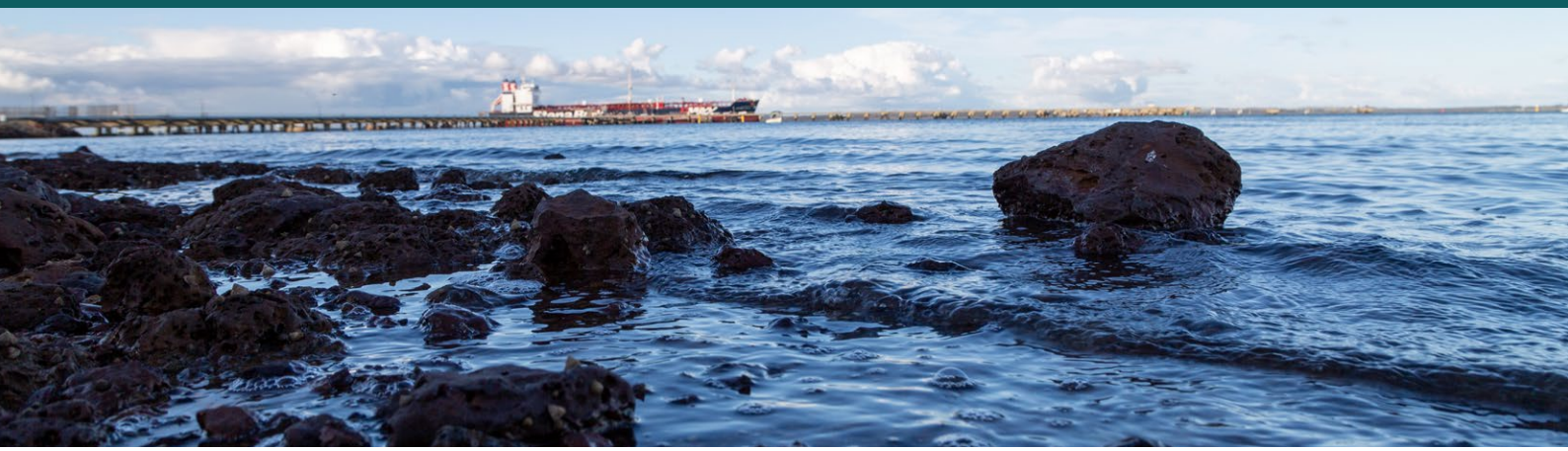
Chapter 23
Climate change risk



This chapter discusses the potential climate change risks to the Gas Import Jetty and Pipeline Project (the Project). This chapter is based on the climate change risk assessment presented in EES Attachment IV: *Climate change risk report*.

23.1 Overview

Victoria's *Climate Change Act 2017* recognises that '*Victoria is particularly vulnerable to the adverse effects of climate change*' (Preamble) and that it must '*build the resilience of the state's infrastructure, built environment and communities through effective adaptation and disaster preparedness action*'.

Climate change puts infrastructure at increased risk of degradation, failure and increased maintenance or replacement costs. The long lifespan of infrastructure assets makes it important to assess climate change risks and integrate adaptation strategies early in the design or development process so that risks can be 'designed out' if identified early, or relevant adaptation measures can be developed and embedded in a project or program as appropriate.

This chapter provides an overview of the potential climate change risks to the Project and identifies existing controls or mitigation measures which would be implemented as a matter of course for a project of this nature.

23.2 EES evaluation objective

EES scoping requirements for the Project were issued by the Victorian Minister for Planning in February 2019. These set out the specific matters to be investigated and documented in the EES in accordance with the *Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978*.

This climate change risk assessment does not correspond directly with a specific draft evaluation objective. However, Victoria's *Climate Change Act 2017* outlines a set of policy objectives to embed climate change in government decision-making and to '*build the resilience of the State's infrastructure, built environment, and communities through effective adaptation and disaster preparedness action*'. It compels decision-makers to have regard to climate change, including potential biophysical impacts, in decisions made or actions taken that are authorised by the provision of the following Victorian Acts relevant to this EES:

- *Catchment and Land Protection Act 1994*
- *Marine and Coastal Act 2018*
- *Environment Protection Act 1970*
- *Flora and Fauna Guarantee Act 1988*
- *Water Act 1989*.

Additionally, the *Coastal Management Act 1995* requires the Victorian Coastal Strategy 2014 (the Strategy) to provide for the long-term planning of the Victorian coast. The coastal strategy provides guidance for agencies and statutory decision-making along the coast and in marine and estuarine environments. Climate change is one of five key issues the coastal strategy identifies to be considered as part of coastal planning. The strategy requires planning for sea level rise of not less than 0.8 metres by 2100 and not less than 0.2 metres by 2040 for urban infill areas (Victorian Coastal Council, 2014).

The Victorian Government is due to release its Marine and Coastal Policy in 2020 to provide further policy direction about planning for sea level rise.

23.3 Methodology

A climate change risk assessment was undertaken in line with AS 5334-2013 *Climate change adaptation for settlements and infrastructure – A risk-based approach*. The risk assessment focuses on the potential physical risks that may impact the Project as a result of climate change (Standards Australia, 2013).

The climate change risk assessment involved the following key tasks:

- Identification of historical climate data and climate change projections of the Project Area.
    - Historical climate data for the Project Area was obtained from the Viewbank Bureau of Meteorology weather station (station number 86068). Data from the Viewbank weather station provides the most consistent data set with a single point for all climate variables. While there are other stations closer to the Project Area, these do not have a complete data set for all variables. Given Viewbank's inland location it does not have the direct marine influence that closer weather stations may have. Regardless, the variability in historic climate data between these weather stations would likely be negligible in the context of climate change given the proximity of these stations to each other and because they are all within the same natural resource management region.
- Analysis of climate projections sourced from:
    - *Climate Change in Australia Technical Report* (CSIRO & BoM, 2015)
    - *Climate Change in Australia Southern Slopes Cluster Report* (Grose et al., 2015)
    - *Victorian Climate Projections 2019 – VCP19 and related datasets* (CSIRO, 2019a)
    - *Victorian Climate Projections 2019 – Technical report* (CSIRO, 2019b)
    - *Victorian Climate Projections 2019 – Greater Melbourne Climate Projections 2019* (CSIRO, 2019c).
- Agreement on a suitable risk assessment method for the assessment:
    - The method used in this climate change risk assessment is distinct from the approach used for the broader EES. This is because the climate change risk assessment seeks to identify the potential impacts of a changing climate on the Project, while the broader EES assess the risks the Project poses to the environment and to the achievement of the EES objectives.
    - AS 5534-2013 notes that climate change risks and treatments should be considered under the same framework as used for other operational or organisational risks and treatments. Therefore, risks to the Project associated with the climate variables were assessed using a single framework that was agreed on by AGL and APA.
- A climate risk workshop was held comprising representatives of the EES team, relevant technical specialists and AGL and APA, with a range of responsibilities including project management, risk management, approvals, design, environment, health and safety and sustainability. The objective of the workshop was to:
    - engage the Project team and relevant stakeholders early on climate risk across a range of disciplines and responsibilities
    - discuss how these impacts should be considered, when and by whom
    - enable climate risks to be managed by considering relevant and feasible adaptation measures.

23.4 Study area

This climate change risk assessment considered impacts to both sets of works: the Gas Import Jetty Works and the Pipeline Works. It included high-level consideration of potential impacts to the following Project components:

- the Crib Point Jetty and land immediately adjacent, including impacts to ancillary topside Jetty Infrastructure such as marine loading arms (MLAs), gas piping mounted to the jetty, electrical and instrumentation systems and the firefighting system
- the FSRU moored at Berth 2 of the Crib Point Jetty
- the approximately 57-kilometre long pipeline
- the Crib Point Receiving Facility and Pakenham Delivery Facility.

Most of the climate change risks identified and assessed relate to the operation and maintenance of the gas import jetty (including the FSRU), the pipeline and the receiving and delivery facilities.

23.5 Climate projections

Climate change is defined as a shift in the average climate conditions and the frequency and severity of extreme weather events, experienced over longer time scales than standard weather patterns.

To develop projections of future climate, a number of models are used. These models are run under a range of different scenarios that represent possible future emissions and greenhouse gas concentrations to the year 2100. The scenarios take into consideration things such as land use and technological changes and shifts in demographics and government policy that may influence emissions.

There are four scenarios, called Representative Concentration Pathways (RCPs): RCP8.5; RCP6.0; RCP4.5; and RCP2.6 as shown in **Figure 23-1** further below.

In 2015, the CSIRO and Bureau of Meteorology (BoM) released a suite of climate change projections, based on the IPCC RCPs and downscaled to provide higher resolution data for Australia's natural resource management regions.

In 2019, the Victorian Government partnered with the CSIRO to develop local-scale climate projections data for Victoria at a five-by-five-kilometre scale. The new data from the Victorian Climate Projections 2019 complement rather than replace or supersede existing projections, as they all represent plausible futures.

The climate projections used in this assessment are sourced from the CSIRO and BoM documents *Climate Change in Australia Technical Report* (CSIRO & BoM, 2015); *Climate Change in Australia Southern Slopes Cluster Report* (Grose et al., 2015) and *Victorian Climate Projects 2019* (CSIRO, 2019).

Recent data indicates that global greenhouse emissions are tracking in accordance with the highest emissions scenario, RCP8.5 (DELWP, 2015). For the Project, RCP8.5 projections have been applied for assessment of risks relevant to the near-term (2030) as a worst-case scenario assessment. For far-term assessments (2090), projections for RCP4.5 as well as RCP8.5 have been considered to reflect potential emission reductions.

Climate projection data, including the range of change and the confidence in projections is provided in Appendix A of EES Attachment IV: *Climate change risk report*. A summary of climate hazards with potential to impact the Project is outlined in **Table 23-1**.

Figure 23-1:
Emissions of carbon dioxide (CO2) across the RCPs (left), and trends in concentrations of CO2 (right)

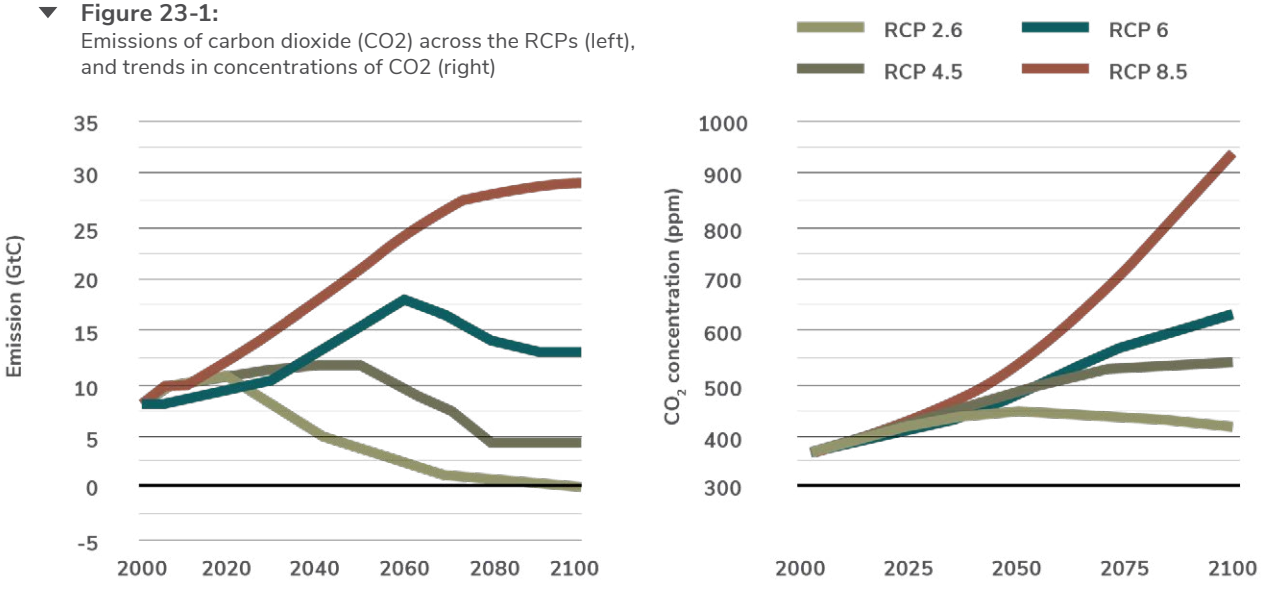


Table 23-1: Summary of climate hazards

Hazard	Description
Extreme heat	• Temperatures in Victoria over the last two decades have increased steadily and climate projections indicate there will be an increase in average temperatures and extreme temperatures. • Extreme heat includes days where the maximum temperature exceeds 35°C and heatwaves, a period of three or more days of unusually high maximum and minimum temperatures. On average there are currently 14.2 days a year above 35°C, per records from the Viewbank weather station (station number 86068). This is projected to increase to an average of 24 days in 2090 under RCP8.5.
Extreme rainfall	• Recent climate data and future projections show longer periods with little rainfall and conversely more intense rainfall events. As temperatures increase the water cycle intensifies with more evaporation which is what results in more intense rainfall events. • Increased extreme rainfall intensity will likely increase the extent and depth of flooding across the Project Area.
Sea level rise/coastal flooding and erosion	• Oceans have warmed considerably over the past century resulting in thermal expansion and melting of ice caps causing rising sea levels. • Under RCP8.5, sea levels are projected to rise by 0.61 to 1.10 metres by 2090 (IPCC, 2019b). • Projection ranges of sea level rise are considered likely (at least 66% probability) and could be subject to further rise if a collapse in the marine based sectors of the Antarctic ice sheet were initiated. Limitations in the understanding of Antarctic ice sheets create uncertainty in sea level projections, though it is estimated that ice sheet loss could increase sea level rise projections later in the century. • Sea level rise has the potential to inundate land adjacent to the coast. Projected sea level rise combined with increased storm events producing greater wave run up can result in areas typically immune from coastal flooding impacts being affected. • Key impacts of sea level rise include associated erosion and exacerbated storm surge and storm tides. Crib Point has been identified as an area of risk from coastal erosion in the Western Port Coastal Villages and Surrounding Settlements Strategy. Storm surge, elevated sea levels resulting from atmospheric wind and low pressure, and storm tide, sea levels resulting from the combination of storm surge and astronomical tides may also impact the area. Modelling for storm tide and storm surge is complex. No modelling for storm tide and storm surge has been undertaken as part of this EES climate change risk assessment.
Change in groundwater levels	• Groundwater levels can be influenced by the action of ocean tides and increase of sea level. • More severe storm surges and rising sea levels will have direct impacts on groundwater, including increasing its elevation and saltwater intrusion.
Saltwater intrusion	• Groundwater quality can be influenced by saltwater intrusion from ocean tides.
Bushfire	• Climate change is likely to result in more intense and frequent bushfire weather in the future. Historically, the Project Area had an average of 2.7 severe fire danger days per year. This is projected to double by 2090. • Parts of the Project Area are situated in a Bushfire Management Overlay.
Extreme wind / storms	• High winds can cause disruption and damage to infrastructure. • More regular and severe storm events are projected to occur in the region surrounding the Project Area as an impact of climate change.

23.6 Risk assessment

The climate change risk workshop and subsequent follow-up review identified and assessed 11 risks.

Of these risks, none were rated as high or above, taking into consideration relevant controls or mitigation measures to be implemented for the Project. Four risks were rated as moderate. These risks were primarily associated with impacts from saltwater intrusion, change in groundwater levels, extreme rainfall and sea level rise. The remaining seven risks were rated low when taking into consideration the relevant controls.

A register of identified and rated risks is summarised in **Table 23-2**. The table groups risks by rating. Low risks are further grouped by hazard. The risk rating in **Table 23-2** takes into account existing controls and mitigation measures.

Table 23-2: Summary of climate risks to the Project

ID*	Works area	Risk description	Hazard	Existing controls	Risk rating
1	Gas Import Jetty Works and Pipeline Works	Saltwater intrusion causes corrosion to assets, resulting in increased operational and maintenance costs.	Saltwater intrusion	• Cathodic protection on pipeline. • If needed, intelligent pig can be deployed to inspect the wall thickness and defects.	Moderate
2	Gas Import Jetty Works and Pipeline Works	Changes in groundwater levels causes corrosion and/or structural damage to assets, resulting in operational disruption and increased operational and maintenance costs.	Change in groundwater levels	• Design to standards for piling works in coastal environments	Moderate
3	Gas Import Jetty Works and Pipeline Works	High rainfall causes flooding, resulting in operational disruption, environmental impacts and/or increased operational costs.	Extreme rainfall	• Stormwater diversion for assets. • Risk reviews incorporated into operating systems and Emergency Management Plans, Emergency Response Procedures.	Moderate
4	Gas Import Jetty Works	Sea level rise causes inundation of the Project assets over time, resulting in damage and/or inoperability of equipment (e.g. over extension of MLA).	Sea level rise	• Onshore assets are designed for coastal environments and allows for storm surge, high tides and sea level rise through the incorporation of a 0.8 metres freeboard in design. • Equipment (including MLA and other topsides equipment) is at an elevation that allows for the forecast increase in sea level over the life of the Project. • Emergency Management Plans, including liaison with relevant local authorities as required	Moderate
5	Gas Import Jetty Works and Pipeline Works	Extreme heat causes heat stress on personnel working onsite, resulting in reversible health effects and reduced productivity.	Extreme heat	• Policies/Permit to Work procedures to manage work appropriately on hot days (FSRU, Crib Point Jetty and Crib Point Receiving Facility). • Minimising need for operational and maintenance staff physically located at the Crib Point Receiving Facility and Pakenham Delivery Facility.	Low

ID*	Works area	Risk description	Hazard	Existing controls	Risk rating
6	Gas Import Jetty Works and Pipeline Works	Increased CO2 penetration into concrete structures causes structural damage to assets, resulting in increased operational and maintenance costs.	Enhanced atmospheric concentrations of CO2	• Visual inspections of concrete structures leading to preventative maintenance.	Low
7	Gas Import Jetty Works and Pipeline Works	External bushfire causes damage to assets, resulting in operational disruption and additional cost for replacement of assets.	Bushfire	• Vegetation clearances around equipment to ensure appropriate firebreak. • Fire water systems. • FSRU would depart in case of bushfire. • Emergency Management Plans, including liaison with relevant local authorities and other port operators (e.g. United Petroleum) as required • Failsafe of isolation valving.	Low
8	Gas Import Jetty Works and Pipeline Works	Bushfire restricts the ingress/ egress to assets and services (e.g. power), resulting loss of production and safety impacts to workers onsite.	Bushfire	• Minimising need for operational and maintenance staff physically located at site. • FSRU is designed to accommodate workforce. • Maritime Security Plan coordination by PoHDA.	Low
9	Gas Import Jetty Works and Pipeline Works	Extreme heat causes damage to assets and restricts services (e.g. power), resulting in disruption of operations and loss of productivity.	Extreme heat	• Uninterruptible Power Supply (UPS) for safe shutdown. • FSRU electrically isolated from jetty and generates its own power.	Low
10	Gas Import Jetty Works and Pipeline Works	Extreme wind/storms cause damage to assets (e.g. failure of mooring system) and impacts services (e.g. powerlines), resulting in disruption of operations and loss of productivity.	Extreme wind/ storms	• Uninterruptible Power Supply (UPS) for safe shutdown. • FSRU electrically isolated from Jetty and generates its own power. • Mooring system designed to meet greater than 1 in 50-year storm event. • PoHDA Emergency Management Plan/ Victorian Regional Channels Authority Harbour Master response manages requirement to put vessels to sea for extreme weather events. • Facilities designed in accordance with Australian Standards (e.g. AS1170.2 Structural Design Actions - Wind Actions).	Low
11	Gas Import Jetty Works and Pipeline Works	Low rainfall causes restricted water availability, resulting in operational disruption and/or increased operational costs.	Extreme rainfall	• Alternative water sources and/or water efficiency equipment.	Low

23.7 Adaptation measures

As per information in **Section 23.6** of this chapter, no risks identified through the climate change risk assessment were rated as high or above when taking into account relevant controls to be implemented by the Project. Four risks were rated as moderate, with controls considered adequate to manage these risks.

AGL and APA would monitor climate impacts, projections and policy for the Project Area throughout the Project life cycle. Monitoring may include operational controls such as routine and preventative maintenance checks as outlined in **Table 23-2** above. As required, Project-specific adaptation measures would be investigated, assessed and implemented to minimise any climate change risks to the Project components.

23.8 Conclusion

A climate change risk assessment has been undertaken to determine the potential impacts of climate change on the Project, aiming for more climate resilient assets.

Eleven climate change risks were identified and assessed. Of these risks, none were rated as high or above, taking into consideration proposed controls.

Four risks were rated as moderate and related to the Gas Import Jetty Works and the Pipeline Works. These risks were primarily associated with impacts from saltwater intrusion, change in groundwater levels and extreme rainfall. Potential impacts from sea level rise have also been identified as a risk for the Gas Import Jetty Works.

Seven risks were rated as low. Proposed controls were considered adequate to manage the potential impacts of climate change on the Project.

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