Central Eyre Iron Project
Environmental Impact Statement

CHAPTER 11

CLIMATE CHANGE AND GREENHOUSE GAS

DISCLAIMER

Iron Road Limited has taken all reasonable steps to review the information contained in this document and to ensure its accuracy as at the date of submission. Note that:

(a) in writing this document, Iron Road Limited has relied on information provided by specialist consultants, government agencies, and other third parties. Iron Road Limited has reviewed all information to the best of its ability but does not take responsibility for the accuracy or completeness; and

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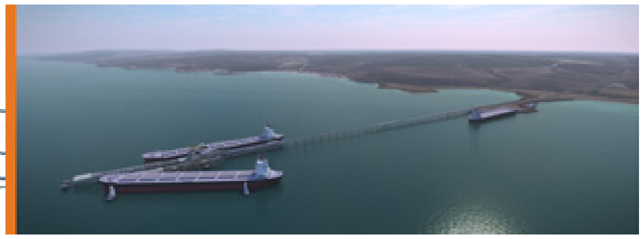
11 Climate Change and Greenhouse Gas 11-1

List of Figures

List of Plates

List of Tables



11 Climate Change and Greenhouse Gas

Climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of conditions, and those changes persist for an extended period, typically decades or longer (Intergovernmental Panel on Climate Change 2015a). Greenhouse gases have been determined to play an important role in determining climate and contributing to climate change. The Intergovernmental Panel on Climate Change is one of the main bodies that reviews climate change science and updates predictions based on new and revised climate (e.g. Intergovernmental Panel on Climate Change 2015b). The Intergovernmental Panel on Climate Change (2014) confirmed the relationship between human activities and climate change, stating in the Fifth Assessment Report that “Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems”.

The links between greenhouse gases and climate change have resulted in significant State and Commonwealth legislation and policy initiatives regarding management and control of greenhouse gas (GHG) emissions.

This chapter outlines the potential risks to and likely effects of climate change on the proposed CEIP Infrastructure and also discusses the impacts of greenhouse gases likely to be generated by the project. This chapter is divided into two parts: Climate Change (Section 11.3) and Greenhouse Gas (Section 11.4).

A summary of the potential effects of climate change on the CEIP Infrastructure from a risk management perspective is provided, e.g. potential climate change risks on the Eyre Peninsula and consequently for the CEIP Infrastructure include reduced annual rainfall, which will place pressure on a region with an already low annual rainfall (refer Plate 11-1). The design and control measures undertaken to mitigate and adapt to potential (predicted) effects and an assessment of residual risk to the CEIP Infrastructure from potential climate change impacts is provided.

The second part of this chapter describes the measures to minimise, reduce and ameliorate GHG where practicable. The results of a quantitative assessment that was completed to predict the level of GHG emissions associated with construction and operations of the CEIP Infrastructure (provided in Appendix K) are described, with reference to how the generation of GHG may impact environmental values. Although it is the subject of a separate government approvals process and therefore not covered in this EIS document, emissions associated with activities undertaken within the proposed CEIP Mine have been included here due to their inter-dependency with the CEIP Infrastructure components, i.e. the emissions associated with the infrastructure components do not occur unless those associated with the mine also occur, and vice versa. Reference to the CEIP means both the CEIP Infrastructure and the activities conducted within the proposed mining lease boundary. It is important to consider that this has resulted in a higher estimation of emissions than is predicted for the CEIP Infrastructure alone.

Design features and mitigation activities to reduce and manage GHG emissions are described. Risks associated with project-related emissions that could reasonably occur during construction and operations of the CEIP are also considered.

Plate 11-1 View of Eyre Peninsula Dryland Farming Landscape from Mount Wudinna

11.1 Applicable Legislation and Standards

Legislation, policy and standards to manage and respond to climate change and GHG emissions have been developed at a Federal, State and Local Government level and key initiatives relevant to the CEIP are outlined below.

11.1.1 Commonwealth

The legislative framework around climate change and GHG emissions management is currently changing, with the July 2014 repeal of elements of past carbon emissions legislation in favour of the new "Direct Action Plan". As a result, the Clean Energy Legislative Package which passed into law in November 2011, is no longer in effect, nor is the *Energy Efficiency Opportunities Act 2006*, which was similarly repealed in September 2014. The Renewable Energy Target (RET) scheme remains in place but the Federal Government are proposing changes to the targets which are yet to be legislated.

The *National Greenhouse and Energy Reporting Act 2007* now forms the basis of climate change management and reporting (refer below) together with the new Emissions Reduction Fund (ERF).

The EFR has three elements including crediting GHG emissions reductions, purchasing GHG emissions reductions, and safeguarding GHG emissions reductions. The ERF was provided legislative effect when the *Carbon Farming Initiative Amendment Bill 2014* was passed in late October 2014. The *Carbon Farming Initiative Amendment Bill 2014* provides for the Clean Energy Regulator to conduct auctions and enter into contracts to purchase emissions reductions, enables a broader range of emissions reduction projects to be approved (including for example upgrading commercial buildings, capturing landfill gas and revegetating marginal land) and amends the project eligibility criteria and processes for approving projects and crediting carbon credit units (Department of the Environment 2015).

Further discussion of the Federal Government's Direct Action Plan and related legislation is provided in Appendix K.

National Greenhouse and Energy Reporting (NGER) Act 2007

Of most relevant to the CEIP is the NGER framework which was legislated in 2007 and contains mandatory reporting provisions for corporations and/or individual facilities owned and operated by constitutional corporations. Reporting provisions are triggered when the entity GHG emissions and/or energy use (as determined using the methodology described within the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines (Department of the Environment 2014d) meet any of the following criteria:

- The total entity GHG emissions were greater than 50,000 t of carbon dioxide equivalent (CO_2-e) per annum
- The total amount of energy produced was greater than 200 TJ per year
- The total amount of energy consumed was greater than 200 TJ per year
- The GHG emissions of a single facility were greater than 25,000 t of CO_2-e per annum, or energy produced or consumed was greater than 100 TJ per year.

Information from NGER is also used to meet Australia's GHG reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and to track progress against Australia's targets under the Kyoto Protocol through the compilation of Australia's National Greenhouse Accounts (Clean Energy Regulator 2014a).

The NGER framework is relevant to the CEIP as detailed in Section 11.4.4 because the estimated volume of annual GHG emissions for the proposed CEIP Mine, once commenced would trigger the threshold for reporting GHG emissions as "a single facility" producing greater than 25,000 t of CO_2-e per annum when calculated in accordance with the National Greenhouse and Energy Reporting Measurement Technical Guidelines.

11.1.2 South Australia

The South Australian Government has introduced a range of legislation, policy and standards to manage and respond to climate change and GHG emissions. The regulatory environment is underpinned by the *Climate Change and Greenhouse Emissions Reduction Act 2007* and the policy environment is underpinned by the direction set by such publications as the South Australian Strategic Plan (Government of South Australia 2011).

Climate Change and Greenhouse Emissions Reduction Act 2007

The *Climate Change and Greenhouse Emissions Reduction Act* 2007 provides for:

> "measures to address climate change with a view to assisting to achieve a sustainable future for the State; to set targets to achieve a reduction in greenhouse gas emissions within the State; to promote the use of renewable sources of energy; to promote business and community understanding about issues surrounding climate change; to facilitate the early development of policies and programs to address climate change; and for other purposes".

Three targets are set within the Act to reduce GHG emissions:

1) Reduce GHG emissions within the state by at least 60% to an amount that is equal to or less than 40% of 1990 levels by 31 December 2050 as part of a national and international response to climate change.
2) Increase the proportion of renewable electricity generated so it comprises at least 20% of electricity generated in the state by 31 December 2014.
3) Increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in the state by 31 December 2014.

The legislation also commits the State Government to work with business and the community to develop and put in place strategies to reduce greenhouse emissions and adapt to climate change.

Iron Road will work with the State Government to ensure the CEIP Infrastructure aligns with South Australian government policy direction and regulatory requirements.

Coast Protection Act 1972

The *Coast Protection Act 1972* provides for "the conservation and protection of the beaches and coast of this State; and for other purposes". The Coast Protection Board, established under the Act has, among other responsibilities, the function of protecting and restoring the coast including from "erosion, damage, deterioration, pollution and misuse". The Board's Policy Document (Coast Protection Board 2012) advises on requirements for new coastal development, including standards for site and building levels to account for sea level rise and setbacks to prevent coastal erosion.

The Coast Protection Board will be an important stakeholder for Iron Road during the ongoing monitoring of climate change impacts, particularly around the proposed port development.

SA Strategic Plan

The SA Strategic Plan is comprised of visions, goals and targets, with a number specifically focused on climate change. The vision that "South Australians think globally, act locally and are international leaders in addressing climate change" is underpinned by five key goals, which drive South Australia's' policy approach to addressing climate change:

- We reduce our greenhouse gas emissions
- We adapt to the long-term physical changes that climate change presents
- We reduce our reliance on cars in the metropolitan area, by walking, cycling and increasing use of public transport
- South Australia has reliable and sustainable energy sources, where renewable energy powers our homes, transport and workplaces
- We aim for zero waste – recycling, reusing and reducing consumption all we can (Government of South Australia 2011)

In addition to the SA Strategic Plan, a number of other standards and policy documents have been developed to provide government, industry and the community with guidance regarding activities to mitigate and manage climate change and GHG emissions. A selection of relevant policies and initiatives are outlined in Table 11-1 below.

Table 11-1 South Australia Policy, Standard and Initiative Examples

Policy/Standards/Initiative	Description
South Australia's Climate Change Adaption Framework	The Climate Change Adaptation Framework sets the foundation for South Australians to develop well-informed and timely actions to be better prepared for the impacts of climate change. It is intended to guide action by government agencies, local government, non-government organisations, business and the community (Department of Premier and Cabinet 2012).
Climate Change Sector Agreements	Sector agreements are formal cooperative agreements between the South Australian Government and specific business entities, industry sectors, community groups and regions to help tackle climate change (Government of South Australia 2014). The agreements typically encourage actions to reduce greenhouse emissions and adapt to climate change.
Premier's Climate Change Council	The Premier's Climate Change Council was established under the *Climate Change and Greenhouse Emissions Reduction Act 2007*. The primary function of the Council is to provide independent advice to the Minister responsible for Climate Change about matters associated with reducing greenhouse gas emissions and adapting to climate change (Premier's Climate Change Council 2013).

11.1.3 Local

Eyre Peninsula Integrated Climate Change Agreement (EPICCA)

The EPICCA is an agreement between the South Australian Minister for Climate Change and the Eyre Peninsula region consisting of the following bodies – the Eyre Peninsula Natural Resources Management Board, the Regional Development Australia Whyalla and Eyre Peninsula Inc. Board and the Eyre Peninsula Local Government Association. The purpose of the agreement is to acknowledge a joint commitment on the part of the "State Government and the Eyre Peninsula Region to respond to climate change by focusing on adaptation and identifying economic opportunities". The agreement is underpinned by an action plan that maps out strategies for the region in tackling climate change, both in the short term (five years) and longer term (Government of South Australia 2010). Under the South Australian Climate Change Adaptation Framework and EPICCA, the Regional Climate Change Adaptation Plan for the Eyre Peninsula (Siebentritt *et al* 2014) was released in early 2014. The Plan presents adaptation pathways for eight focus areas across the Eyre Peninsula, including port and wharf facilities.

11.2 Assessment Method

11.2.1 Climate Change

The climate change risk assessment was undertaken through a desktop assessment and review of existing climatic conditions relevant to the development of the CEIP Infrastructure. The summary of existing climatic conditions was collated through desktop review of existing databases and information sources as described in Chapter 7, Physical Environment. Predicted changes to climatic conditions were identified based on a literature review of relevant documentation, including:

- Regional Climate Change Projections: Eyre Peninsula (DENR 2010)
- Climate Change 2013: The Physical Science Basis (Intergovernmental Panel on Climate Change 2013a)
- Climate Change Risks to Australia's Coast (Department of Climate Change 2009)

A risk assessment was undertaken based on the predicted changes to the climate, and the subsequent implications for the operability of the CEIP Infrastructure (see Section 11.3).

11.2.2 Greenhouse Gas

The GHG impacts of the CEIP have been assessed in accordance with national standards and guidelines and as such the methodology used to calculate the impact assessment reflects recognised national reporting requirements. The standards and guidelines referred to include:

- National Greenhouse and Energy Reporting Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia (July 2014) – used for the determination/calculation of NGERs-reportable emissions (Department of the Environment 2014d).
- National Greenhouse Accounts Factors (December 2014) – used for the determination of non-NGERs reportable direct and indirect GHG emissions (Department of the Environment 2014e).
- The Greenhouse Gas Protocol (Revised Edition, March 2004) – used to set boundaries for the GHG assessment (World Business Council for Sustainable Development 2004)

Assessment Calculation Methodology

Emissions calculations have been undertaken in accordance with the methodologies detailed within the National Greenhouse and Energy Reporting System Measurement: Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia (Department of the Environment 2014d).

The six major groups of greenhouse gases assessed in this assessment are consistent with those reported upon in the annual National Greenhouse Gas Inventory. The six major groups that have been assessed are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_20)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF_6)

In order to compare the relative effects of different gases, all non-carbon dioxide gases are converted to carbon dioxide equivalent using the Global Warming Potential index (GWPs).

Assessment Boundaries

This assessment accounts for all emissions associated with the CEIP that are considered, based on NGER methodology (Department of Environment 2014d), to be under Iron Road's operational control. In addition, this assessment accounts for scope 3 emissions that have been considered based on the following criteria:

- Size – They contribute significantly to the project's total estimated GHG emissions.
- Influence – There are potentially significant GHG emissions reductions that could be undertaken or influenced by Iron Road.
- Risk – They contribute to Iron Road's risk exposure. Such risks may include financial, regulatory, supply chain, product, technology, compliance, litigation, reputational or physical risks.
- Stakeholders – They are deemed critical by key stakeholders, including customers, suppliers, investors, and local, regional or national residents.
- Outsourcing – They are outsourced activities that were either previously performed in-house, or are commonly performed in-house by other similar industries.
- Other – They meet any additional criteria developed or implemented by Iron Road, the industry sector or the Government (JBS&G 2015).

Although subject to a separate approvals process, emissions associated with all activities undertaken within the proposed CEIP mining lease have been included given the inter-dependency with the CEIP Infrastructure components with the proposed mine. Emissions associated with third parties that may use the port facility or infrastructure corridor for their own purposes have been excluded.

Emissions scopes

Impacts have been assessed based on the Department of Environment National Greenhouse Accounts (DoE 2014e) which are activity specific and can be referred to as direct and indirect emissions or scope 1, scope 2 and scope 3 emissions. A description of the emissions is provided below:

- Scope 1 (Direct GHG emissions) – These emissions occur from sources that are directly owned or operated by the CEIP.

- Scope 2 (Electricity indirect GHG emissions) – The indirect emissions occur from the generation of electricity used by the CEIP across the extent of its construction and operations. They are generated at power generation sites, but attributed to the end user.
- Scope 3 (Other indirect GHG emissions) – These emissions occur as a consequence of activities associated with the CEIP, but occur from sources not owned or controlled by Iron Road. Reporting of scope 3 emissions is optional under all of the standards and guidelines relevant to this assessment.

For a detailed description of the impact assessment methodology, refer to the Greenhouse Gas Impact Assessment Technical Report (JBS&G 2015) presented in Appendix K.

11.3 Climate Change

This section provides an overview of the potential effects on the CEIP Infrastructure as a result of predicted climate change. Risks to the CEIP Infrastructure are determined based on current understanding of climate change scenarios, proposed mitigation measures and design controls. The climate change predictions represent alterations to the existing physical environment as outlined in Chapter 7. It should be noted that the risk assessment process utilised in this section differs from the process utilised elsewhere in this EIS. Risks here are considered in the context of climate change impacting the project and design measures to protect the infrastructure, whereas the remainder of this document considers the impacts and risks which the project is predicted to have, or could potentially have on existing environmental values.

11.3.1 Climate Change Predictions

Chapter 7 details the existing physical environment in the region of the proposed CEIP Infrastructure, including climatic conditions, natural hazards, topography and geology. Chapter 7 also identifies the potential outcomes of climate change on the physical environment of the Eyre Peninsula.

South Australia, including the Eyre Peninsula, is predicted to be impacted by climate change as a consequence of higher temperatures, less rainfall, rising sea levels and more frequent extreme climatic conditions or events. Given the proximity of the CEIP to Goyder's Line (the arbitrary point north of which agriculture is considered unsustainable due to limited rainfall), further reductions in rainfall, or reliability of rainfall, due to climate change, may impact on the ongoing viability of agricultural operations in the region.

In addition to higher temperatures, less rainfall and rising seas levels, an increase in extreme weather events is predicted to occur. The intensity and frequency of droughts, extreme heat and storm events are all anticipated as a result of altered climatic conditions.

The key predicted changes to the climate based on a low, medium and high emissions scenario are summarised in Table 11-2.

Table 11-2 Summary of Climate Change Projections

Variable	Year	Change Under Low Emissions Scenario	Change Under Medium Emissions Scenario	Change Under High Emissions Scenario
Temperature °C (Annual[1])	2030	+0.8	+0.8	+0.8
	2070	+1.25	+1.75	+2.25
Rainfall % (Annual[1])	2030	-3.5	-3.5	-3.5
	2070	-7.5	-15	-15
Evapotranspiration % (Annual[1])	2030	0	+3.0	+3.0
	2070	+3.0	+6.0	+6.0

Variable	Year	Change Under Low Emissions Scenario	Change Under Medium Emissions Scenario	Change Under High Emissions Scenario
Relative Humidity % (Annual[1])	2030	0	0	0
	2070	-0.75	-0.75	-1.5
Solar Radiation (%) (Annual[1])	2030	0	0	0
	2070	0	+1.5	+1.5
Wind Speed % (Annual[1])	2030	0	0	0
	2070	0	0	0
Sea Level Rise (m) (Department of Climate Change 2009)	2030	+0.132	+0.146	+0.2
	2070	+0.333	+0.471	+0.7
	2100	+0.496	+0.819	+1.1
Sea Surface Temperature °C (Spencer Gulf Port Link 2013)	2030	-	-	+0.45

[1] Source: DENR 2010

11.3.2 Design Measures to Manage Climate Change

The following design and control measures have been incorporated to minimise risks to the CEIP Infrastructure as a result of the predicted changes to climatic conditions:

- Marine and coastal infrastructure (causeway (including module off-loading facility), wharf and jetty) are designed with allowance for sea level rise to prevent the inundation or damage to infrastructure (refer to Chapter 4, Project Description, for an explanation of the marine infrastructure design).
- The port site is located within a natural 'amphitheatre' with on-shore infrastructure located behind the fore-dune on higher land, avoiding potential future inundation from high tides, extreme storm events, or sea level rise (refer to Figure 11-1).
- Run-off water sedimentation basins are proposed at the port site to catch stormwater running off the concentrate stockpile, module laydown area and hardstand at the rail unloading facility from extreme weather events (refer to Figure 11-1 for locations).
- The borefield water supply proposed for the CEIP (construction and operation of the CEIP Mine) is a saline water source not relied upon by other users. This discounts current and future reliance on mains water supplies, which are predicted to be under increasing pressure in the future.
- Utilisation of native and drought-tolerant vegetation for landscaping purposes to improve resilience to climate change and minimise water requirements.
- Detailed design shall further consider the latest climate change predictions to:
    - Adopt appropriate rainfall design scenarios (due to altered rainfall patterns) to inform detailed design of the stormwater management approach and sedimentation ponds to accommodate at least 1 in 100 year storm events. Allowance on site for detailed design of the stormwater management infrastructure is available to include extending/deepening of the proposed sedimentation basins if required.
    - Materials selected will take into consideration climate change projections with the objective of maximising durability (e.g. heat resistance, corrosion protection, design features to improve thermal comfort).
    - Consider additional movement of footings and foundations (due to the drying of soil).
    - Consider wind intensity and frequency (due to altered wind conditions and additional storm events).

- Incorporate durable materials and finishes (e.g. to minimise heat degradation of infrastructure, corrosion of marine infrastructure).
- Include passive design features to improve thermal comfort in habitable buildings.

Climate change design control measures have been developed with the overarching aim of maintaining the safe and efficient operability of the CEIP Infrastructure whilst considering predicted climate change scenarios.

11.3.3 Impact Assessment: Climate Change

Given the implementation of design measures which already consider climate change scenarios and the uncertainty inherent in climate change predictions, no impacts to the construction or operation of the CEIP Infrastructure are currently envisaged as a result of predicted climate change. However, it is acknowledged that climate change represents a risk to the operation of the CEIP Infrastructure and is discussed in Section 11.3.5 below. Given that construction will occur over a three-year period, climate change is not anticipated to represent a risk to the CEIP during this time.

11.3.4 Control and Management Strategies: Climate Change

In order to minimise the impact of climate change on the proposed CEIP Infrastructure, a series of control strategies will be incorporated into the Operations Environmental Management Plan (OEMP) and implemented for each project component. Key control and management strategies are summarised in Table 11-3. Chapter 24 provides a framework for implementation of these strategies.

Table 11-3 Control and Management Strategies: Climate Change

Control and Management Strategies	EMP ID
Bushfire management and emergency response procedures will be developed and incorporated into the Construction Environmental Management Plan (CEMP) and OEMP to consider the amplified risk of bushfire and extreme weather events as a result of climate change.	BF_C1 BF_O1
Consideration of the fire danger season and total fire ban days as declared by the CFS will be given when planning hot works and other high risk activities. Bushfire management measures recommended by the CFS will be incorporated in the CEMP and OEMP.	BF_C1 BF_O1
Inspection of water retention ponds and stormwater management infrastructure following extreme storm events, to determine the integrity of dam walls, to monitor available capacity and to determine whether the design capacity remains current.	GHG_09
Monitoring the marine environment for build-up of invasive marine species which may be favoured by an increase in sea temperatures and could influence the functionality of the port and the local marine environment.	GHG_10
Development of extreme heat procedures to minimise occurrence of heat stress amongst the workforce, balancing productivity with health and wellbeing of the workforce.	BF_C1 BF_O1

11.3.5 Residual Risk Assessment: Climate Change

This section identifies and assesses the residual climate change risks to the CEIP Infrastructure that could occur based on predicted climate change scenarios. Although the predicted climate change scenarios may not eventuate, the purpose of the risk assessment process was to identify management and mitigation measures required to reduce the identified risks to a level that is ALARP. The climate change management and mitigation measures identified are presented in Sections 11.3.2 and 11.3.4 and form a part of the Environmental Management Framework presented in Chapter 24.

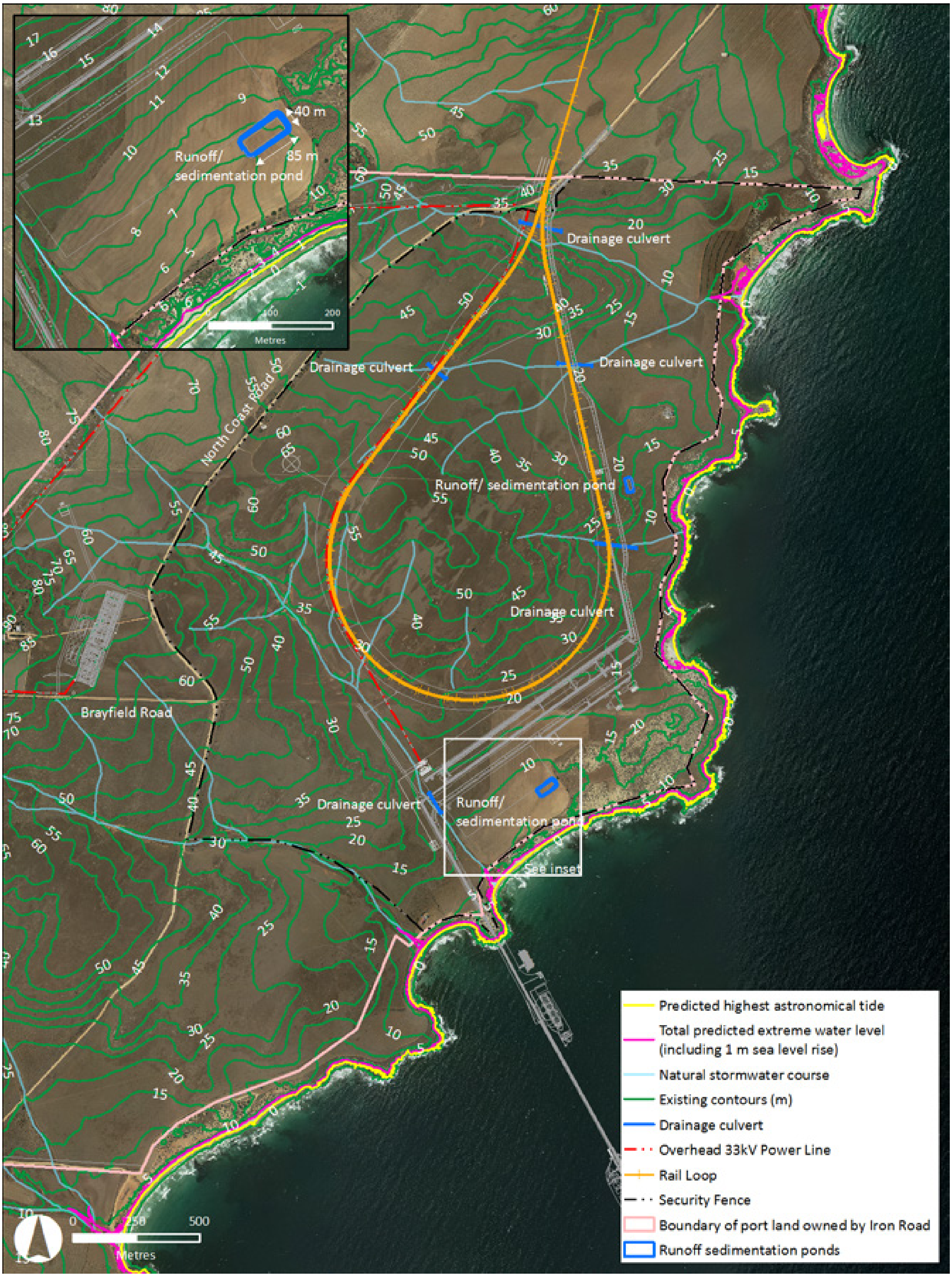


Figure 11-1 Marine and Coastal Infrastructure Layout

As noted above, the climate change risk assessment considers the potential effects of climate change on the CEIP Infrastructure. As such, the consequence lookup table presented in Chapter 9, Risk and Impact Definition, is not relevant. The consequence criteria developed for the climate change risk assessment are presented in Table 11-4.

Table 11-4 Criteria for Categorising Consequence of Climate Change on CEIP Infrastructure

Category	Effect on Assets
Insignificant	No damage to CEIP Infrastructure or the ability of the assets to operate.
Minor	Minor damage to CEIP Infrastructure that can be immediately repaired. Minor disruption to operation of assets.
Moderate	Significant damage to CEIP Infrastructure, reparable in the short term. Significant disruption to operation of assets.
Major	Extensive damage to CEIP Infrastructure reparable in the long term. Complete disruption to operation of assets.
Catastrophic	Permanent damage to or loss of CEIP infrastructure, or loss of ability for the assets to operate.

The criteria for determining likelihood and the risk matrix presented in Chapter 9 remain appropriate and are utilised to determine the overall risk presented by predicted climate change scenarios on the CEIP Infrastructure.

The following predicted climate change events that represent a risk to the construction and operation of the proposed CEIP Infrastructure have been identified:

- Sea level rise
  - Inundation of coastal infrastructure
- Extreme heat
  - Higher rates of infrastructure deterioration due to extreme heat (railway buckling, material delamination, hard stand deterioration)
  - Increased risk of damage to infrastructure from bushfire
  - Loss of power supply – extreme heat and bushfires
  - Longer and more severe heat waves leading to heat stress on employees and site personnel
  - Elevated sea temperatures
- Reduced rainfall
  - Insufficient water supply
- Extreme weather events, including extreme rainfall, wind and storm surge
  - Exceedance of site drainage capacity
  - Increased frequency or permanent inundation of coastal infrastructure and utilities
  - Destruction and damage to marine assets
  - Increased rates of deterioration of marine infrastructure
  - More severe wind and hail storms damaging buildings and associated major infrastructure
- Fire event
  - More severe and frequent bushfire risk leading to increased requirement for emergency response and recovery operations
  - Risks to public safety (working conditions)

Sea Level Rise

As previously outlined, sea levels on the Eyre Peninsula are anticipated to rise by 0.2 m by 2030, 0.7 m by 2070 and 1.1 m by 2100 in a high emissions scenario (Department of Climate Change 2009). The Coast Protection Board Policy Document requires new coastal development to account for a sea level rise of 0.3 m by 2050 and 1 m by 2100. The effects of sea level rise may be exacerbated during storm events. During storm events, an elevated sea level may result in damage to coastal and marine infrastructure. It is anticipated that any damage would be reparable in the short term, and the consequences of such an event are considered to be **moderate**. Design of the proposed port facility has incorporated an allowance for projected sea level rise to support ongoing safe operations for the life of the project. Due to the site's elevation (Figure 11-1) it is considered **rare** that coastal or marine infrastructure will be inundated and damaged during the operable life of the CEIP Infrastructure. As such, the overall risk is considered to be **low**.

Heat Damage / Deterioration

Temperatures (under Medium Emissions Scenarios) are projected to increase 0.8% by 2030 and 2.25% by 2070 as a result of climate change (DENR 2010). In addition, extreme heat waves and extended periods of drought are anticipated to increase in likelihood and intensity. As previously outlined, materials selected during detailed design will consider the durability of the CEIP Infrastructure based on projected increased temperatures. As such, temperature increases are considered to be of **minor** consequence and not result in a significant disruption to operation activities. Despite the implementation of design and management controls, it is considered **possible** that extreme heat damage will occur during operation of the CEIP Infrastructure. Therefore, the residual risk is considered to be **low**.

Elevated Fire Risk

Climate change predictions indicate that bushfire events will increase in frequency and intensity in the Eyre Peninsula region. Bushfire events may result in damage or destruction of CEIP Infrastructure components, as well as threaten the safety of Iron Road employees. Fire management procedures will be established, including stop work provisions for high risk activities proposed to be conducted during days of 'Catastrophic' or 'Extreme' fire danger ratings (as declared by the CFS). There is minimal native vegetation within the region, generally resulting in low fuel loads, and thus moderate intensity fires, in the event of ignition.

Nevertheless, a significant fire event could (in the worst case) result in the destruction or damage to CEIP Infrastructure components, or stop the ability to continue operation activities. This is considered to represent a **major** consequence. It is considered **possible** that a fire event of this magnitude would result from climate change and impact the CEIP Infrastructure given the control measures proposed to be implemented and the low fuel loads in the region adjacent to the project. As such, the overall risk is considered to be **medium**.

Loss of Power Supply

Power supply may be lost in the event of extreme heat or a fire event resulting in outages in transmission or distribution infrastructure external to the CEIP Infrastructure. Backup generation will be in place for all critical elements required for construction or the safe operation of the CEIP Infrastructure. As such, a **minor** disruption to construction or operation activities may be encountered in the event of a loss of power supply; however activity is likely to continue largely unaffected. It is considered **possible** that power supply to the CEIP Infrastructure will be disrupted at some point during the life of the project. As such, the overall risk of loss of power is considered to be **low**.

Heat Stress

Elevated temperatures and an increase of extreme heat events may result in increased occurrences of heat stress for employees, potentially disrupting operational activities. Extreme heat procedures will be developed to balance the well-being of employees and continuation of operations during periods of elevated heat, such as the alteration of working hours to avoid extreme heat, the provision of appropriate protective equipment and working conditions, and shut-down procedures where considered appropriate. Given the implementation of control measures, a minor disruption to the operation of assets is the worst scenario anticipated as a result of heat stress; a **minor** consequence. Given the implementation of control measures, it is considered **possible** that employees will be affected by heat as a result of climate change during the life of the CEIP. As such, the overall risk is considered to be **low**.

Elevated Sea Temperature

The corrosive properties of sea are enhanced by increases in temperature. Sea temperatures are predicted to increase by 0.45ºC by 2030 and 0.6ºC by 2070 (Spencer Gulf Port Link 2013). The predicted increase in temperature may result in increased deterioration of marine infrastructure due to the elevated corrosion. When selecting the materials and finishes for the marine infrastructure, resistance to corrosion as a result of climate change will be considered. In addition, periodic inspection and maintenance of the marine infrastructure will be undertaken to maintain structures in sound operating condition. As such, the consequences of elevated sea temperatures and increased corrosion are considered to be of **minor** consequence and not disrupt the operating ability of marine infrastructure. It is considered **possible** that sea temperatures will increase during the life of the project. As such, the overall risk is considered to be **low**.

Reduced Water Supply

Climate change predictions indicate that rainfall is anticipated to reduce by 3.5% by 2030 and 15% by 2070 (DENR 2010). Water required for construction and operation of the CEIP Infrastructure is not dependent on rainfall. Water supply at the port facility and long-term employee village will be sourced from the mains supplies; the SA water pipeline and the Wudinna township supply. Similarly, water required for construction of the infrastructure corridor will be sourced from groundwater. Rainwater may be collected and utilised as irrigation for on-site landscaping and captured for non-potable purposes (e.g. toilets); however backup supplies will remain available. As such, reduced rainfall is considered to have an **insignificant** effect on the construction and operation of the CEIP Infrastructure. Patterns of reduced rainfall are considered **likely** to occur at some point during the life of the project. As such, the overall risk is considered to be **low**.

Extreme Rainfall Events

An increase in extreme rainfall events may result in surface water flows exceeding the capacity of drainage and retention / detention infrastructure. The design criteria for the various project components varies depending on the sensitivity of the infrastructure to surface water inundation in terms of likely damage, ability to remain operable and any subsequent environmental effects. Infrastructure considered most vulnerable to extreme rainfall events (such as hazardous materials storage areas) will be designed to manage surface water flows during a 1 in 100 year event. Conversely, less vulnerable infrastructure (such as internal roads) will be design to manage lower peak flows. As previously outlined, the design capacity of drainage infrastructure will be reviewed during detailed design, considering latest climate change predictions and peak flow estimations.

Given that there are no significant watercourses intersected by the CEIP Infrastructure, an increased rate of significant rainfall events are anticipated to result in only a **minor** disruption to operation activities with any overflow entering existing natural drainage channels. It is considered **possible** that extreme rainfall events result in disruption to the operation of the CEIP Infrastructure. As such, the overall risk is considered to be **low**.

Plate 11-2 Example of Rainfall Event on the Eyre Peninsula

Altered Wind Conditions

Climate change predictions indicate that wind speeds on the Eyre Peninsula may increase by 3.5% by 2030 and 7.5% by 2070 in a high emissions scenario (DENR 2010). Wind conditions are likely to be amplified during storm events; also predicted to increase in frequency and intensity as a result of climate change. Design of the CEIP Infrastructure will be undertaken in accordance with the anticipated wind loads. Consideration of additional wind loads as a result of climate change will be made for structures or buildings considered to be at risk during extreme wind events. As a result, no significant damage to CEIP Infrastructure is anticipated. Any damage is anticipated to be minor in nature and able to be rectified immediately; a **minor** consequence. It is considered **possible** that elevated wind conditions will result in damage to CEIP Infrastructure during construction and operation of the project. As such, the overall risk of increased wind is considered to be **low**.

Summary of Risks

A summary of each of the identified risks to the CEIP Infrastructure from predicted climate change is provided in Table 11-5. All identified risks are categorised as low or medium, and were considered ALARP and not warrant specific control measures at this point in time.

Table 11-5 Residual Risk Assessment Outcomes: Climate Change

Risk Event	Pathway	Receptor	Project Phase	Consequence	Likelihood	Residual Risk
Inundation of coastal /marine infrastructure	Sea level rise, storm surge	Port facility coastal / marine infrastructure	Construction, Operation	Moderate	Rare	Low
Deterioration of infrastructure (e.g. buckling of railway)	Extreme heat reducing durability of infrastructure	All project components	Construction, Operation	Minor	Possible	Low
Fire destruction / damage to infrastructure or threatening safety of CEIP staff	Fire event	All project components, CEIP staff	Construction, Operation	Major	Possible	Medium
Loss of power supply	Extreme heat or fire event	Long-term employee village, port facility	Construction, Operation	Minor	Possible	Low
Heat stress and exposure	Elevated temperatures and increased extreme heat events	CEIP staff	Construction, Operation	Minor	Possible	Low
Increased rate of corrosion of marine and coastal infrastructure	Elevated sea temperatures increasing rate of corrosion	Marine and coastal infrastructure	Construction, Operation	Minor	Possible	Low
Reduced water supply	Reduced frequency and intensity of rainfall	Site landscaping	Construction, Operation	Insignificant	Likely	Low
Rainfall event exceeding drainage capacity	Increased severe storm / rainfall events	All project components	Construction, Operation	Minor	Possible	Low
Wind damage to infrastructure	Elevated wind speeds, storm events	All project components	Construction, Operation	Minor	Possible	Low

11.4 Greenhouse Gas

The CEIP Infrastructure will result in the release of GHG emissions primarily as a result of the use of diesel fuel for the mobile fleet and transport of iron concentrate by train from the mine site to the port facility, the use of purchased electricity for materials handling at the port site, and changes in the carbon stocks of land as a result of land clearance.

11.4.1 Existing Environment

GHG emission levels are measured at a State, National and Global level.

Table 11-6 provides an overview of current and projected South Australian, Australian and Global emissions, following 'business as usual' reduction scenarios.

Table 11-6 Current and Projected SA, Australian and Global Emissions

Source	Unit	Current	2020	2030
South Australia (Department of Environment 2014a)	CO_2-e (Mt)	29.9	47.8	52.1
Australia (Department of Environment 2014b)	CO_2-e (Mt)	558.8	685	801
Global (ABARE, 2007)	CO_2-e (Mt)	42,300	53,800	63,600

The CEIP Infrastructure is located in an area where the existing GHG levels are expected to be comparable to levels across South Australia. Subsequently the levels of GHG experienced by the South Australian, Australian and global community, are considered a key environmental value.

Low GHG levels are highly valued by the community as they relate directly to perceived air quality, climate change and its resulting impacts.

At a regional level, low GHG levels are a particularly important environmental value given that the agricultural landscape is critical to the existing economy on the Eyre Peninsula and could be impacted by changed climatic conditions (reduced rainfall, higher evaporation and higher temperatures).

Plate 11-3 Farming Activities on the Eyre Peninsula

11.4.2 Design Measures to Protect Environmental Values

The design of the CEIP has incorporated a number of measures to minimise GHG emissions.

Iron Road has invested significant effort in reducing the GHG footprint of the CEIP during design optimisation by incorporating measures that have directly contributed to a reduction in projected energy demand during construction and operation, including:

- **Reduction in size of truck fleet** – The change from diesel-powered conventional load and haul mining to the proposed in-pit crushing and conveying mining method has significantly reduced the size of the haul truck fleet required from approximately 93 to 12 trucks, while taking advantage of greener grid-based electricity as the mining energy supply.
- **Module offloading facility (MOF)** – Proposed transportation of pre-constructed modules from the proposed MOF (at the proposed port development) directly to the mine rather than truck delivery of all construction material to the mine for on-site construction has significantly reduced fuel requirements during construction.
- **Optimisation of blasting techniques** – Rock and ore blasting techniques have been optimised to minimise the energy consumed in the primary crushing phase of the mining process.
- **Water source from borefield** – Initial designs of a desalination plant located near Elliston or a water supply and desalination plant at the proposed port site required significantly more power to pump the required water to the proposed mine near Warramboo. The current proposal pumps water approximately half the distance of earlier designs.
- **Optimisation of processing plant operations and dry stacked tailings** – Project water demand (and associated pumping energy requirements) has been reduced (by approximately 70% from initial studies) through the adoption of dry stacked tailings and optimisation of the processing plant operations, which includes recovery and reuse of waste water from processing and tailings dewatering.
- **Integration of tailings and rock storage facilities** – The integration of the tailings storage facility and rock storage facilities significantly reduce the project footprint and thus the carbon stocks that would be disturbed during land clearing, saving around 100,000 t of CO_2-e over the life of the operation.
- **Efficient railway line** – The gradient of the railway line has been minimised to maximise fuel efficiency. Additional outcomes are reduced engine strain, braking and brake noise. New locomotives will be used which will meet the Australian Standards for railway rolling stock and emit less noise than older locomotives.
- **Minimisation of disturbance footprint** – The CEIP Infrastructure has been located to avoid significant areas of native vegetation and infrastructure requirements will be ‘co-located’ within a single corridor to minimise the project footprint. Existing rail and road corridors will be utilised wherever possible to minimise the footprint. Maintenance tracks and vehicle laydown areas will be developed within the Infrastructure footprint to avoid further vegetation clearance, minimise ongoing disturbance (e.g. vehicle traffic and construction activities) and facilitate rehabilitation of disturbed areas for significant environmental benefit (SEB) offset. The transmission line from Yadnarie will follow the existing ElectraNet transmission line, utilising land where vegetation is already cleared and/or degraded. The long-term employee village will also be located in an area already cleared of native vegetation.

Further optimisation to reduce energy demand will include:

- **Water balance optimisation** – Further optimisation of the mine water balance, including the application of water-efficient fixtures, fittings and appliances, and the capture and reuse of stormwater together with water sensitive urban design will result in transfer of less water from the remote borefield, thus reducing energy demand.

- **Incorporation of energy-efficient design elements and small scale renewable** – Energy efficient design elements will be incorporated within the accommodation, administration and workshop facilities to reduce electricity demands (including the use of energy-efficient fixtures, fittings and appliances, and the use of passive solar design elements within the plant and accommodation facilities). Small scale renewable options will be considered, where practicable, such as solar-powered monitoring stations and solar power for site administration, accommodation and workshop facilities.
- **Optimisation of train transport** – The optimisation of the product train transport regimes and equipment will maximise the number of tonnes transported per unit of fuel, and reduce the potential for trains to remain idling for long periods of time.
- **Minimisation of fuel consumption** – Fuel consumption will be minimised by sourcing products locally wherever practicable to minimise travel distances, and by selecting efficient plant and equipment.
- **Offsets** – Iron Road will investigate opportunities for the application of greenhouse emission offset programmes under the Emissions Reduction Fund and associated Carbon Farming Initiative.

11.4.3 Impact Assessment: Greenhouse Gas

This section assesses GHG emissions that would result from the construction and operation of the CEIP (including the proposed mine). Emissions have been assessed in accordance with the impact assessment methodology outlined in Chapter 9, Risk and Impact Definition, and Section 11.4. A summary of these impacts is provided in Section 11.4.4. A detailed description of the impact assessment is provided in the Greenhouse Gas Impact Assessment Technical Report provided in Appendix K.

Construction Phase

Construction emissions include scope 1, scope 2 and scope 3 emissions as defined in Section 11.2.2. Examples of emissions include: construction fleet energy consumption; land use change associated with land clearing activities; electricity consumption and the embodied energy emissions associated with the mass of concrete and steel used in the mine and related infrastructure.

Scope 1 Emissions

Emissions generated from the consumption of liquid fuels (diesel consumption by mobile fleet) are scope 1 emissions. An estimated total of 22.75 GL of diesel is expected to be used by the mobile fleet during the construction of the proposed CEIP, with fuel usage involving the following types of fleet:

- Excavators
- Cranes
- Bulldozers
- Trucks
- Haul Trucks
- Vehicles
- Front-End Loaders
- Graders
- Track-laying equipment

Emissions resulting from diesel consumption usage are estimated to be approximately 61,372 t.

Land Clearing activities are also considered scope 1 emissions. It is estimated that 5,532 ha of land will be cleared during construction, which will result in a one-off scope 1 emission of approximately 652,600 t CO_2-e.

Scope 2 Emissions

Emissions generated from the consumption of electricity are considered scope 2 emissions. The total estimated electricity consumption resulting from the purchase of electricity during construction is 272,404 kWh, which will result in the emission of approximately 166 t CO_2-e.

Scope 3 Emissions

Steel and concrete will be required to construct the CEIP Infrastructure. The steel and concrete will require manufacturing and transport. GHG emissions will be generated from both the embodied emissions present in the steel and concrete and the manufacturing and transport of the steel and concrete from China to the project site. The total GHG emission associated with scope 3 activities is approximately 602, 753 t CO_2-e (549,389t CO_2-e resulting from embodied energy emissions and 53,364t CO_2-e resulting from construction material transport energy emissions).

Emissions Summary

Summaries of the total CEIP emissions estimates for the entire Construction phase are provided in Table 11-7 and shown graphically in Figure 11-2.

Table 11-7 CEIP Construction Phase GHG Emissions Summary

Energy Demand	Greenhouse Gas Emission (t CO_2-e)
Scope 1	
Diesel	61,372
Land clearing	652,600
Sub-total	713,972
Scope 2	
Electricity	166
Sub-total	166
Scope 3	
Embodied energy	549,389
Material transport	53,364
Sub-total	602,753
Construction phase total	**1,316,891**

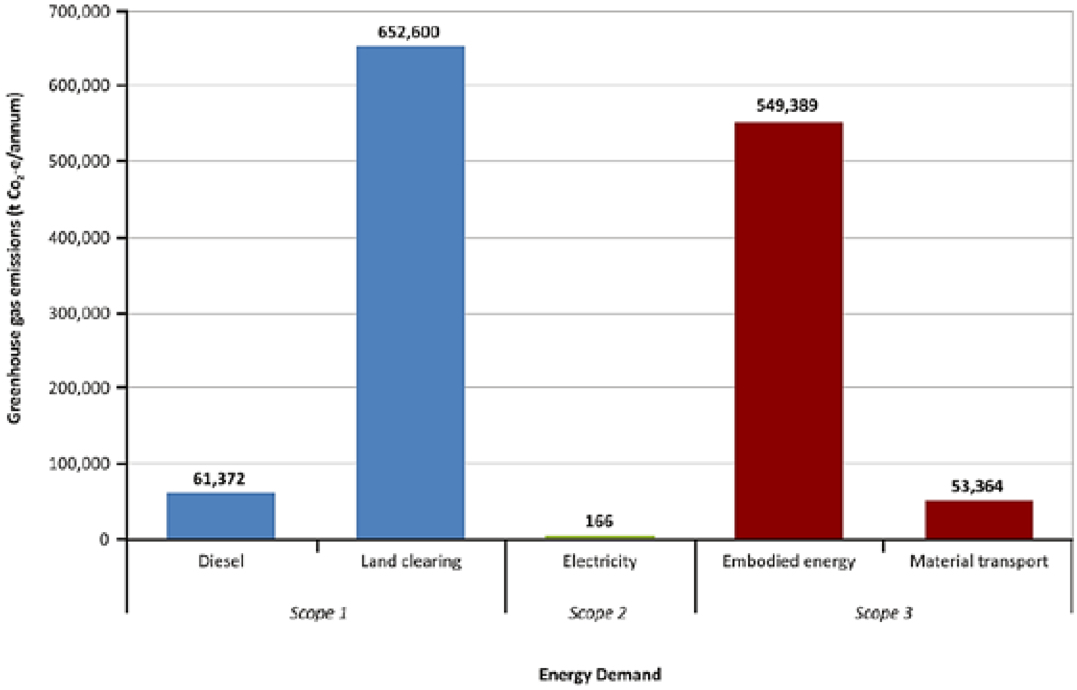


Figure 11-2 CEIP Construction Phase GHG Emissions Summary

Operations Phase

Scope 1, scope 2 and scope 3 emissions will occur as a result of energy use during the Operation phase.

Scope 1 Emissions

Scope 1 emissions will be released through the consumption of liquid fuels (diesel consumption by mobile fleet, and diesel consumption by product transport via rail to port), emissions from the use of explosives, and emissions from switchgear gas leakage.

An estimated 26,200 kL of diesel per annum is expected to be utilised by the mobile fleet during operations resulting in approximate emissions of 70,691 t CO_2-e/annum. Product transport diesel consumption (from the mine to the Port facility via a dedicated rail line) will use approximately 8,640 kL/ annum resulting in approximate emissions of 23,312 t CO_2-e/annum.

Associated emissions from the use of explosives are estimated to be approximately 20,414 CO_2-e per annum.

Based on benchmarking (BHP Billiton 2009), leakage of switchgear gases on-site has been estimated to be 4,800 t, resulting in the emission of approximately 43 t CO_2-e/annum.

Scope 2 Emissions

Scope 2 emissions will be released through the purchase and consumption of electricity from the main electricity grid for operation of the CEIP. The indicative electricity consumption associated with the project is 2,699,300 MWh per annum. It is estimated that emissions associated with energy consumption would be 1,646,573 CO_2-e per annum.

Scope 3 Emissions

Scope 3 emissions have been identified based on guidance provided within the Greenhouse Gas Protocol (World Business Council for Sustainable Development 2004) and include workforce transport (FIFO) and disposal of solid waste.

It is anticipated that solid waste generation, based on the estimated operations work force of 760, will produce associated emissions of approximately 3633 t CO_2-e per annum.

Additional emissions will arise from the FIFO work force transport of approximately 872 t CO_2-e per annum.

Emissions Summary

Summaries of the CEIP annual emissions estimates for the Operational phase are provided in Table 11-8 and shown graphically in Figure 11-3. It is important to consider that this is the peak level of per annum emissions and it is anticipated that emissions will be significantly less than this peak level in most years.

Table 11-8 CEIP Operational Phase GHG Emissions Summary

Energy Demand	Greenhouse Gas Emission (t CO_2-e/annum)
Scope 1	
Mobile fleet diesel	70,691
Product transport diesel	23,312
Switchgear gas leakage	43
Explosives	20,414
Sub-total	114,460
Scope 2	
Purchased electricity	1,646,573
Sub-total	1,646,573
Scope 3	
Solid waste generation[1]	3,633
Workforce transport	872
Sub-total	4,505
Operation phase total	**1,765,538**

[1] Solid waste generation has been calculated to include waste produced during construction given it is an annual, rather than once-off emission.

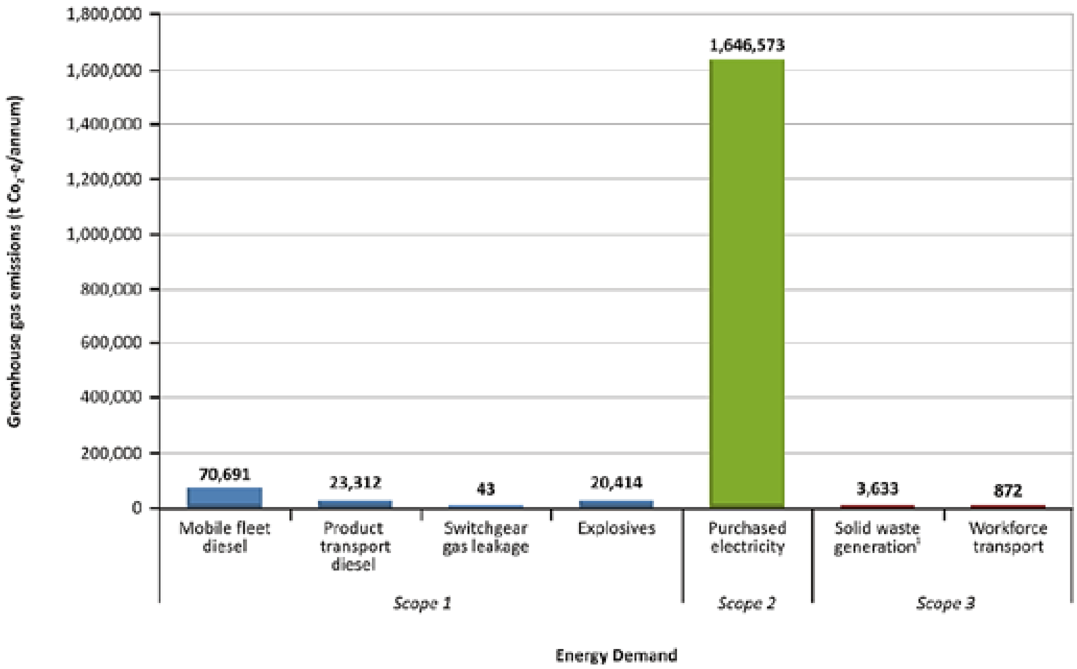


Figure 11-3 CEIP Operational Phase GHG Emission Summary

IRON ROAD

11.4.4 Summary of Impacts: Greenhouse Gas

Estimated emissions from the CEIP have been compared against South Australian, Australian and global current and projected emissions to understand the impact on state, national and global GHG volumes. The generation and/or emission of GHG as a result of the project represent only a small percent of national and global emissions. Regionally, emissions from the project may represent up to 5.9 % of South Australia's contribution to global GHG emissions.

Table 11-9 provides an overview of approximate annual emissions (noting that these are considered a maximum) from the CEIP as a proportion of South Australian, Australian and Global emissions. South Australian, Australian and Global emissions levels for current (2014), 2020 and 2030 are based on 'business as usual' reduction scenarios.

Table 11-9 CEIP Greenhouse as a Proportion of SA, Australian and Global Emissions

Source	Unit	Current	2020	2030
South Australia[1]	CO_2-e (Mt)	29.9	47.8	52.1
	CEIP (%)	5.9	3.7	3.4
Australia[2]	CO_2-e (Mt)	558.8	685	801
	CEIP (%)	0.32	0.26	0.22
Global[3]	CO_2-e (Mt)	42,300	53,800	63,600
	CEIP (%)	Negligible	Negligible	Negligible

[1] Current emissions sourced from Department of the Environment 2014a. 2020 and 2030 emissions projections from ABARE 2007.
[2] Current emissions sourced from Department of the Environment 2014b. 2020 and 2030 emissions projections from Department of the Environment, 2013.
[3] Current emissions referenced to 2010. 2020 and 2030 emissions projections from ABARE 2007.

A summary of the scope 1, scope 2 and scope 3 impacts is provided in Table 11-10. This summary illustrates that all impact events have been demonstrated to have a low level of impact on environmental values.

Table 11-10 Greenhouse Gas Impacts

Impact Event	Comment	Level of Impact
Construction		
Impacts to environmental values from scope 1 GHG emissions associated with construction	Emissions from mobile fleet diesel use and land clearance during construction will contribute to GHG levels in the atmosphere.	Low
Impacts to environmental values from scope 2 GHG emissions associated with construction	Emissions from electricity consumption during construction will contribute to GHG levels in the atmosphere.	Low
Impacts to environmental values from scope 3 GHG emissions associated with construction	Greenhouse gas emissions will be generated from both the embodied emissions present in the steel and concrete and the manufacturing and transport of the steel and concrete from China to the project site.	Low
Operations		
Impacts to environmental values from scope 1 GHG emissions associated with operations	Emissions from mobile fleet diesel use, product transport diesel use, switchgear gas leakage, and explosives, during operations will contribute to GHG levels in the atmosphere.	Low

Impact Event	Comment	Level of Impact
Impacts to environmental values from scope 2 GHG emissions associated with operations	Emissions from electricity consumption during operations will contribute to GHG levels in the atmosphere.	Low
Impacts to environmental values from scope 3 GHG emissions associated with operations	The emission of greenhouse gases through solid waste generation and workforce transport will occur during operations.	Low

Given the estimated volume of annual GHG emissions, the project, once commenced, would trigger the threshold for the legislative instruments associated with the reporting and management of GHG emissions, as described in Table 11-11.

Table 11-11 Reporting Requirements

Legislative Instrument	Summary of Requirements
National Greenhouse and Energy Reporting Act 2007	Requirement to report all relevant scope 1 and scope 2 GHG emissions in accordance with the NGERs framework as a result of the single entity producing greater than 25,000 t of CO_2-e per annum when calculated in accordance with the National Greenhouse and Energy Reporting Measurement of Technical Guidelines.

11.4.5 Control and Management Strategies: Greenhouse gas

Greenhouse gas mitigation will focus on the implementation of processes, systems and equipment that reduce the energy demands associated with construction and operation activities, and aim to reduce the project's GHG footprint.

In addition to meeting Federal reporting requirements, Iron Road, through the establishment of a Climate Change Sector agreement, will work closely with the South Australian Government with the aim of achieving South Australia's emissions reduction targets. This climate change sector agreement would include the following type of commitments:

- Reducing emissions where reasonably practical
- Improving energy efficiency where reasonably practical
- Reducing energy consumption where reasonably practical
- Identifying opportunities to adapt to climate change
- Innovation in technologies or practices
- Promotion of the use of renewable energy where reasonably practical (Government of South Australia 2014)

Plate 11-4 Iron Road will Reduce Emissions where Practicable through the use of Renewable Energy

In order to minimise the project's GHG emissions during construction and operations, the management approaches listed in Table 11-12 will be incorporated into the CEMP and OEMP, which will be implemented following the framework provided in Chapter 24.

Table 11-12 Control and Management Strategies: Greenhouse Gas

Control and Management Strategies	EM ID
Reducing emissions and energy consumption where reasonably practical	
Minimisation of Fuel Consumption and Optimisation · Vehicle speed limits will be managed in accordance with construction traffic management plans and site conditions to mitigate wheel generated dust.	GHG_C1 GHG_C2 GHG_O1
Innovative Material Sourcing · Sourcing of materials that have minimal embodied energy and environmental impact. · Reducing emissions through the sourcing of local materials where practicable. · Sourcing construction rock for the Modular Offloading Facility from reclaimed rock excavated from the site during construction of foundations. · Balancing cut and fill requirements along the infrastructure corridor where practicable during construction to avoid requirement for transportation of additional fill material or waste.	GHG_C3
Land Clearance · Avoiding higher quality native vegetation where practicable.	GHG_C4
Management and Monitoring · Maintenance, inspection and verification requirements for all of the mobile fleet to enhance efficiency and reduce emissions. · Monitoring programme to detect whether CEIP construction and operations are exceeding required emissions levels for the project. · Energy and water audits to be conducted annually once operations have commenced to ensure project efficiencies.	GHG_C2 GHG_O1

Control and Management Strategies	EM ID
Improving energy efficiency and promotion of use of renewable energy where reasonably practical	
Energy Efficiency and Use of Renewable Energy · Energy efficient design elements will be incorporated within the accommodation, administration and workshop facilities to reduce electricity demands (including the use of energy-efficient fixtures, fittings and appliances, and the use of passive solar design elements within the plant and accommodation facilities). · The use of solar hot water systems and solar photovoltaic systems for powering the site administration, accommodation and workshop facilities, where practicable.	GHG_C3 GHG_O2
Opportunities to adapt to climate change	
· Determination of offsets to compensate for residual impacts from the project associated with clearance of vegetation. · Stockpiling of topsoils during operations for subsequent use in rehabilitation activities. · Compensation for vegetation clearance by purchasing regional land for conservation purposes or payment into the Native Vegetation Fund (as part of Significant Environmental Benefit offset, as per requirements of the Native Vegetation Act). · Liaison with local and regional stakeholders to ensure sustainable and viable offsets are selected (e.g. use of local species for vegetation projects that are known to survive under harsh seasonal conditions).	GHG_C5 GHG_O3

11.4.6 Residual Risk Assessment: Greenhouse Gas

This section identifies and assesses GHG risks that would not be expected as part of the normal operation of the CEIP Infrastructure, but could occur as a result of faults, failures and unplanned events. Although the risks may or may not eventuate, the purpose of the risk assessment process is to identify mitigation and management measures required to reduce the identified risks to a level that is ALARP and acceptable to Iron Road, the Government, sensitive receptors and the broader community.

There are two main risk events that have been identified in the residual risk assessment. There is a risk that the predicted levels of emissions during construction and operations are higher than predicted in this chapter; however the consequence of this event would be considered **minor** because the level of emissions will still be a small percentage of state and national emissions. Higher than predicted emissions resulting from the CEIP is considered **unlikely**, since comprehensive project information was available for the impact assessment and the emissions predicted were based on peak emissions scenarios. Therefore the overall risk of this event is considered to be **low**.

There is also a risk that an equipment failure could result in unplanned releases of GHG emissions. This could occur as a result occurrences such as machinery engine faults or failure leading to fire, or an accident during use of explosives. Consequences of this event are considered to be **minor**. The likelihood of this occurring is considered to be **unlikely** given the design standards, safety and operation procedures applied. Therefore the overall risk of this event is considered to be **low**.

Summary of Risks

The key risks to environmental values associated with the project GHG emissions are presented in Table 11-13. Through the adoption of design modification or specific mitigation measures, all identified risks have been reduced to levels of low, which is considered to be ALARP and therefore acceptable. The key risks would be monitored through the CEIP Environmental Management Framework.

Table 11-13 Residual Risk Assessment Outcomes: Greenhouse Gas

Risk Event	Pathway	Receptor	Project Phase	Likelihood	Consequence	Residual Risk
Actual levels of emissions are higher than expected	Scope 1, scope 2 and scope 3 emissions	Greenhouse gas levels in atmosphere	Operations and Construction	Unlikely	Minor	Low
Emissions event from equipment failure/poor performance (e.g. fire)	Unplanned, abnormal or emergency equipment failure	Greenhouse gas levels in atmosphere	Operations and Construction	Unlikely	Minor	Low

11.5 Findings and Conclusion

Climate change is predicted to have a range of consequences, including higher temperatures, less annual rainfall and rising sea levels, which will impact the CEIP Infrastructure. Potential risks to the project as a consequence of climate change include: deterioration of infrastructure (e.g. buckling of railway), loss of power supply, fire destruction/damage to infrastructure or threatening safety of CEIP staff, heat stress and exposure, increased rate of corrosion of marine and coastal infrastructure, reduced water supply, rainfall event exceeding drainage capacity, inundation of coastal/marine infrastructure and wind damage to infrastructure.

Iron Road has undertaken and will undertake a range of design and control and management strategies in order to mitigate the potential impacts of climate change. These include: designing the marine and coastal infrastructure to allow for sea level rise and considering the latest climate change predictions during detailed design (e.g. adopting appropriate rainfall design scenarios, considering wind intensity and frequency, incorporating durable materials and finishes). Residual risks to the CEIP Infrastructure arising from climate change have all been classified as low and medium. Given the level of residual risks, all will be managed as part of Iron Road's standard Environmental Management Framework presented in Chapter 24.

The volume of GHG emissions generated by the CEIP, which includes the emissions associated with all activities undertaken within the proposed mining lease boundary and the infrastructure components, are estimated to be approximately 1,316,891 t of CO_2-e during construction, and 1,765,538 of CO_2-e per annum during operations. It is important to consider that the operations figure of 1,765,538 of CO_2-e per annum is a peak level estimate and it is anticipated that in most years emissions levels will be considerably lower.

The emission of greenhouse gases as a result of the CEIP represents a small percentage of national and global emissions. Regionally, emissions from the CEIP may represent up to 5.9% of South Australia's contribution to global GHG emissions.

Mitigation actions will be taken by Iron Road to ensure GHG emissions are ALARP. This includes design modifications to protect environmental values including: modifications to operational design features; minimisation and optimisation of fuel consumption and minimisation of land clearance.

In order to minimise GHG emissions and risks to environmental values during construction and operations, the CEIP will include management strategies focused on: minimising fuel consumption (for example through a reduction in the size of the truck fleet, optimisation of water balance and blasting techniques); optimising efficiency of plant and equipment; using renewable energy where possible; sourcing recycled material and material that has minimal impact on environmental values; sourcing local materials wherever practicable; generation of offsets to compensate for residual impacts; stockpiling of topsoil to be used in rehabilitation activities; minimising land clearance; and comprehensive monitoring and energy audits to monitor emissions levels.

Iron Road is committed to working with the South Australian Government, through such mechanisms as the Regional Adaptation Plan for the Eyre Peninsula and establishment of a Climate Change Sector Agreement, to achieve South Australia GHG emissions targets.

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