Normal operating hours would be 7am – 5.30 pm Mon – Friday.

Figure 4 Proposed site plan



The proposed helicopter landing site is not visually distinctive or unique, as it is located in the northeast section of the block and is hidden from view from Lanyon Drive and Shepard Street due to its elevation and surrounding trees/vegetation.

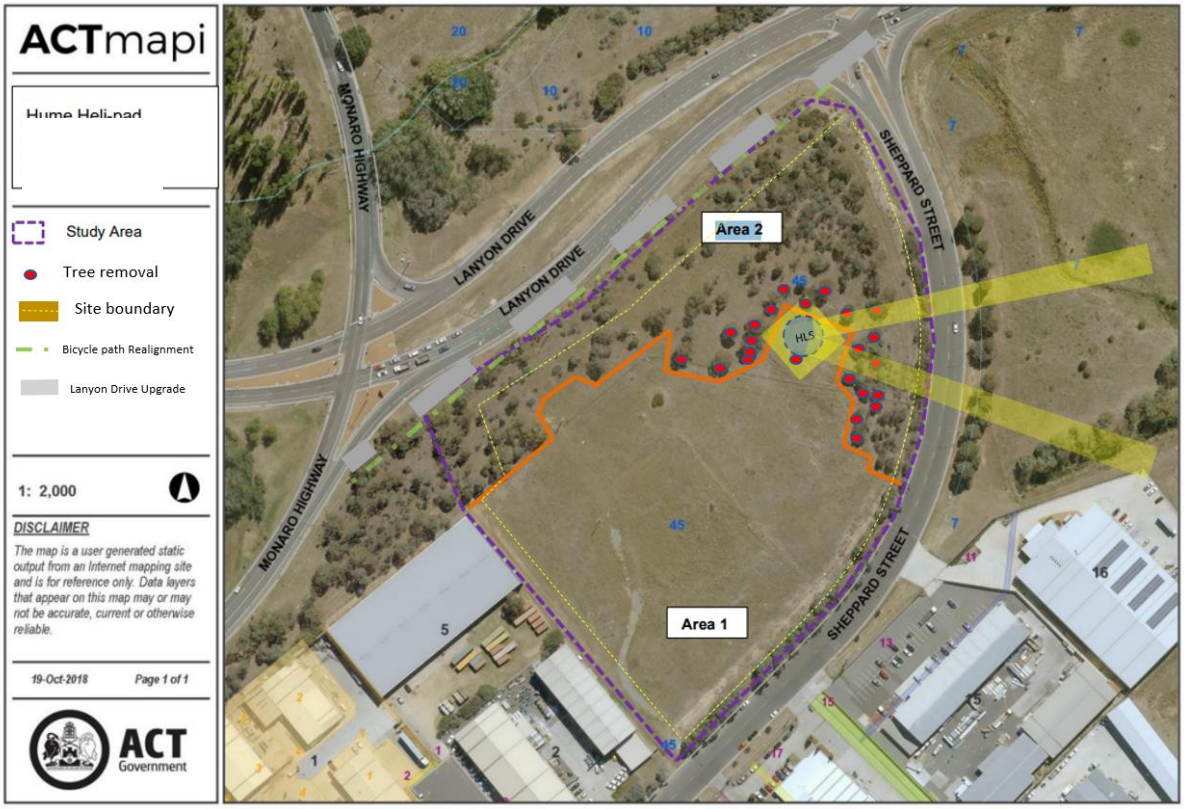


Figure 5 illustrating preferred helicopter flight paths / proposed tree removal

3.0 Legislation, Policy and Planning Context

3.1 Legislation

3.1.1 ENVIRONMENTAL PROTECTION ACT 1997

The (ACT) *Environmental Protection Act 1997* provides the general environmental consideration to be addressed in the proposal for any development or activity. Part 3B and 3C of the Act provide the general objectives and principles which are consistent with the ecologically sustainable development requirement. Specifically, a key objective relevant to the overall scope of this EIS, is to achieve effective integration of environmental, economic, and social considerations in decision-making processes at both a national and ACT environment scale. The inter-generational equity principle (Part 3D of the Act), relative to this EIS, provides that such considerations be made such that the present generation ensures the health, diversity and productivity of the environment be maintained or enhanced for the benefit of future generations. The climate change and greenhouse gas assessments within this assessment have taken these Act requirements into consideration with proposed adaptation methods.

3.1.2 PLANNING AND DEVELOPMENT ACT 2007

The *Planning and Development Act 2007* requires broadly that any development proposal be in line with the current 'Territory Plan' (created under the National Capital Plan), and further that the necessary matters to be addressed within the EIS relevant to the proposal be set out in the EIS Scoping Document. This is enforced and more aspects specifically defined by the Planning and Development Regulation 2008. Summarising the climate change aspects of the Project, the following is to be addressed: 1 How the project would reduce the risks from climate change impacts, including adaptation measures to increase the resilience of the community and territory 2 How the project would avoid contribution to urban heat and contribute to urban cooling measures 3 How the project would contribute to reducing greenhouse gas emissions in working towards the legislated target for a net zero emissions Territory.

3.1.3 CLIMATE CHANGE AND GREENHOUSE GAS REDUCTION ACT 2010

The *Climate Change and Greenhouse Gas Reduction Act 2010*, responsible for legislating the net zero Territory requirements by 2045, is also therefore applicable for the project. Part 2 of this Act provides the target that 'any emissions of greenhouse gas in the ACT are balanced by (a) avoidance and mitigation activities; and (b) emissions offsets outside the ACT.

Greenhouse gas emissions from the project construction phase and on-going operation are to be considered, as well as the risks climate change poses for its operation.

3.2 Policy and Planning

The following documents have been identified as key in considering the alignment of the Project with current government policy and planning. The relevant aspects for each have been summarised with their relevance to climate change and greenhouse gas emissions appropriate to this type of infrastructure project.

3.2.1 ACT CLIMATE CHANGE ADAPTATION STRATEGY

The *ACT Climate Change Adaptation Strategy (ACT Government, 2016*) identifies the key adaptation policy challenges for the ACT and aims to help the community, city and natural environment adapt to climate change and become more resilient to projected impacts. The Adaptation Strategy adopts a sectoral assessment approach to identify climate change risks and consider adaptation actions, with actions developed for many sectors, including natural resources and infrastructure which are relevant for the Project.

3.2.2 ACTION PLAN 2 (AP2)

Action Plan 2 (AP2) was released in October 2012 to provide a pathway for the ACT to achieve the Territory's legislated 2020 greenhouse gas reduction targets and envisaged a carbon neutral city by 2060. More recently, the ACT Government moved to amend this goal by bringing forward the date for carbon neutrality to 2050 (ACT Government, 2016). AP2 contains 18 actions that contribute towards the overarching target of net zero Territory by 2050. Actions that the project will be accountable to contribute towards include: — Energy Efficiency Improvement Scheme — Low Emission Vehicle Strategy — ACT Waste Management Strategy — Renewable Energy Target.

3.2.3 NATIONAL CAPITAL PLAN

The principles outlined in the *National Capital Plan* (National Capital Authority, 2016), as required by the ACT Planning and Land Management Act 1988, provide direction for sustainability issues to be addressed in the ACT. The sustainability principles, relevant to this Project and Technical Paper include: — protecting the natural environment — ensuring development respects environmental values including with resilience to impacts of climate change. The purpose of the Project implementation is to directly address these issues for the short and long ter. This assessment provides preliminary recommendations for ways in which the Project can minimise future risk by assessing predicted climate changed conditions, impacts the Project could potentially have on the local microclimate and heat island effect, as well as the likely greenhouse gas emission sources from both the construction and operation stages of the Project's life.

4.0 CLIMATE CHANGE RISK ASSESSMENT

Climate Change Context Setting:

The assessment of risks and possible adaption plans are qualitative, not quantitative.

The climate change variables for the project are considered to be temperature, rainfall, hail, bushfire, flooding and high wind speed.

The projected climate change variables are summarised below:

Temperature

Based on long-term observations, temperatures in the ACT have been increasing since the 1950s. The ACT is projected to continue to warm into the near future compared to recent years.

Extreme heat has potential for: fatalities; impact on health, significant impact on vulnerable communities; impact on energy consumption and resulting disruption in supply; impact on the provision of essential services and infrastructure; increased risk to the environment, animals; and increased risk of bushfire.

CC Variable	Present Climate	2030		2070		Source
	Av max	L	H	L	H	
Temp change (°C)	Jan - 29°C July - 12°C	+o.4°C	1.6°C	+1.0°C	+4.8°C	Bates, B. *Climate change projections and effects on water yield and water demand for the Australian Capital Territory, CSIRO 2003.*
Extreme heat projected number of days above 35°C	5.4	6	12	8	35	

Rainfall

Canberra's rainfall averages 52.4 mm per month and 629 mm annually. The average is 108 rain days per year, however local variability can mean no rain in some months and the whole season's rain in just a few days.

Climate projections for the water cycle indicate even more reduced reliability of evenly spread rain throughout the year. In the mid to longer term, winter and early spring rain will decrease, but there will be more intense rain events in the warmer months of spring and summer.

CC Variable	Present Climate	2030		2070		Source
		L	H	L	H	
Rainfall change Annual (%)	633mm/yr	-9%	+2%	-29%	+7%	Bates, B. *Climate change projections and effects on water yield and water demand for the Australian Capital Territory, CSIRO 2003.*

Extreme Rainfall

The variables shown in the table below are for a 1 in 40 1 – day rainfall event and the average number of days per year ≥ 50 mm rainfall.

CC Variable	Present Climate	2030		2070		Source
		L	H	L	H	
Extreme Rainfall (%)	4.4 days o.6 days	+7%		+5%		NSW Government *Climate Change in the Murrumbidgee Catchment*, CRIR0 2008

Hail

Longer term projections for water cycle changes include tropical cyclones reaching further south, thereby increasing the frequency of storms over a lengthened storm season and potentially increasing the likelihood of hail.

More frequent intense storms with hail and intense rain can impact on infrastructure.

CC Variable	Present Climate	2030	2070	Source
Hail risk[1]	Av max	L H	L H	Climate Change in Australia – Technical Report 2007, CSIRO 2007.
Hail risk	na	+ 0 days	2days	

Bush fire

The current ACT average severe fire days of 1.1 is expected to increase to 7 days per year by 2030 and 19 days per year by 2070.

Bushfires have potential for: loss of Life, property damage, loss of infrastructure and utilities and supply; environmental, cultural, business, and economic impact; disruption to transport by evacuation etc.

CC Variable	Present Climate	2030		2070		Source
		L	H	L	H	NSW Government *Climate Change in the Murrumbidgee Catchment*, CRIR0 2008
Fire risk (no of fire days per year)	23 fire days	26 fire days	29 fire days	28 fire days	38 fire days	

Flooding

Severe storms with flooding have potential for: loss of life, injuries, property damage, loss of infrastructure and utilities, impacts on vulnerable communities, local community, local businesses, and local economy; disruption to transport and closure of roads; impact on the environment; and impacts on domestic animals and livestock.

[1] A2 Emission Scenario

High Wind Speed

CC Variable	Present Climate	2030		2070		Source
Wind Speed (%)	40km/hr[2] 9.0 days[3] 1.5 day[4]	L	H	L	H	NSW Government *Climate Change in the Murrumbidgee Catchment*, CRIR0 2008
		-10%	+16%	-32%	+23%	

4.1 RISK ASSESSMENT AND POTENTIAL ADAPTATIONS

The climate change risk assessment for the Project is shown in the following tables. The assessment includes key identified risks, potential risk treatment (adaptations) to be considered within the design process and overall risk ratings for impacted project components. Many of the potential risk treatments are standard industry practices coring design, construction and operational aspects.

Table 2 - Site risk selection considerations - Constraints on land use planning because of physical climate change processes.

Risk Id	Risk	Commentary on possible impact	Likelihood	Consequences	Risk Rating	References
S1	Increase in surface water due to extreme rainfall.	No constraints – The zone/site is not within a flood prone area.	Remote	Moderate	Very low	ACT mapi flood prone areas of the ACT.
S1	Groundwater/hydrology Water table recharge following increase in rainfall over prolonged period.	Site is elevated well above the water table under adjacent land	Remote	Moderate	Very low	ACT mapi
S1	Bush fire prone area	The grazing land adjacent presents a threat to proposed assets in the event of a bushfire. Damage from bushfire to	Possible	Moderate	Low	Bush fire prone area – no BAL.

[2] Annual Average Maximum Daily Wind Speed
[3] Average Number of Days Maximum Wind Speed ≥75km/hr
[4] Average Number of Days Maximum Wind Speed ≥100km/hr

		assets could come from three sources, Direct fire crossover, Radiant Heat, and Flying Embers.				

Table 3 - Design risk considerations which need to provide resilience of the infrastructure in the face of new climate change conditions for the variables posed.

Risk Id	Risk	Commentary on possible impact	Likelihood	Consequences	Risk Rating
D1	Temperature rise	Increased frequency and intensity of bushfires.	Possible	Moderate	**Low**
D2	Extreme heat projected number of days above 35°C	Heat stroke for workers. Softening of road pavement. Increase in energy demand.	Possible	Moderate	**Medium**
D3	Rainfall decrease	Decrease in soil moisture. Decrease in available water.	Possible	Moderate	**Low**
D4	Rainfall increase	Flash flood. Site erosion.	Possible	Moderate	**Low**
D5	Extreme rainfall	Flash flood. Impact of flooding on intake infrastructure – sumps/pipes/well pumps/detention/retention structures etc. Site erosion.	Possible	Moderate	**Medium**
D6	Hail	Impact of flooding on intake infrastructure – sumps/pipes/well pumps/detention/retention structures etc. Impact on plant/infrastructure.	Possible	Moderate	**Medium**
D7	Bush Fire	Fire damage to buildings. Increased insurance costs.	Possible	Moderate	**Medium**

		Loss of telecommunication and power. Loss of firefighting water supply/inadequate pressure			
D8	High Wind	Impact on infrastructure. Surrounding environment. Impact on helicopter operation.	Possible	Moderate	**Medium**

Table 4 Construction Phase

Risk Id	Risk	Commentary	Likelihood	Consequences	Risk Rating
C1	Temperature rise	Increased frequency and intensity of bushfires	Possible	Low	Low
C2	Extreme heat projected number of days above 35°C	Heat stroke for workers Softening of road pavement. Increase in energy demand. Risk of fire from hot work.	Possible	Moderate	Medium
C3	Rainfall decrease	Decrease in soil moisture leading to soil instability. Decrease in available water.	Possible	Low	**Low**
C4	Rainfall increase	Flash flood. Site erosion/silt loss. Pollution of creek/water ways.	Possible	Low	**Low**
C5	Extreme rainfall	Flash flood. Site erosion/silt loss. Pollution of creek/water ways. Construction delay.	Possible	Moderate	**Medium**
C6	Hail	Impact on temporary erosion control structures reducing effectiveness to trap silt etc.	Possible	Low	**Low**
C7	Bush Fire	Impact/damage to erosion control structures, plant and machinery.	Possible	Moderate	**Low**

C8	High Wind	Dust generation, Impact on surrounding area.	Possible	Low	**High**
C9	Greenhouse Gas Emissions – project contribution to greenhouse gas emissions.	The construction and excavation works will contribute to greenhouse gas emissions.	Likely	Minimal	Low

Table 5 Operational Phase

Risk Id	Risk	Commentary on possible impact	Likelihood	Consequences	Risk Rating
O1	Temperature rise	Increased frequency and intensity of bushfires.	Possible	Moderate	**Medium**
O2	Extreme heat projected number of days above 35°C	Heat stroke for workers. Softening of road pavement. Increase in energy demand.	Possible	Moderate	**Medium**
O3	Rainfall decrease	Decrease in soil moisture impact on landscaping. Decrease in available water.	Possible	Moderate	**Low**
O4	Rainfall increase	Flash flood.	Possible	Moderate	**Medium**
O5	Extreme rainfall	Flash flood. Impact of flooding on intake infrastructure – sumps/pipes/well pumps/detention/retention structures etc. Site erosion.	Possible	Moderate	**Medium**
O6	Hail	Impact of flooding on intake infrastructure – sumps/pipes/well pumps/detention/retention	Possible	Moderate	**Medium**

		structures etc. Impact on plant/infrastructure.			
O7	Bush Fire	Fire damage to plant. Increased insurance costs. Loss of telecommunication and power. Polluted waterways. Loss of firefighting water supply/inadequate pressure. The impact of having insufficient water/adequate water pressure to fight a fire may cause the fire to spread to other properties in the area.	Possible	Moderate	**Medium**
O8	High Wind	Impact on infrastructure.	Possible	Moderate	**Low**

The risk tables following present the identified risks from the risks that have been assessed to have an unmitigated risk level of Medium or higher due to a climate change variable. For each risk a number of adaptation actions are proposed, resulting in a Mitigated or adaptation adopted revised risk level.

Table 6 Design climate change consideration/adaptation actions to reduce risk

Risk Id	Identified Risk	Unmitigated risk	Adaptation Action(s)	Likelihood	Consequences	Expected risk
D2	Heat stroke for workers. Softening of road pavement. Increase in energy demand.	Medium	Hard stand areas to be constructed of reinforced concrete. Ensure substation has adequate capacity to service proposed development stages now and in the future. Enclose workshop in a well-ventilated. Provide reverse air conditioning system to admin building.	Possible	Minor	Low
D5	Flash flood. Impact of	Medium	Design structures to revised Australian rainfall and	Possible	Minor	Low

	flooding on intake infrastructure – sumps/pipes/well pumps/detention /retention structures etc. Site erosion.		runoff specifications. Allow for overflow from stormwater sumps by grading pavement to secondary structures. Install landscape stabilised earth berm along the downslope site boundary to prevent the egress of stormwater from the site. Stormwater detention system in accordance with MUSIC model. Stormwater capture tank to harvest surface water for reuse.			
D6	Impact of hail blockage on intake infrastructure – sumps/pipes/well pumps/detention /retention structures etc. Impact on plant/infrastructure.	Medium	Allow for overflow from stormwater sumps by grading pavement to secondary structures. Install landscape stabilised earth berm along the downslope site boundary to prevent the egress of stormwater from the site. Ensure structures can support weight of hail – especially cantilever awnings.	Possible	Minor	Low
D8	Impact on infrastructure.	Medium	Ensure structures can withstand wind loading.	Possible	Minor	Low
D7	Bush Fire damage to buildings. Increased insurance costs. Loss of telecommunication and power. Polluted waterways. Loss of firefighting water	Low	Although low risk extra actions taken to reduce risk due to bush fire prone area Provided back up firefighting pumps connected to rook water tanks. Appropriate distances to neighbouring properties. Appropriate distances to			

	supply/inadequate pressure.		potential bushfire sources (asset protection zones). Fire Extinguishers to AS1940. Ensuring adequate water supplies are available for firefighting resources protecting personnel and equipment.			

Table 7 Construction climate change consideration/adaptation actions to reduce risk

Risk Id	Identified Risk	Unmitigated risk	Adaptation Action(s)	Likelihood	Consequences	Expected risk
C2	Heat stroke for workers Softening of road pavement. Increase in energy demand. Risk of fire from hot work.	Medium	Educate staff on the risk of heat stress and develop management plans. No hot work to take place on high-risk bush fire delayed days.	Possible	Minor	Low
C5	Flash flood. Site erosion/silt loss. Pollution of creek/water ways. Construction delay.	Medium	Sediment and erosion controls installed in accordance with Environment Protection Guidelines (ACT) as detailed in the CEMP. Undertaking environmental monitoring during the work including inspections of erosion and sediment control device in accordance with the CEMP, especially prior to, during and following event.	Possible	Minor	Medium[5]

[5] Reason for same rank is that sedimentation controls to be designed only in accordance with the "Blue Book" requirements which are industry best practice, complete capture is not envisaged.

C8	Dust generation, Impact on surrounding area workers health.	High	Take weather conditions into account when planning work by: • Avoiding work during high wind conditions. • Use of water truck to wet down and keep soil moist during excavation and handling. • Covering loads. Decontaminating vehicles and machinery leaving site.	Possible	Minor	Low

Table 8 Operational climate change consideration/adaptation actions to reduce risk

Risk Id	Identified Risk	Unmitigated risk	Adaptation Action(s)	Likelihood	Consequences	Expected risk
O1	Increased frequency and intensity of bushfires.	Medium	Waste to be fully contained in designated areas. Ensure that vegetation does not accumulate around infrastructure, right-of-way, and flammable materials and structures to reduce ignition potential. Ensuring adequate water supplies are available for firefighting resources protecting personnel and equipment. Monitoring the location and status of active fires that may impact operations and be aware of high bush fire danger events that may put operations and infrastructure at risk. Be informed and ready to act in consultation with the fire brigade if bush fires are burning near the facility.	Possible	Minor	Low

			Trafficked areas are to be kept clean. All on site equipment and vehicles will be properly maintained. Ensure adequate equipment and training of staff to fight fires. Maintain landscape areas in accordance with Landscape management plan.			
O2	Heat stroke for workers. Softening of road pavement. Increase in energy demand.	Medium	Educate staff on the risk of heat stress and develop management plans.	Possible	Minor	Low
O4	Flash flood.	Medium	Ensure stormwater structures are maintained. Inspection required prior to storm event to assess effectiveness of structures. – downpipes, storage tanks, sumps, pipelines, pumps, grit chambers etc.	Possible	Minor	Low
05	Extreme event. Flash flood. Impact of flooding on intake infrastructure – sumps/pipes/well pumps/detention/retention structures etc. Site erosion.	Medium	As above, but management plan to report on structure effectiveness during extreme event.	Possible	Minor	Low
O6	Impact of hail on intake infrastructure – sumps/pipes/well pumps/detention/retention structures etc. Impact on	Medium	As above, but management plan to report on structure effectiveness during extreme event. Hail clearance from structure may be necessary.	Possible	Minor	Low

	plant/infrastructure.					
O7	Bush Fire damage to plant. Loss of production. Increased insurance costs. Loss of telecommunication and power. Polluted waterways. Loss of firefighting water supply/inadequate pressure. The impact of having insufficient water/adequate water pressure to fight a fire may cause the fire to spread to other properties in the area.	Medium	Adequate training of staff. Ensure that vegetation does not accumulate around infrastructure, right-of-way, and flammable materials and structures to reduce ignition potential. Ensuring adequate water supplies are available for firefighting resources protecting personnel and equipment. Monitoring the location and status of active fires that may impact operations and be aware of high bush fire danger events that may put operations and infrastructure at risk. Be informed and ready to act in co consultation with the fire brigade if bush fires are burning near the facility.	Possible	Minor	Low
O8	Impact on infrastructure.	Medium	No waste material outside of the designated contained area.	Possible	Minor	Low

The actions outlined in the climate change adaptation tables and recommendations relating to design, construction and operation of the proposed emergency facility to mitigate the impacts of climate change variables will be transferred to the respective management plans for implementation. Given that the recommended actions are based on a qualitative assessment, it is recommended to set in place a monitoring program to assess progress on the risks posed. This will serve as a continuous improvement process, in keeping with the companies' quality environmental manage system, to manage Climate Change risks into the future.

- *How the project would avoid contribution to urban heat and contribute to urban cooling measures.*

Typical microclimate conditions that can be impacted by the built environment and structures include structures isolated/surrounding wind speeds, reflective solar radiation increasing surrounding temperature (known as the heat island effect) and local shading.

A CSIRO report commissioned by the ACT Government identifies Canberra neighbourhoods that are hotter due to the 'urban heat island effect'.

The report finds that:

Canberra's summer land surface temperatures can be up to 10 °C hotter by mid-morning in parts of the city, and up to 8 °C hotter than surrounding rural areas at night.

Areas that typically experience above-average temperatures on summer mornings include areas with large surfaces such as rooftops, carparks and paving, commonly found in commercial and industrial areas, major roads and intersections, and new housing developments; areas with low, sparse, dry vegetation; areas with few trees and little irrigation, and some artificial playing surfaces.

Areas that typically experience below-average temperatures on summer mornings include Irrigated areas, water features and lakesides, areas with green vegetation, trees, and forest cover, as well as shady areas. Neighbourhoods with tree canopy shade of 30% or more can be up to 130 C cooler on a hot summer day.

Vulnerable groups, including low-income households and the elderly, are more at risk in extreme heat conditions.

Although the proposed development poses an increase in urban heat due to the creation of hard stand surfaces, this is considered minimal risk due to the surrounding land use. To mitigate this risk the design of the emergency facility plant building aims to minimise radiation reflectivity by extended counter leaver awnings from the building providing shading and effective roof sheeting, cladding and concrete walls. Further opportunity to reduce heat island contributions are found in the landscape design. Moreover, as shown in figure 5b it is proposed to retain existing vegetation in the northern section of the site/northern boundary and in verges surrounding the site as shown in the following site plan.

Figure 5 Site plan illustrating retained canopy/vegetation areas within the site – approx. 22% of block area (source: Six Maps).

Hume Section 3 Block 45 is located at the intersection of Lanyon Drive and Sheppard Street. Under the Territory Plan the block's Land Use Zone is NUZ1: BROADACRE with an overlay Zone: MAAR: Main Avenues and Approach Routes. The block is 3.5163 hectares in area. A Deposited Plan does not yet exist for the block.

The potential contribution of the Development to urban heat island effect is negligible due to the scope and design of the Development which is located within an industrial estate.

- *How the project would contribute to reducing greenhouse gas emissions in working towards the legislated target for a net zero emissions Territory*.

Greenhouse Gas Reduction:

Australia is currently contributing around 1.3 per cent of global GHG emissions. Australia's emissions for the year to March 2019 were approximately 540 million tonnes carbon dioxide equivalent (CO2-e), up 0.6 per cent on the previous year, primarily due to increased liquefied natural gas (LNG) exports. This is only 11.7 per cent below emissions in 2005, and the National Inventory Reports 2014 to 2017 indicate that Australia's GHG emissions have risen each year since 2014.

The UNFCCC provides the framework for international cooperation to reduce global GHG emissions and limit temperature increases. The UNFCCC Paris Agreement entered into force on 4 November 2016 and Australia is currently committed to reducing GHG emissions by 26 to 28 per cent below 2005 levels by 2030. The Paris Agreement states that net zero emissions will be required in the second half of the century to achieve its goals of limiting warming to well below two degrees Celsius above pre-industrial levels. More recently, the Intergovernmental Panel on Climate Change's (IPCC's) report indicated that global emissions need to fall by about 45 per cent from 2010 levels by 2030, reaching 'net zero' around 2050, to limit global warming to 1.5 degrees Celsius.

The ACT is committed to setting ambitious greenhouse gas emission reduction targets to achieve its goal of zero emissions by 2045

The proposed Facility will provide emergency response services to fight bushfires which have a number of adverse primary and secondary impacts on human health and the environment.

National and international greenhouse gas reporting standards define a set of distinct classes (scopes) of GHG emissions that delineate sources and associated responsibilities.

Scope 1 GHG emissions are the emissions released to the atmosphere as a direct result of an activity, or a series of activities at a facility level.

Scope 2 GHG emissions are the emissions from the consumption of an energy product.

Scope 3 emissions are indirect GHG emissions other than scope 2 emissions that are generated in the wider community. Scope 3 emissions occur because of the activities of a facility, but from sources not owned or controlled by that facility's business[6].

Generally, GHG emissions from a proposal will be assessed where they exceed 100,000 tonnes of scope 1 emissions each year measured in CO2-e. This is currently the same as the threshold criteria for designation of a large facility under the Australian Government's Safeguard Mechanism.

The proposed project will generate will below 100,000 tonnes across the following sectors.

Scope 1 emissions

- stationery combustion

fuels in stat equipment – pumps /boilers

mobile – trucks

[6] Clean Energy Regulator (20 July 2018). Greenhouse gases and energy. Retrieved from http://www.cleanenergyregulator.gov.au

Scope 2 emissions

Purchased electricity.

Scope 3

Emissions process emissions / fuel production.

Mobile comb / transportation fuel / employee.

Fugitive /waste disposal - landfill gas.

Sewage disposal.

Given the construction phase of the Project, is only short and for a limited period it is unlikely to materially or directly be measured towards the 2045 target. However, continually taking initiatives towards improving the materials used, procurement requirements, design considerations, construction plant, equipment and methodologies, all greatly contribute towards the overall growth of sustainable infrastructure development.

Mitigation Opportunities

Scope 1

Combustions of fuels in plant and equipment during construction

Consider energy and fuel-efficient construction plant and equipment for use during construction phase. — Consider use of biofuels in plant and equipment (e.g., biodiesel, ethanol, or blends such as E10 and B880) to reduce greenhouse gas emissions from plant and equipment, where feasible.

Combustions of fuels in plant and equipment during operation

Consider use of energy and fuel-efficient permanent plant. — Consider use of energy and fuel-efficient plant and vehicles required during operations.

Scope 2

Use of grid electricity during construction

Consider energy efficient plant and equipment for use during construction phase. — Consider the use of grid-sourced renewable energy supply for construction and/or on-site renewable energy generation (i.e., solar panels on construction compounds).

Operational electricity consumption for the facility

Consider efficient fans and motors for the facility. — Consider use of renewable energy to supply a proportion of the electricity demand for the operation of the Project.

Scope 3

Transport of construction materials, equipment and fuels to site

Source construction materials from close proximity to Project site. — Consider or require consideration of (if works subcontracted) energy and fuel-efficient plant and equipment for required maintenance procedures.

Embodied emissions from construction materials (e.g., concrete and steel in pipeline)

Consider sourcing construction materials with lower embodied emissions (where a suitable substitute is available for construction materials with high embodied emissions). This includes lowcarbon concrete, recycled metals and recycled construction aggregate. It is important that the life-cycle embodied emissions of these materials also consider transportation.

Transport and disposal of construction waste

Maximise reuse of soil and excavated material onsite — Maximise opportunities for recycling of construction waste.

Transport of workers to site during both construction and operation

Develop Green Travel Plans for construction and maintenance staff (i.e., with inclusion of items such as vehicle sharing).

5.0 Conclusion

The proposed Facility will provide emergency response services to fight bushfires which have a number of adverse primary and secondary impacts on human health and the environment. Against this laudable quest, this assessment has identified a number of climate change implications which should be taken into account in the design, construction and operation of the proposed development.

It is recommended that the actions outlined in this assessment and recommendations relating to design, construction, and operation of the proposed emergency facility to mitigate the impacts of climate change / greenhouse gas variables be transferred to the respective management plans for implementation.

Tree canopy and permeability is an indicator of improved Urban Heat Island Effect conditions. Retainment of existing trees will provide shade to approx. 22% of the site. This is in keeping with the Living Infrastructure Report recommendations that promotes maximising tree canopy and permeability. Furthermore, verge areas surrounding the site are heavily vegetated and will largely be retained, exempt in the area of the proposed driveway entrance to the site.

The implementation of initiatives proposed in this assessment towards improving materials used, procurement requirements, design considerations, construction plant, equipment, and methodologies, all greatly contribute towards the overall growth of sustainable infrastructure development in an age of climate change variability.