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HEALTH AND SAFETY

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30.1 Introduction

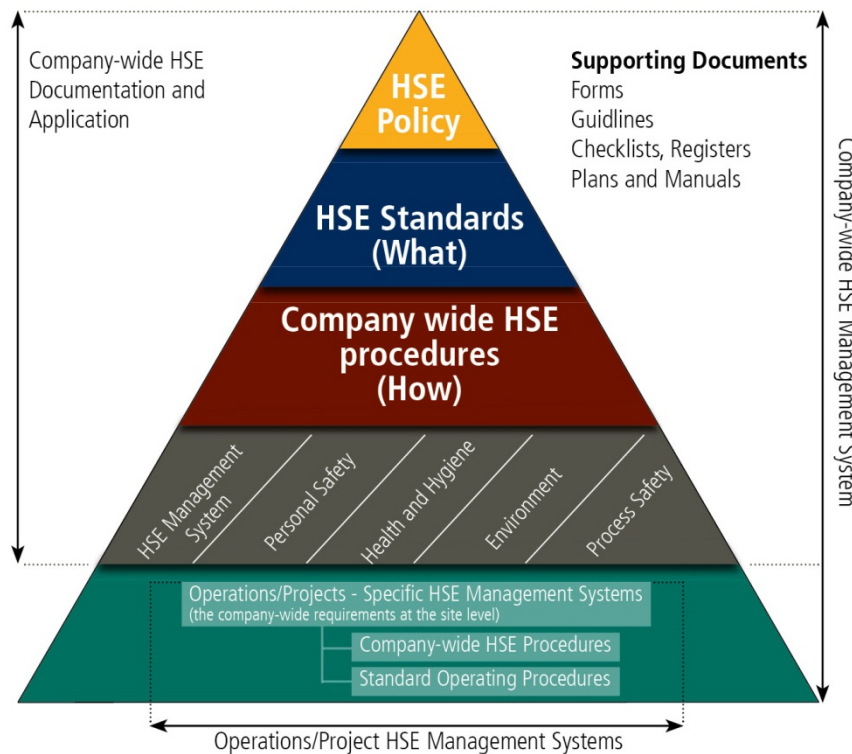
This chapter assesses the health, safety and environment (HSE) issues relevant to the development of the Project. Health and safety issues for construction and operations employees, site visitors and the public are assessed and mitigation measures outlined where appropriate.

A cross reference to the locations where each of the requirements of the ToR has been addressed is given in Appendix B which references both the study chapters (Sections 1 through 34) and/or the Appendices (A through EE).

30.2 Health and Safety Management System

Arrow is committed to providing a safe and healthy workplace for its employees, consultants, contractors, service providers and visitors, and completing the Project with minimal negative impacts to the surrounding environment and communities. HSE risks associated with the development and operation of the Project will be managed under Arrow’s Health Safety and Environment Management System (HSEMS) (Arrow, 2012). The HSEMS hierarchy, depicted in Figure 30-1, consists of policies, standards, procedures, plans, manuals, guidelines, forms, checklists and registers.

Figure 30-1 Arrow HSEMS Document Hierarchy



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The HSEMS sets the foundation for the risk-based approach to management and mitigation of potential HSE impacts through design, construction, operation and management of the Project.

30.2.1 Life Saving Rules

As a component of the HSEMS, Arrow has adopted 12 Life Saving Rules that are associated with activities where non-compliance has the highest likelihood to result in death or serious injury. The rules are:

- Work with a valid work permit when required;
- Conduct gas tests when required;
- Verify isolation before work begins and use the specified life protecting equipment;
- Obtain authorisation before entering a confined space;
- Obtain authorisation before overriding or disabling safety critical equipment;
- Protect yourself against a fall when working at height;
- Do not walk under a suspended load;
- Do not smoke outside designated areas;
- No alcohol or drugs while working or driving;
- While driving, do not use your phone and do not exceed speed limits;
- Wear your seat belt; and
- Follow prescribed Journey Management Plan.

30.2.2 Legislation

The legislation and regulatory requirements relevant to the Project are described in Table 30–1.

Table 30-1 Relevant Legislation, Guidelines and Australian Standards

Relevant Legislation	Requirements	Compliance
<i>Petroleum and Gas (Production and Safety) Act 2004</i> (Queensland)	To facilitate and regulate the carrying out of responsible petroleum activities and the development of a safe, efficient and viable petroleum industry in a way that, among other things, regulates and promotes the safety of persons.	To comply with the safety and technical requirements set out in the act and regulation when performing relevant work.
<i>Work Health and Safety Act 2011</i> (Queensland) Work Health and Safety Regulation 2011 (Queensland)	Sets out the laws about health and safety requirements affecting most workplaces, work activities and the use of plant and substances in Queensland. Seeks to protect the health and safety of everyone at the workplace, while undertaking work activities or using plant and substances.	Adopt health and safety management that provides for risk identification and assessment; hazard analysis, management and control; and reporting. Abide by Queensland regulations and Codes of Practice outlined within legislation.

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Relevant Legislation	Requirements	Compliance
<i>Worker Compensation and Rehabilitation Act 2003</i> (Queensland)	Establishes a workers' compensation scheme for Queensland, providing benefits relating to workplace injuries or fatalities, and insurance for all Queensland-based employers.	Compensate any Arrow employed workers injured on site per the Act. Ensure all contractors are registered for worker compensation.
The Australian Dangerous Goods Code (Commonwealth)	This code lists all provisions applicable to the transport of dangerous goods.	
AS 1940:2004 <i>Storage and handling of flammable and combustible liquids</i>	Sets out requirements for separation and other considerations for storing flammable and combustible liquids.	Undertake storage and handling of flammable and combustible liquids in accordance with the standard.
AS 2436:1981 <i>Guide to noise control on construction, maintenance and demolition sites</i>	Details measures to be implemented to manage noise on construction sites, if required. Measures may also be applicable to mobile plant and equipment during operations.	If required, utilised these measures to address occupational noise levels, or in response to noise complaints.
AS / NZS 3000 <i>Wiring Rules: electrical installations</i>	This standard details the measures to be implemented when conducting electrical installations.	Electrical wiring will be conducted as per the standard.
<i>Transport Infrastructure Act 1994</i> (Queensland)	This Act provides for and encourages effective integrated planning and efficient transport infrastructure management	Adhere to requirements that govern the use of public roads, in accordance with State legislation.
<i>Transport Infrastructure (State Controlled Roads) Regulation 2006</i> (Queensland)	Details traffic regulations and requirements relating to ancillary works and encroachments on state roads.	

30.3 Description of Health, Safety and Environment Values

30.3.1 Overview

The Project is located approximately 850 km north of Brisbane and 150 km south-west of Mackay, Queensland. It is expected to involve the development of up to 6,625 production wells and associated CSG infrastructure over the approximate 40 year Project life.

The Project area is predominantly used for grazing and agricultural land, black coal mining, metals processing, gas development and forestry. The towns of Blackwater and Coppabella are located within the Project area, whilst the urban areas of Glenden, Nebo, Moranbah, Dysart and Middlemount are located within the region, adjacent to the Project area.

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30.3.2 Community Values

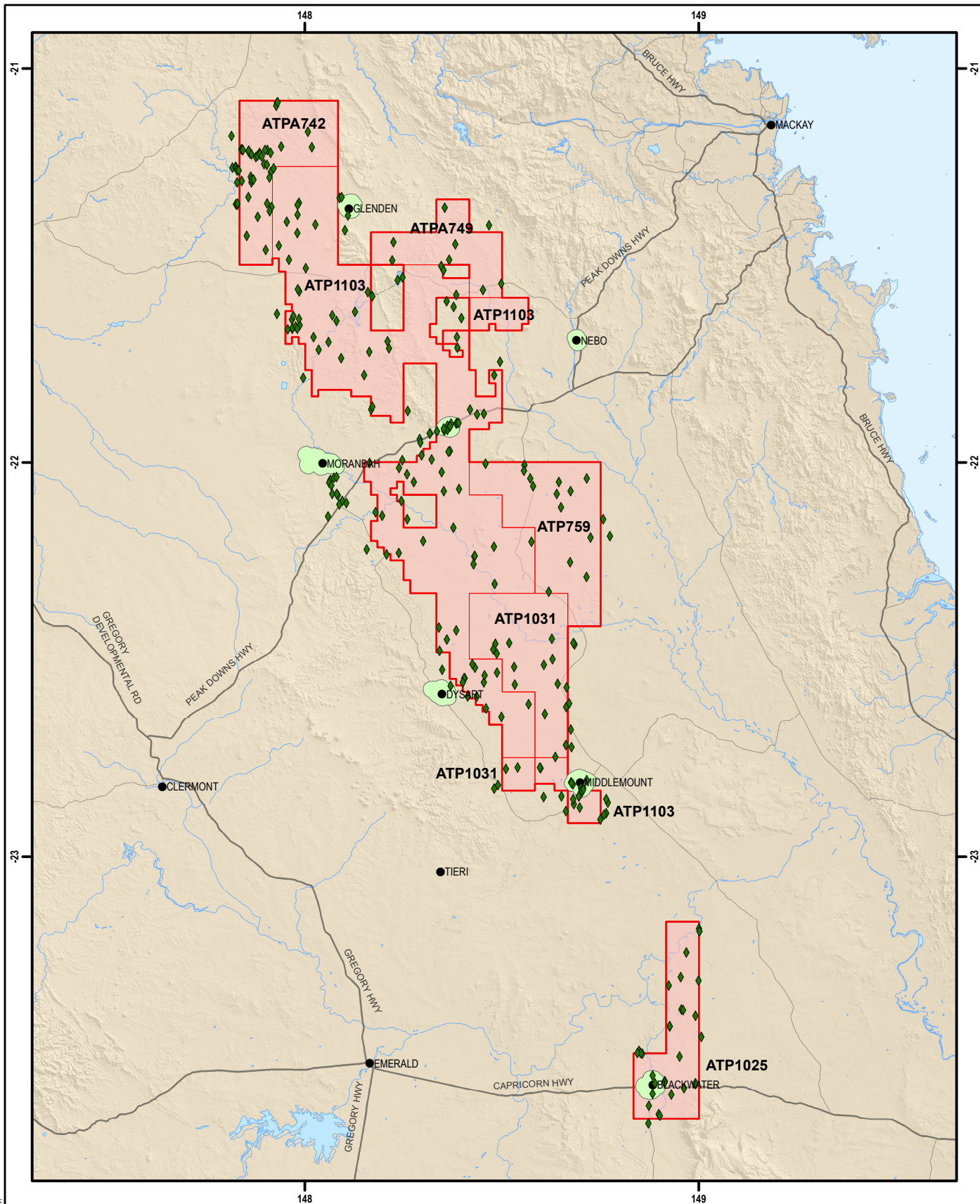
Project infrastructure will be located throughout the development area but not in any of the towns. The towns will be influenced by Project development to different degrees due to the sequence of development over the Project life. Moranbah and Dysart are likely to be the most directly influenced, with most of the major infrastructure and Temporary Worker Accommodation Facilities (TWAFs) to be developed near these towns. Middlemount and Glenden are less likely to be affected despite geographic proximity to the tenements, whereas Nebo could be potentially affected by transportation of construction materials and workforce-related traffic. Current expectations are that construction is not due to commence near Blackwater until 2033, though for example, changes to Project sequencing could bring forward impacts on Blackwater and subsequently delaying impacts on Moranbah and/or Dysart.

The sensitive receptors that may be affected by the Project were determined in a desktop survey and are described in Constraints Mapping (Appendix BB of this EIS). Sensitive receptors in the study area will be ground truthed at a later stage. Figure 30-2 shows the locations of sensitive receptors in the study area.

A Social Impact Assessment undertaken for the Project (see Appendix U of the EIS) found that the existing community values for public health and safety are considered to include, but are not limited to:

- Safe and secure living spaces;
- Healthy outdoor lifestyles and natural environmental values;
- Availability of clean water supplies;
- Access to health and community services;
- Community health and wellbeing; and
- Quality of life.

Further information can be found in the Social chapter (Section 24) and the Social Technical Report (Appendix U) of this EIS.



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0 10 20 40 km
 1:1,500,000
 Projection: Geographic (GDA94)

Bowen Gas Project Tenements

◆ Sensitive Receptor Point Location

Sensitive Receptor Built Up Area

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BOWEN GAS PROJECT EIS

LOCATION OF SENSITIVE RECEIVERS



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Figure: **30-2**

File No: 42626960-g-1092.mxd

Drawn: XL

Approved: DS

Date: 18-10-2012

Rev. A

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30.3.3 Project Workforce

Construction workforce employment period is expected to peak between 2015 and 2022, with a maximum of 1,542 personnel predicted to occur in 2016. From 2022 to 2033, construction workforce numbers will range between approximately 235 and 550. The operational workforce is expected to peak at approximately 610 personnel in 2034, and remain relatively constant thereafter for the Project lifespan.

The majority of construction and operation workforce will be accommodated on-site in TWAFs. These will be constructed at integrated processing facilities (IPFs) central to each development region. It is currently anticipated that four TWAFs will be required over the life of the Project.

Arrow's preference is to provide employment to people sourced locally (within the Bowen Basin regional area); however, due to the high demand by other CSG proponents and low unemployment rates, Arrow recognises that labour will likely need to be sourced from further afield. Project workforce is likely to be a percentage of fly-in / fly-out (FIFO) or drive-in / drive-out (DIDO) workers.

The primary issue for management of health and safety for the Project workforce will be that the work environment and living conditions are safe, clean and sanitary. The potential impacts and mitigation measures to protect health and safety of the Project workforce is described in Section 30.4.2 below.

30.4 Potential Impacts and Mitigation Measures

This section highlights the potential impacts and mitigation measures relevant to health and safety of the local community and the Project workforce. A detailed assessment of the Project-related impacts on the health and safety of the local community, workforce and other stakeholders are presented in Sections 8 to 29 of this EIS, and summarised below.

Implementation of mitigation measures and continued monitoring of the workplace environment will help to protect the health, safety and quality of life of Project employees, contractors and visitors.

30.4.1 Community

Arrow aims to minimise or eliminate adverse impacts on the environment and local community health, safety and well-being, while enhancing regional benefits. Impact management measures will be adopted to minimise potential HSE risks to sensitive receivers. These are outlined in the relevant sections of this EIS, and summarised in Table 30-2.

The Social Impact Management Plan (SIMP) (Appendix V of this EIS) also contains measures to address workforce and public health impacts potentially arising from the Project.

30.4.2 Workforce Health and Safety

In relation to potential risks to health and safety of employees, a high level assessment only is provided. The *Work Health and Safety Act 2011* sets out the laws about health and safety requirements that ensures workplace risk is at an acceptable level. This requires comprehensive

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hazard identification and preparation of health and safety risk management procedures, which are beyond the scope of this study.

The potential risks to the health and safety of Project personnel, along with associated mitigation measures, are presented in Table 30-2. At a minimum, Arrow is committed to ensuring that all personnel are appropriately trained for their roles, and hold appropriate licences, certifications and permits, as required. Further, Arrow will ensure that all staff are trained in the HSEMS, and that this is integrated into the planning of all construction and operation activities. Further information is provided in the HSEMS (Arrow, 2012).

Health and safety of the Project workforce will also be managed using the following tools:

- Safety management plans;
- Safety inspections;
- Job safety and environmental analysis tools;
- Safety audits; and
- Hazard / safety observations.

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Table 30-2 Project Workforce and Public Risk - Potential Impacts and Mitigation Measures

Issues / Potential Impact	Mitigation Measures		EIS Section
	Public Risk	Project Workforce	
Odour	<ul style="list-style-type: none"> Odour was assessed for compliance with the <i>Environmental Protection (Air) Policy 2008</i> (EPP (Air)), and no exceedences were predicted. Putrescible solid waste will be stored in covered containers to prevent odours and removed and disposed of at an off-site location [B398]. Odour associated with hydrogen sulfide from gas flaring and fugitive gas emission is not anticipated to create a nuisance. 		Section 9 – Air Quality Section 28 – Waste Management
Gas vapours -	<ul style="list-style-type: none"> Gas emissions were assessed for compliance with the EPP (Air), and no exceedences were predicted. Given that flaring will be an intermittent activity, URS does not anticipate that potential fugitive emissions resulting from venting and flaring of CSG are likely to create a nuisance issue. Arrow will ensure the use of efficient gas and water separation methods on wellheads, gathering and process facilities to minimise fugitive gas release. 		Section 10 – Greenhouse Gas Emissions
Dust and particulates	<p>Dust and particulate management measures were assessed for compliance with EPP (Air). Potential impact management measures include:</p> <ul style="list-style-type: none"> Dust generated from earthmoving machinery will be controlled by road watering. The land cleared for construction purposes will be kept to the minimum necessary, especially during the drier months of the year. The number and sizes of stockpiles will be kept to minimum. The cleared areas and stockpiles will be progressively rehabilitated through revegetation and/or mulching. Dust suppression shall be undertaken during construction and clearing activities, particularly during high wind conditions. Haul roads and other unsealed areas may be watered to suppress dust. All vehicles and machinery will be fitted with appropriate emission control equipment, maintained frequently and serviced to the manufacturers' specifications. Smoke from internal combustion engines will not be visible for more than 10 seconds. Arrow will maintain a complaints register and assess options for dust mitigation at nearby sensitive receivers, if required. Arrow will monitor air quality at nearby sensitive receivers in accordance with Australian Standards. 		Section 9 – Air Quality

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Issues / Potential Impact	Mitigation Measures		EIS Section
	Public Risk	Project Workforce	
Noise and vibration	<ul style="list-style-type: none"> Noise and vibration levels will be assessed for compliance with the <i>Environmental Protection (Noise) Policy 2008</i> (EPP (Noise)). Where practical, noise and vibration emissions from Project related activities will be mitigated through: <ul style="list-style-type: none"> — site layout; — the use of noise reduction measures such as use of mufflers on equipment, or screening / enclosure / barriers; — using off-site processes to minimise the construction work required at site; — managing times of activities to avoid night works and other sensitive times. Arrow will liaise with nearby sensitive receivers so they can work around specific activities; and — ensuring that machinery or equipment is properly maintained and turned off when not in use. 		Section 22 – Noise and Vibration
	<p>Arrow will maintain a complaints register and assess options for noise and vibration mitigation at nearby sensitive receivers, if required.</p>	<ul style="list-style-type: none"> All personnel working with noise generating equipment will wear appropriate personal protective equipment (PPE) (i.e. earplugs). TWAFs will be designed to include noise mitigation measures such as air-conditioning and double-glazing of windows. 	
Roads and traffic	<ul style="list-style-type: none"> Arrow employees and contractors will be required to comply with Arrow's Safe Driving Requirements (Arrow, 2012) and the Journey Management and Driver Safety Procedure (Arrow, 2012). This will include: <ul style="list-style-type: none"> — carrying out a Journey Management Plan; — complying with all legislative requirements in relation to operating a vehicle; — all Project vehicles and plant will be properly maintained and operated; and — Complying with all state enforced and Arrow site-specific road rules, including: <ul style="list-style-type: none"> — obeying speed limits; — only using 4WD vehicles on unsealed roads; and — adhering to all roadwork signage; and — zero tolerance for drug and alcohol use. All Arrow employees using road travel for carrying out work activities will be competent as per the competency requirements set by the Australian Petroleum Production and Exploration Association (APPEA) in the CSG Driver Competencies Standard. 		Section 21 – Roads and Traffic

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Issues / Potential Impact	Mitigation Measures		EIS Section
	Public Risk	Project Workforce	
	<ul style="list-style-type: none"> All Arrow vehicles will be fitted with an In Vehicle Monitoring System (IVMS) as per the APPEA Guidelines for Light Vehicle Specifications and Driver Competency (see Section 30.4.3). Road closures will be enforced during and after severe rainfall events until assessed and deemed safe for operation. Watering or treatment of unsealed roads will suppress dust, improving visibility. Any roads constructed by Arrow will be graded to an adequate and safe level of operation for heavy and light vehicles, depending on the use of the road. TWAFs will be constructed central to each development region. This will minimise commute times, with an average travel distance of approximately 20 km to 30 km (a maximum of 40 km). This will reduce the risk of fatigue-related incidents to and from the Project site. 		
Visual amenity	<ul style="list-style-type: none"> A large proportion of the landscape within the Project area will have a reasonably high capability to accommodate and visually absorb the majority of changes associated with the Project. Measures to reduce visual impact include: <ul style="list-style-type: none"> — retention of existing vegetation buffers where possible within the Project development area, and re-establishment of vegetation cover on disturbed areas; — management of natural regeneration within the Project development area where possible; — colour selection and finishes for key infrastructure elements within the Project development area; and — lighting design. 	N/A	Section 20 – Landscape and Visual Amenity
Water supplies	<ul style="list-style-type: none"> Potable water for TWAFs will be sourced from treated water produced at IPFs. Consequently, the Project will not adversely impact on the community's access to raw water. Wastewater generated from Project activities will be treated and reused on-site where possible. Treated effluent from the sewage treatment plant will only be discharged for irrigation if it achieves specific water criteria, which will be provided in an Effluent Irrigation Management Plan. Areas of disturbed or exposed soil will be managed to reduce sediment mobilisation and erosion in an effort to minimise surface water runoff during rainfall events and consequent discharge to watercourses, and the potential for airborne dust 		Section 14 – Groundwater Section 15 – Surface Water

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Issues / Potential Impact	Mitigation Measures		EIS Section
	Public Risk	Project Workforce	
	<p>to contaminate private water sources such as rainwater tanks.</p> <ul style="list-style-type: none"> • Implementation of an on-going groundwater monitoring program will provide a method for early detection of potential impacts in the event of leaks, spills or inadequate well installations. Regular maintenance and well testing will also be undertaken. • Sufficient on-site storage will be provided through the application of the relevant guidelines for mine water storage capacity. This limits the risk of uncontrolled discharge of dirty water during significant rainfall events. • Dams will be designed and constructed in accordance with the requirements of the most recent version of the Department of Natural Resources and Mines <i>Manual for Assessing Hazard Categories and Hydraulic Performance of Dams</i>. • All chemical and fuel storage areas will be appropriately bunded in accordance with AS 1940, and refuelling and transfer of fuels and chemicals will occur within bunded areas in accordance with AS 1940 at a distance of greater than 50 m from watercourses. • The following protection measures will be implemented to reduce risk of public and workforce exposure to chemicals used for hydraulic stimulation: <ul style="list-style-type: none"> — worker training and hazard identification; — use of appropriate PPE; — flow back storage pond fencing to prevent entry of livestock; — installation of dam liners and routine dam inspections to prevent releases from flow back storage ponds; and — routine operational and security patrols to prevent trespassing. 		
Waste management	<ul style="list-style-type: none"> • Detailed waste management strategies are outlined in the Waste Management chapter (Section 28 of this EIS) and include clear procedures for minimisation, segregation, storage, handling, transport and treatment of waste materials to avoid direct or indirect impacts on the environment or health of people working on site and the community. • Regulated wastes will be handled, stored and disposed of in accordance with relevant standards and the Environmental Protection (Waste Management) Regulation 2000. • Procedures developed will rely on safe work method statements and Materials Safety Data Sheets (MSDS) to inform workers of the appropriate Health and Safety practices associated with each material used. • Waste receptacles at the TWAF will be collected and cleaned regularly. • Hazardous waste tracking will occur as per legislative requirements. • Sewage will be treated on-site to appropriate levels before reuse for industrial applications on-site. 		Section 28 – Waste Management

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Issues / Potential Impact	Mitigation Measures		EIS Section
	Public Risk	Project Workforce	
	<ul style="list-style-type: none"> Onsite waste monitoring and auditing procedures will be developed. 		
Chemical hazard	<ul style="list-style-type: none"> All dangerous goods will be transported and managed in accordance with requirements of relevant legislation and standards. Only appropriately trained and qualified personnel will be allowed to handle and maintain dangerous goods storage areas. To minimise the hazards during fuel transfer, equipment will be well maintained and operators trained in safe operation and emergency procedures. Approved spill containment and fire-fighting equipment will also be available. Transfers will be done in areas where spills can be contained, should one occur (AS 1940:2004). Leaks of fuel oil from storage tanks will be controlled by appropriate tank design (AS 1692:2006) and bunded areas to contain spills (AS 1940:2004), tank level indicators to monitor levels, and appropriate maintenance to ensure safe and effective operation. Spill kits will be available at appropriate locations. 		Section 27 – Preliminary Hazard and Risk
Food hygiene	N/A	<ul style="list-style-type: none"> Areas involved in the provision, supply or consumption of food, such as meal rooms, will operate in compliance with current food and hygiene legislation. Safety posters regarding personal hygiene will be used throughout the accommodation village meal rooms. 	Section 27 – Preliminary hazard and Risk
Disease vectors	<ul style="list-style-type: none"> On-site water management will limit the potential for increase in disease vectors such as mosquitoes and biting midge species. Control measures to prevent increase in local populations of biting insect species will be contained in a Pest Management Plan within the EM Plan, if required. An on-site health service will be provided for the workforce in TWAFs, and Arrow will liaise with emergency services and Queensland Health during Project planning. The Social Impact Management Plan (Appendix V of this EIS) contains measures to address public health impacts arising from the Project. 	<ul style="list-style-type: none"> It is not expected that the Project area will be exposed to an elevated risk of disease vectors such as mosquitoes, rodents or water-borne diseases. All site personnel will wear appropriate PPE in the field and, where appropriate, use insect repellent and ensure first aid kits (including snake bite kits) are available. Awareness of appropriate hygiene and local dangerous snakes, spiders, etc. will be communicated through staff induction and training. 	Appendix V – SIMP Appendix Z – EM Plan

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Issues / Potential Impact	Mitigation Measures		EIS Section
	Public Risk	Project Workforce	
Security	<ul style="list-style-type: none"> • Prior to being given access to the site, visitors will complete an environmental, health and safety induction. The scope of the induction will reflect the areas that the visitor will be permitted to access. • Induction training will include emergency response techniques. • A security management plan will be developed. 		Section 27 – Preliminary Hazard and Risk
Fire / Explosion	<ul style="list-style-type: none"> • Appropriate fire fighting equipment will be installed. Project workforce will attend fire training and complete fire and evacuation drills. • Storage of flammable materials will be in restricted areas to Australian Standards, with appropriate emergency equipment nearby. 		Section 27 – Preliminary Hazard and Risk

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30.4.3 Arrow Journey Management and In-Vehicle Monitoring System

Arrow is committed to eliminating road traffic accidents involving employees and contractors. In line with the APPEA *Guidelines for Light Vehicle Specifications*, all company supplied and contractor light vehicles will be fitted with an IVMS. The IVMS will integrate with the establishment of Arrow's Journey Monitoring Centre, and in conjunction with Arrow's Journey Management Centre, IVMS will improve Journey Management Planning.

The purpose of IVMS is to reduce the risk of light vehicle accidents to As Low As Reasonably Practicable, with a goal of 'Target Zero'. The IVMS software will provide wireless communication between vehicles and the Journey Monitoring Centre. Vehicle monitoring will aim to reduce serious incidents involving light vehicles by:

- Improving driver behaviour by monitoring common 'at risk behaviours' such as; speeding, harsh braking, harsh acceleration, not wearing a seatbelt;
- Identifying training needs of drivers;
- Decreasing the likelihood of vehicle roll-over incidents through changing driver behaviour;
- Reducing 'at risk' driving behaviours. Driver notification when set parameters are exceeded (harsh acceleration, harsh braking, harsh cornering and sustained over-speed);
- Using this information to assist in safety promotion, driver training and emergency response; and
- Improving response time for light vehicles involved in accidents / incidents with the use of the panic switch.

IVMS trained personnel will be available for support and will also monitor reports on a weekly basis to assist supervisors in identifying areas for individual improvement.

30.5 Continuous Monitoring

In compliance with the HSE Systems Review Management Standard, annual monitoring will be undertaken to assess whether the Project's HSE measures are being implemented and are effective. Monitoring will involve the compilation of information acquired from reporting of near misses, incident reports and any health surveillance data (e.g. sickness).

30.6 Emergency Management

Arrow will establish and maintain regional emergency response systems and plans in consideration of controlled, uncontrolled and emergency situations arising from natural events such as bushfire, flood and extreme storms. These will be established as per the HSE Management Standards (Arrow, 2012), and be prepared consultation with relevant regional emergency service providers, including Queensland Police Service, Queensland Fire and Rescue Service, and Queensland Ambulance Service, with support from Emergency Management Queensland.