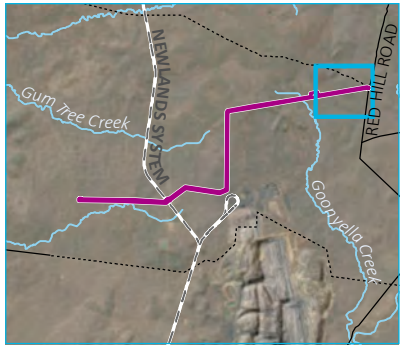


KEY

- Project area
- Electrical transmission line
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP002 EVNTsurvevrecords 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

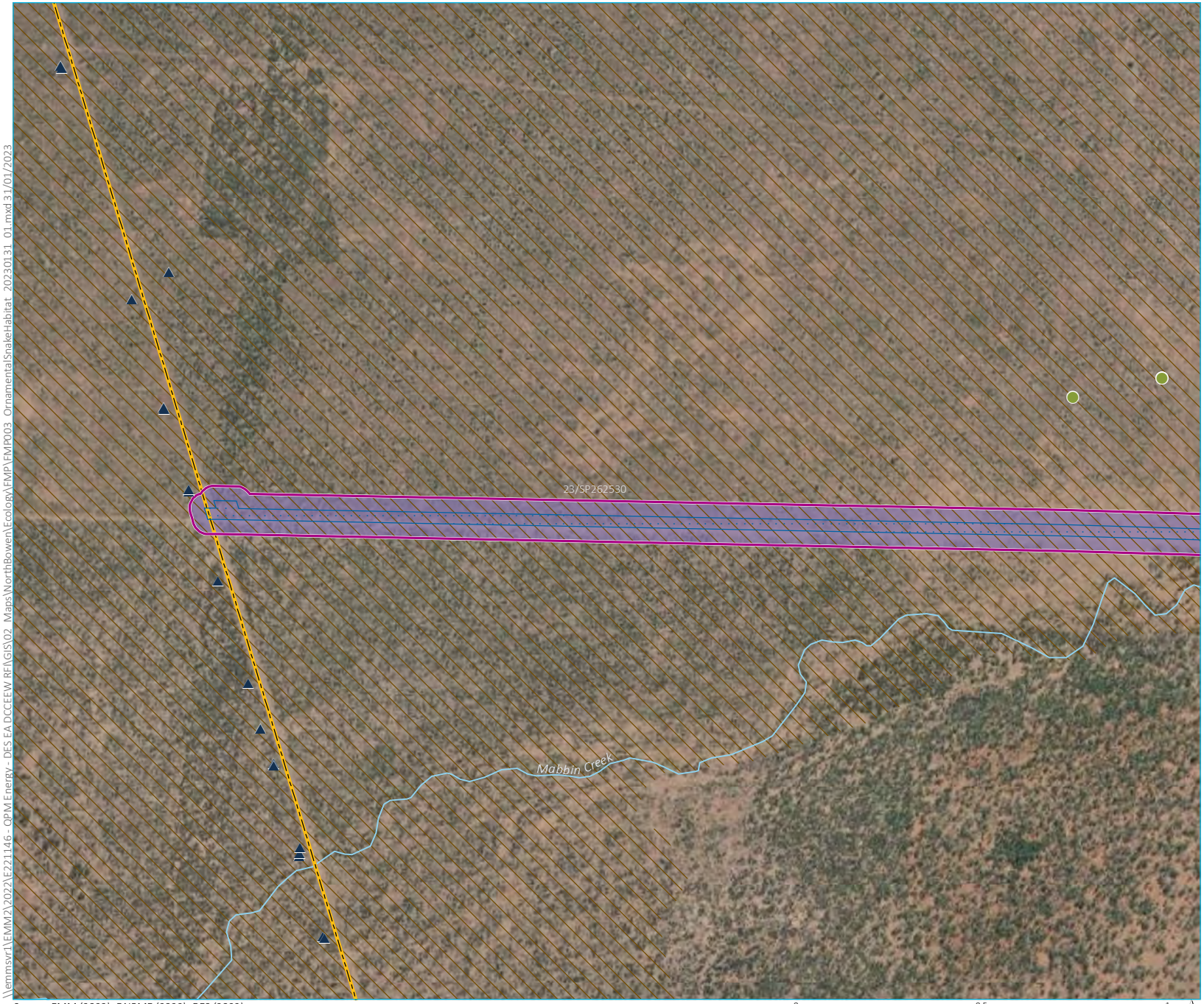
GDA 1994 MGA Zone 55

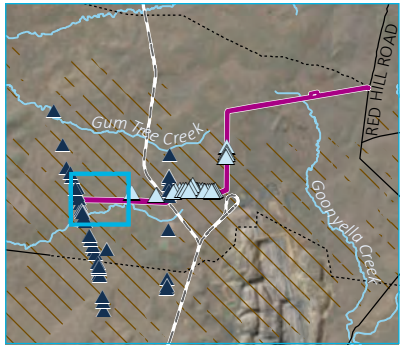
N

EMM threatened species records within the project area
Map 6 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.1

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- North Queensland Gas Pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary
- Preclear land zone 4
- Frog sighting (EMM)

Ornamental Snake records

- EMM
- Wildnet

Ornamental Snake habitat

- Preferred

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

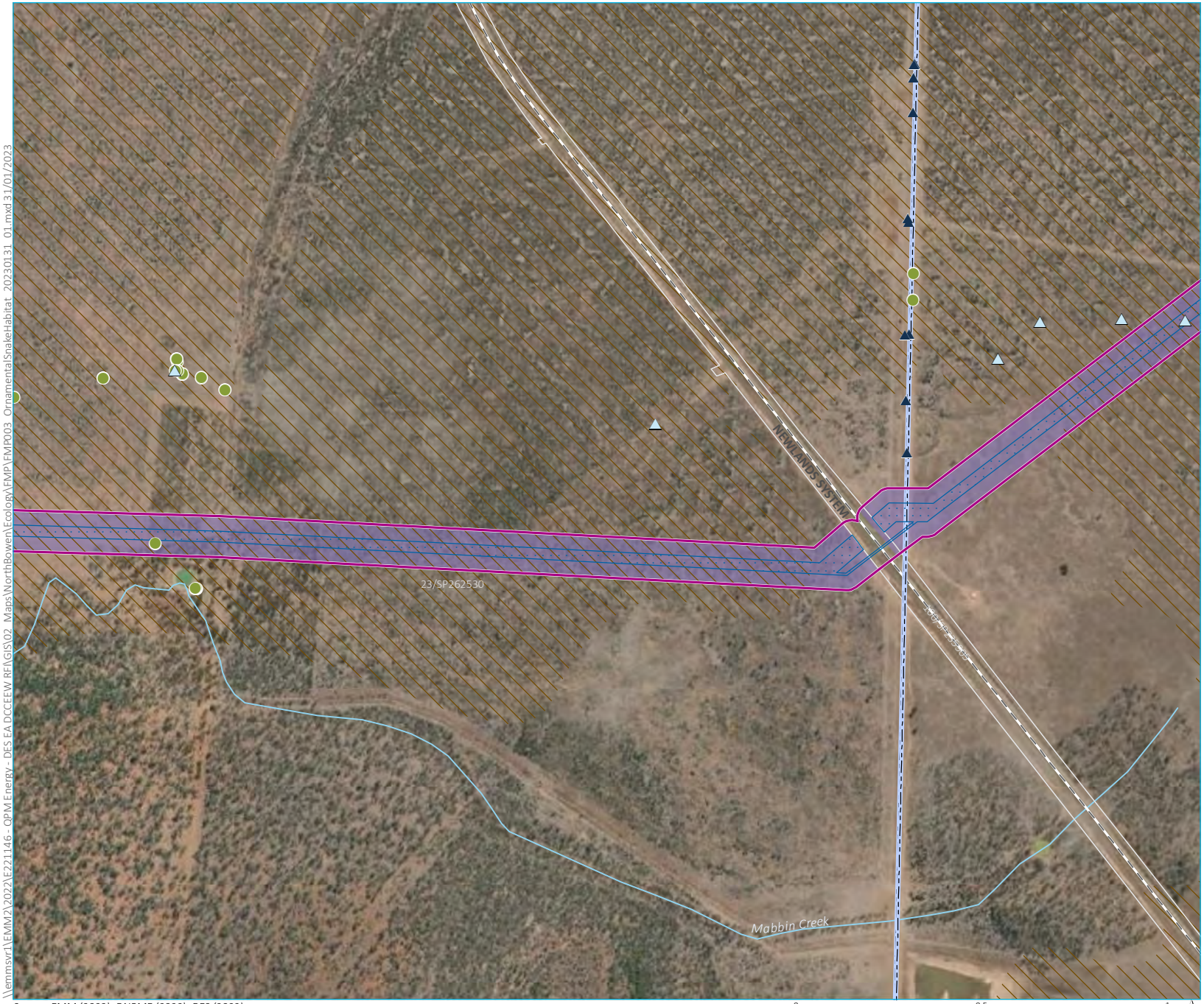
N

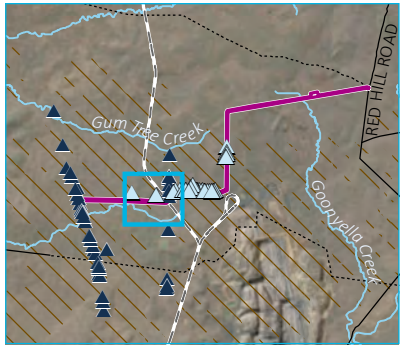
\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP003 OrnamentalSnakeHabitat 20230131 01.mxd 31/01/2023

Ornamental Snake habitat within the project area Map 1 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.2

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary
- Preclear land zone 4
- Frog sighting (EMM)

Ornamental Snake records

- EMM
- Wildnet

Ornamental Snake habitat

- Preferred

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

GDA 1994 MGA Zone 55

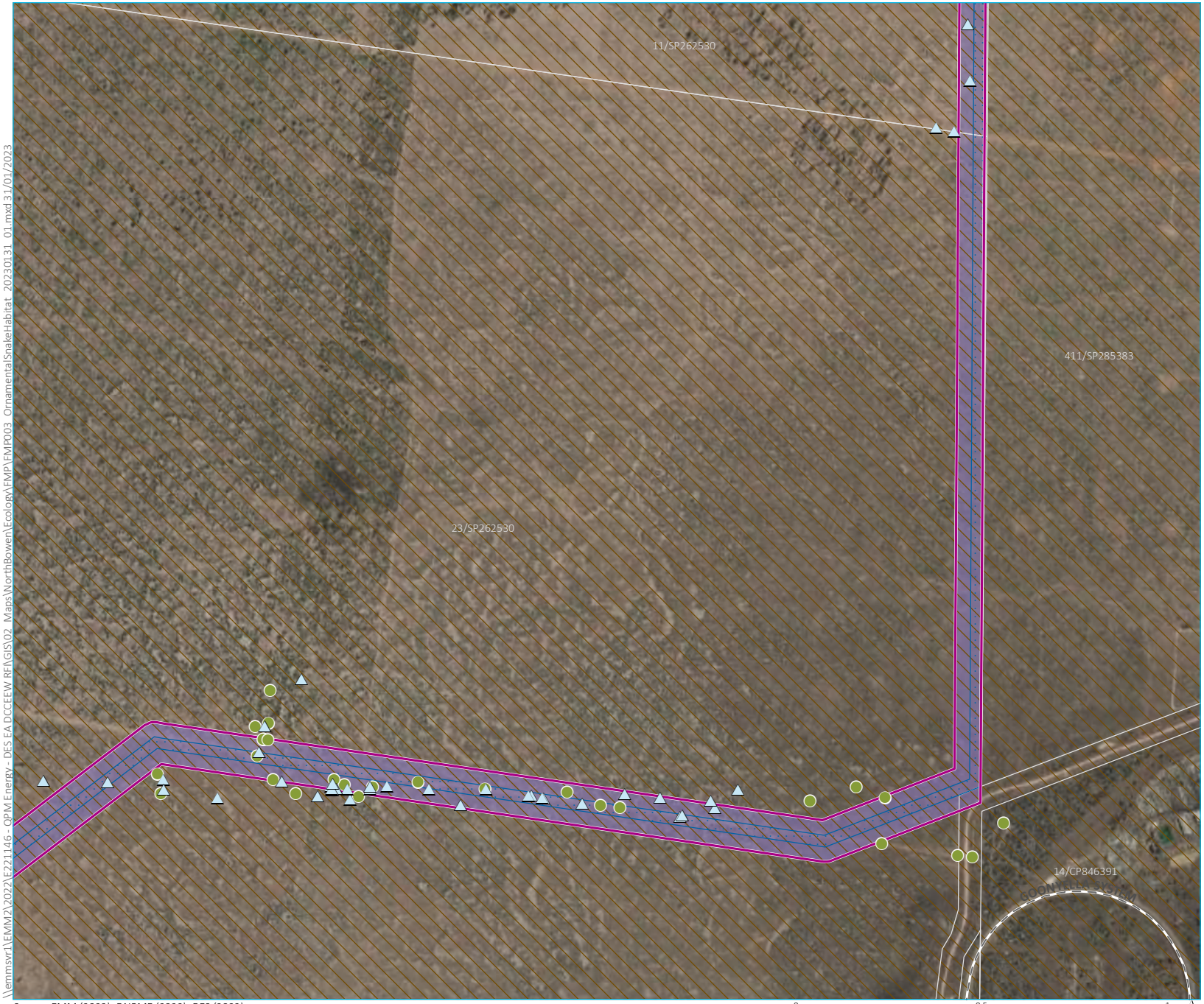
N

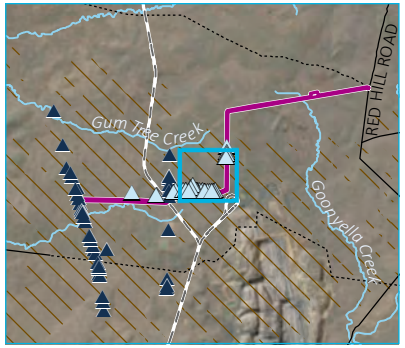
\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP003 OrnamentalSnakeHabitat 20230131 01.mxd 31/01/2023

Ornamental Snake habitat within the project area Map 2 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.2

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary
- Preclear land zone 4
- Frog sighting (EMM)

Ornamental Snake records

- EMM
- Wildnet

Ornamental Snake habitat

- Preferred

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP003 OrnamentalSnakeHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

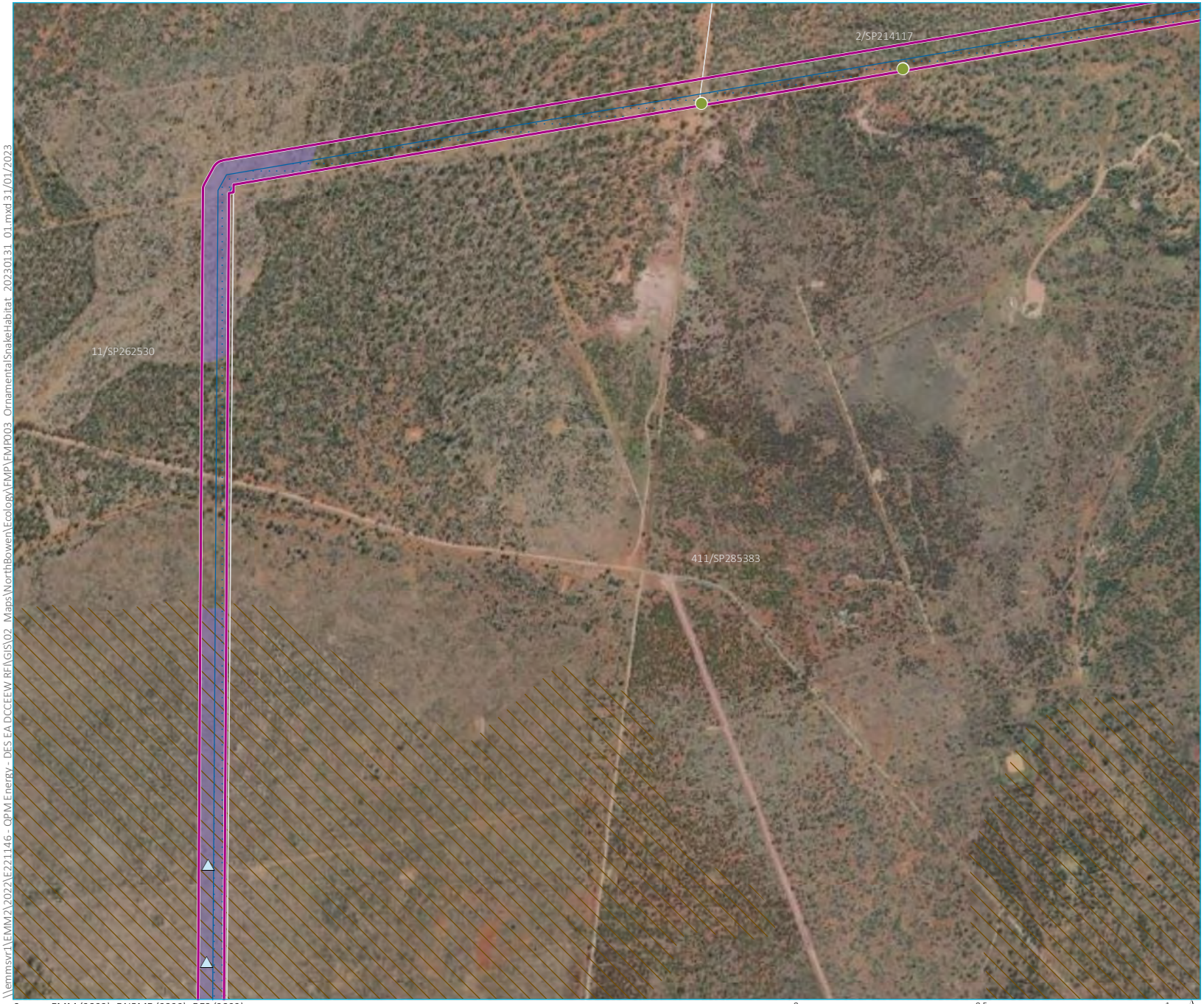
GDA 1994 MGA Zone 55

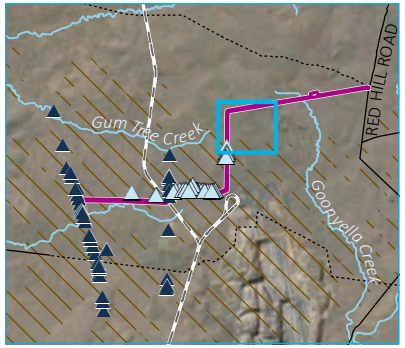
N

Ornamental Snake habitat within the project area Map 3 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.2

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary
- Preclear land zone 4
- Frog sighting (EMM)

Ornamental Snake records

- EMM
- Wildnet

Ornamental Snake habitat

- Preferred
- Connectivity

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP003 OrnamentalSnakeHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

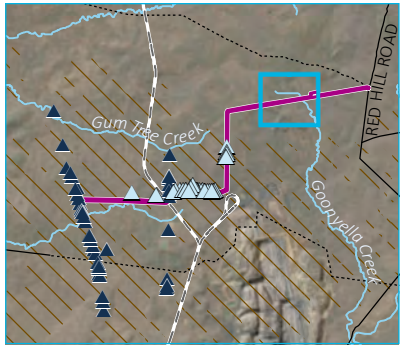
GDA 1994 MGA Zone 55

N

Ornamental Snake habitat within the project area Map 4 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.2

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary
- Preclear land zone 4
- Frog sighting (EMM)

Ornamental Snake records

- EMM
- Wildnet

Ornamental Snake habitat

- Connectivity

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP003 OrnamentalSnakeHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

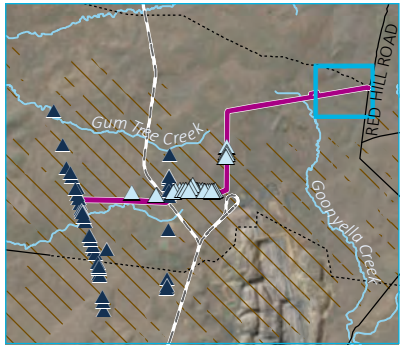
GDA 1994 MGA Zone 55

N

Ornamental Snake habitat within the project area Map 5 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.2

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Electrical transmission line
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary
- Preclear land zone 4
- Frog sighting (EMM)

Ornamental Snake records

- EMM
- Wildnet

Ornamental Snake habitat

- Connectivity

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP003 OrnamentalSnakeHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

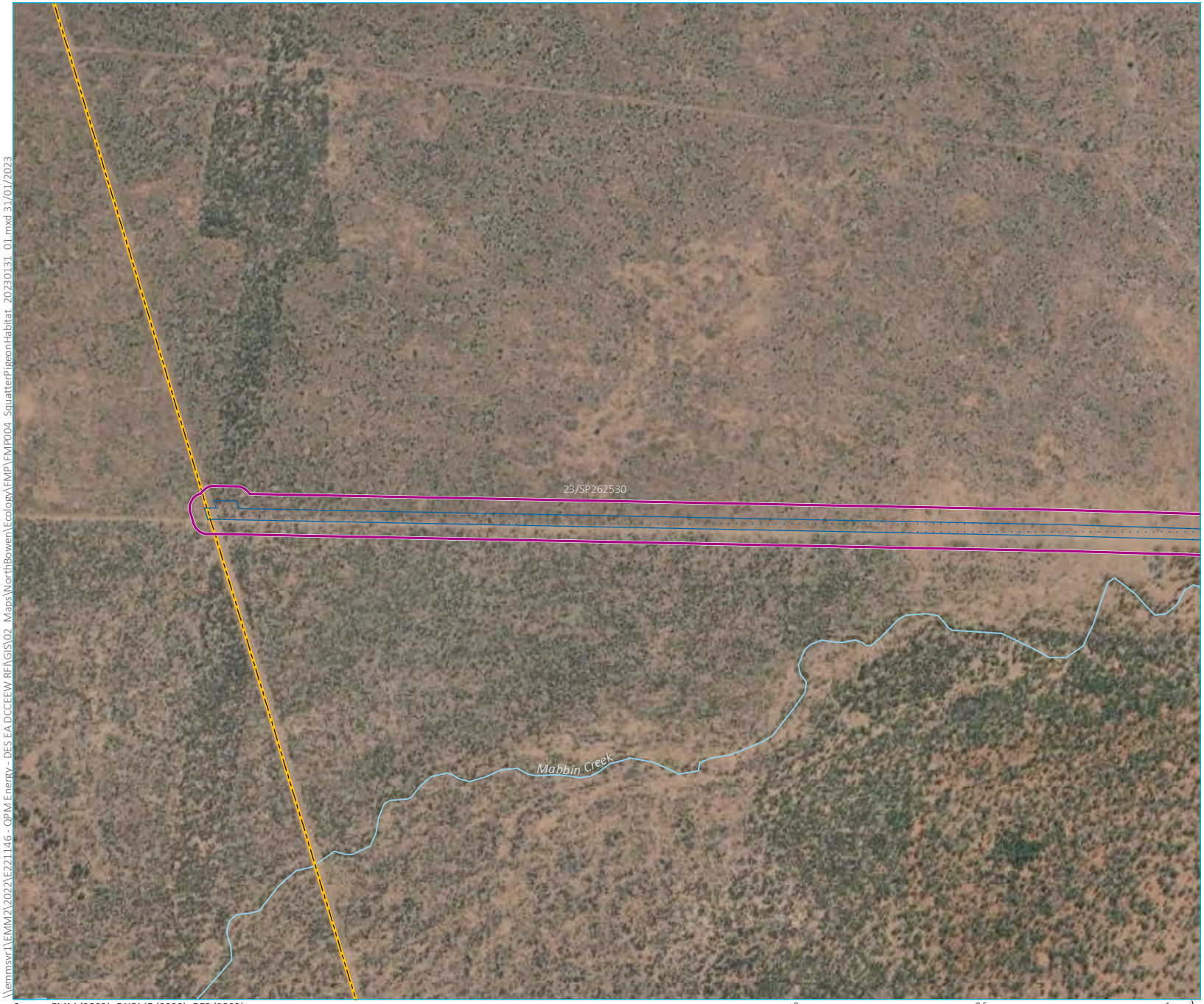
GDA 1994 MGA Zone 55

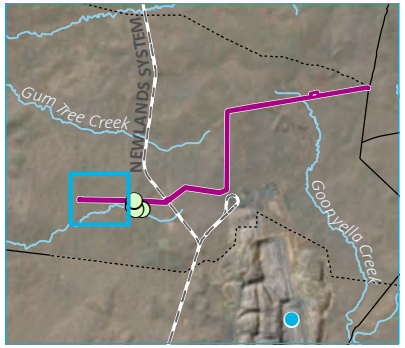
N

Ornamental Snake habitat within the project area Map 6 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.2

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- North Queensland Gas Pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Squatter Pigeon records

- EMM
- Wildnet

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP004 SquatterPigeonHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 km

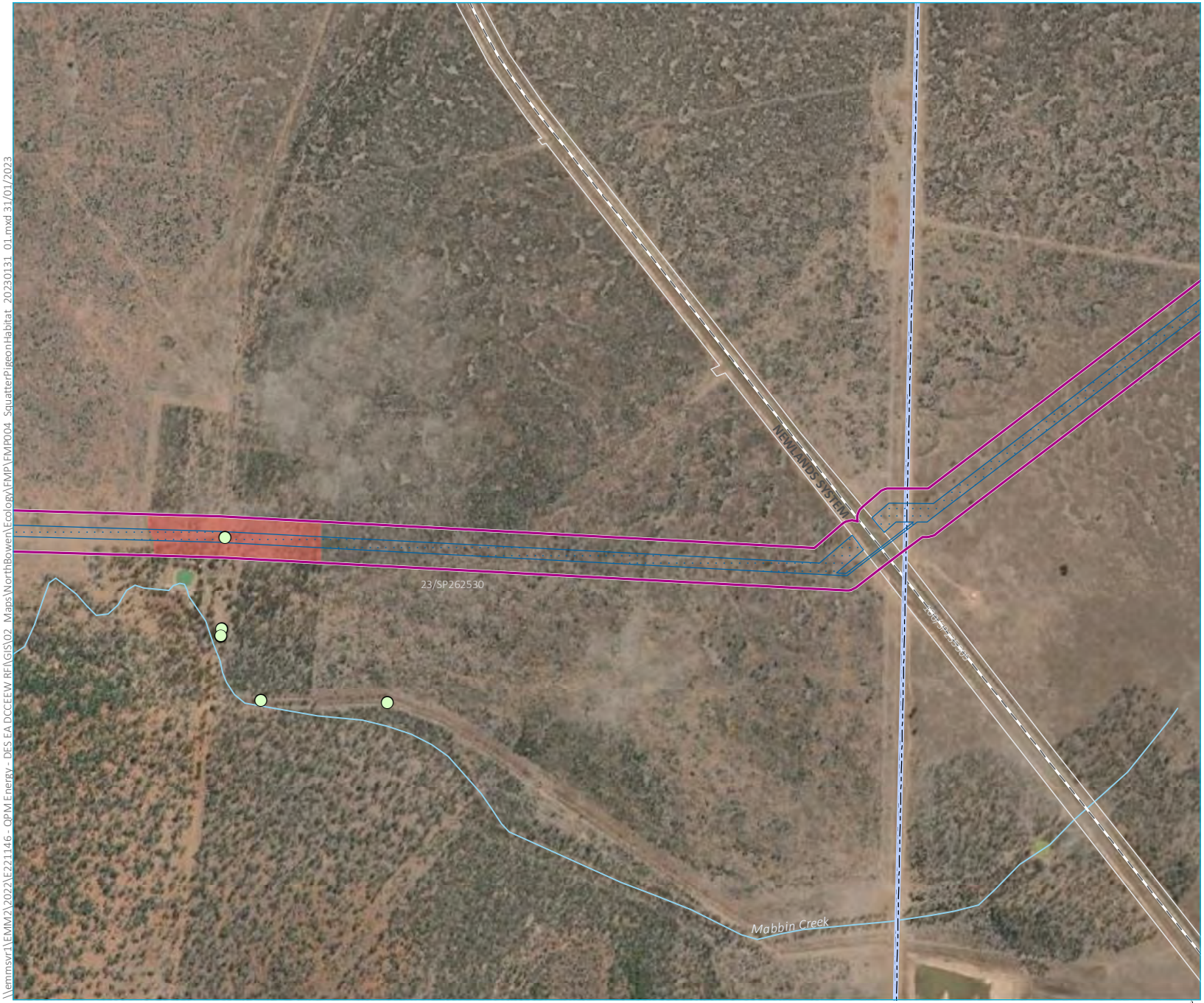
GDA 1994 MGA Zone 55

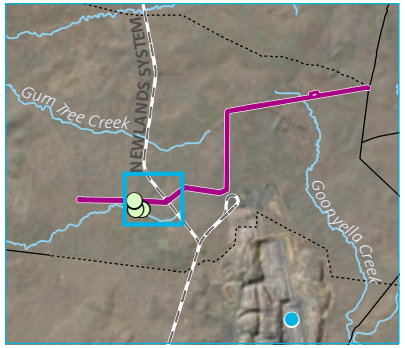
N

Squatter Pigeon habitat within the project area Map 1 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.3

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Squatter Pigeon records

- EMM
- Wildnet

Squatter Pigeon habitat

- Breeding

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP004 SquatterPigeonHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 km

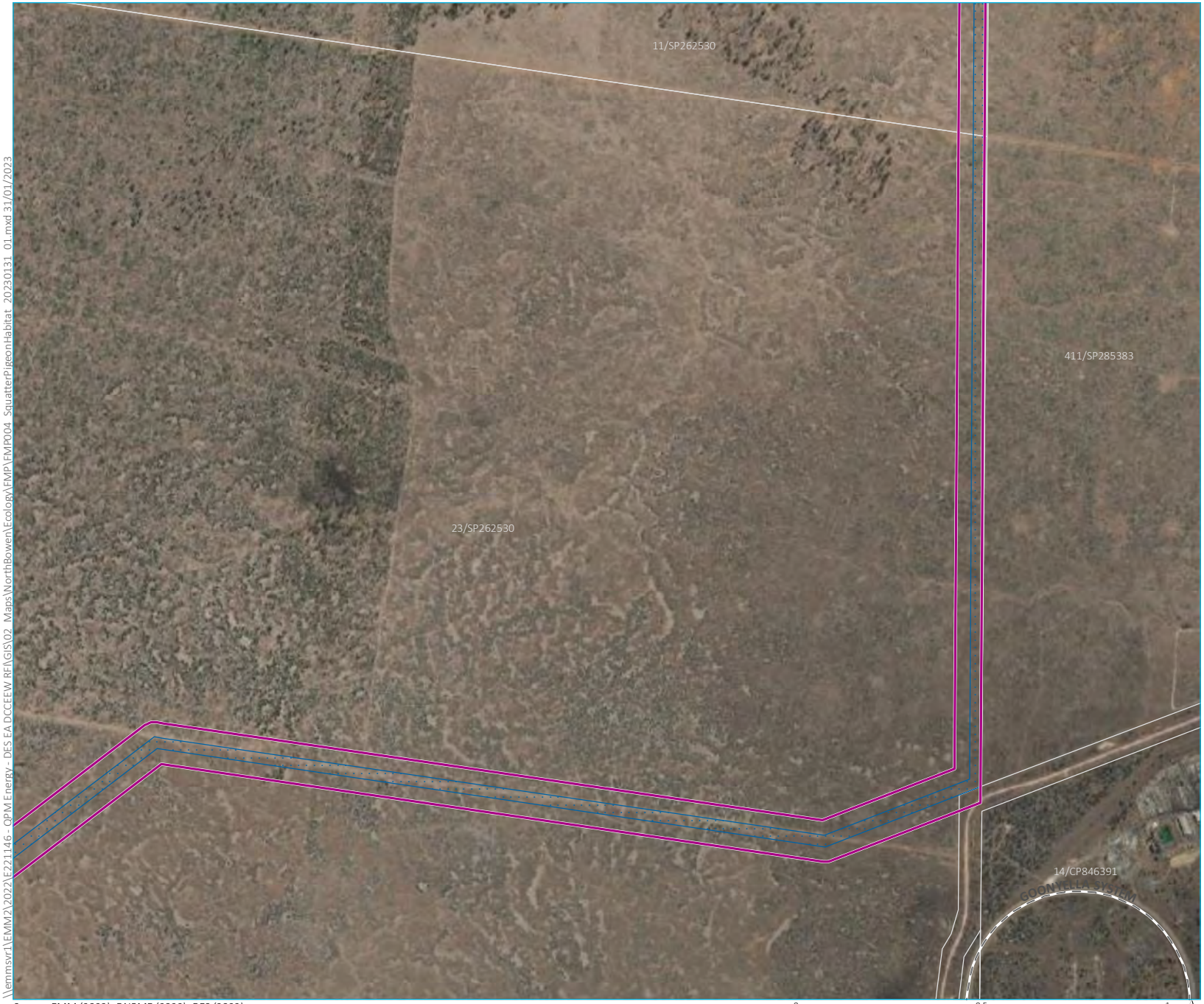
GDA 1994 MGA Zone 55

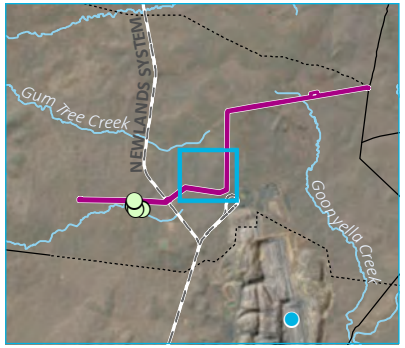
N

Squatter Pigeon habitat within the project area Map 2 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.3

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary

Squatter Pigeon records

- EMM
- Wildnet

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP004 SquatterPigeonHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

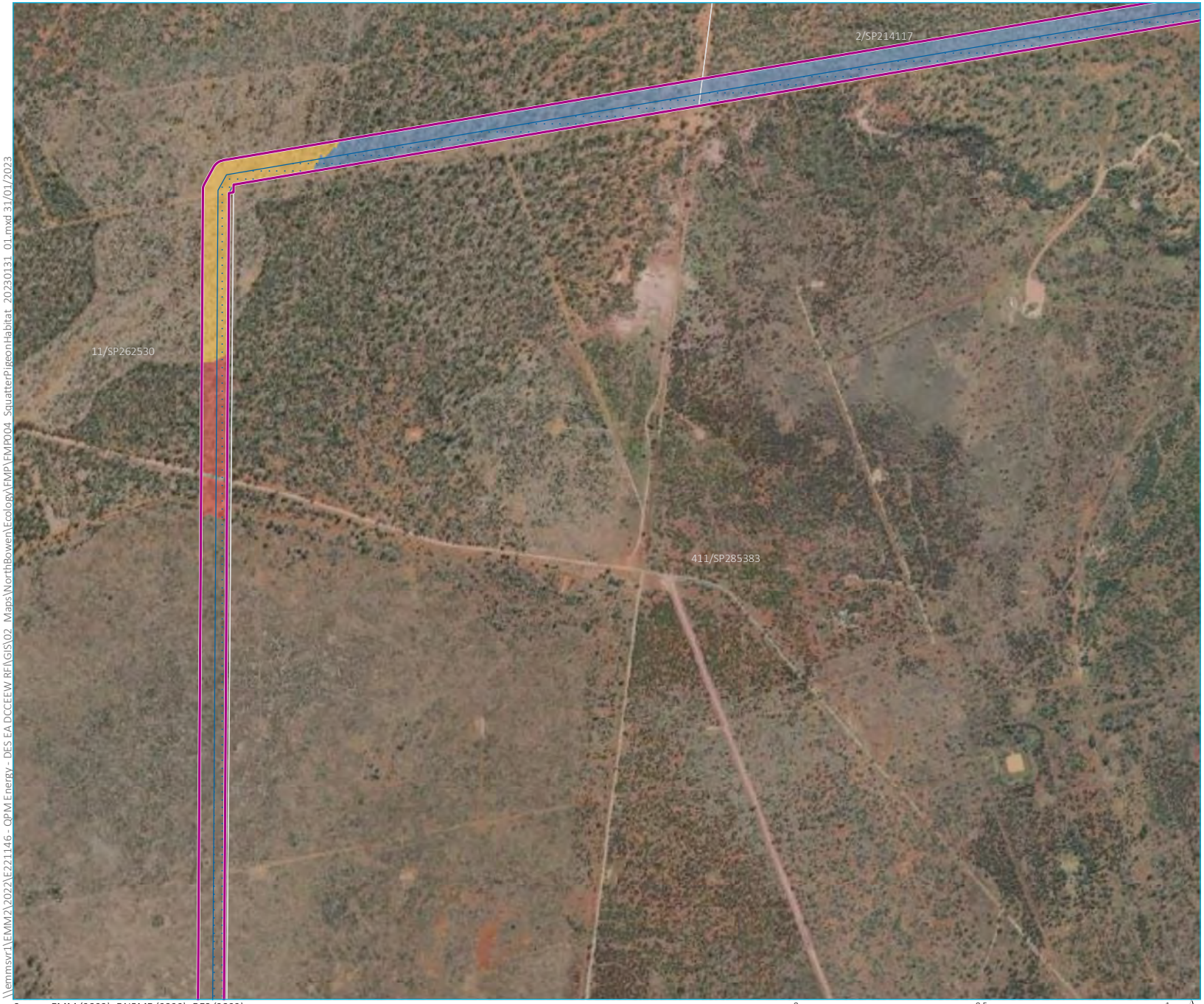
GDA 1994 MGA Zone 55

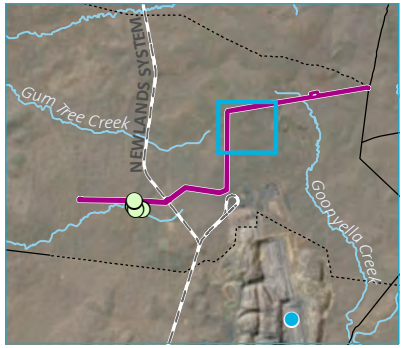
N

Squatter Pigeon habitat
within the project area
Map 3 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.3

EMM
creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary

Squatter Pigeon records

- EMM
- Wildnet

Squatter Pigeon habitat

- Breeding
- Foraging
- Dispersal

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

GDA 1994 MGA Zone 55

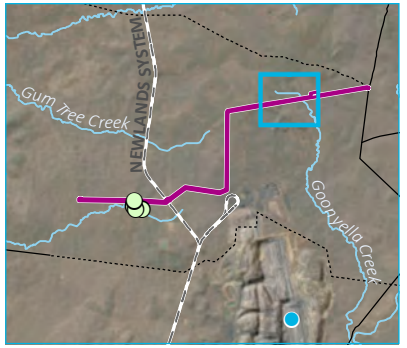
N

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP004 SquatterPigeonHabitat 20230131 01.mxd 31/01/2023

Squatter Pigeon habitat within the project area Map 4 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.3

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Squatter Pigeon records

- EMM
- Wildnet

Squatter Pigeon habitat

- Breeding
- Foraging

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

GDA 1994 MGA Zone 55

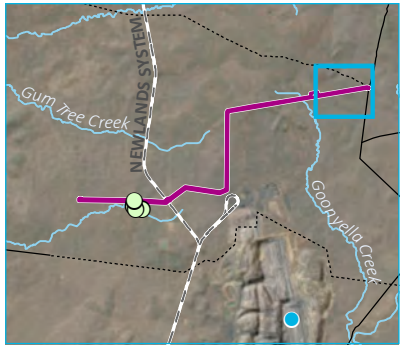
N

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02_Maps\NorthBowen\Ecology\FMP\FMP004_SquatterPigeonHabitat_20230131_01.mxd 31/01/2023

Squatter Pigeon habitat within the project area Map 5 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.3

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Electrical transmission line
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Squatter Pigeon records

- EMM
- Wildnet

Squatter Pigeon habitat

- Breeding
- Foraging

Source: EMM (2023); DNRME (2022); DES (2022)

0 0.5 1 m

GDA 1994 MGA Zone 55

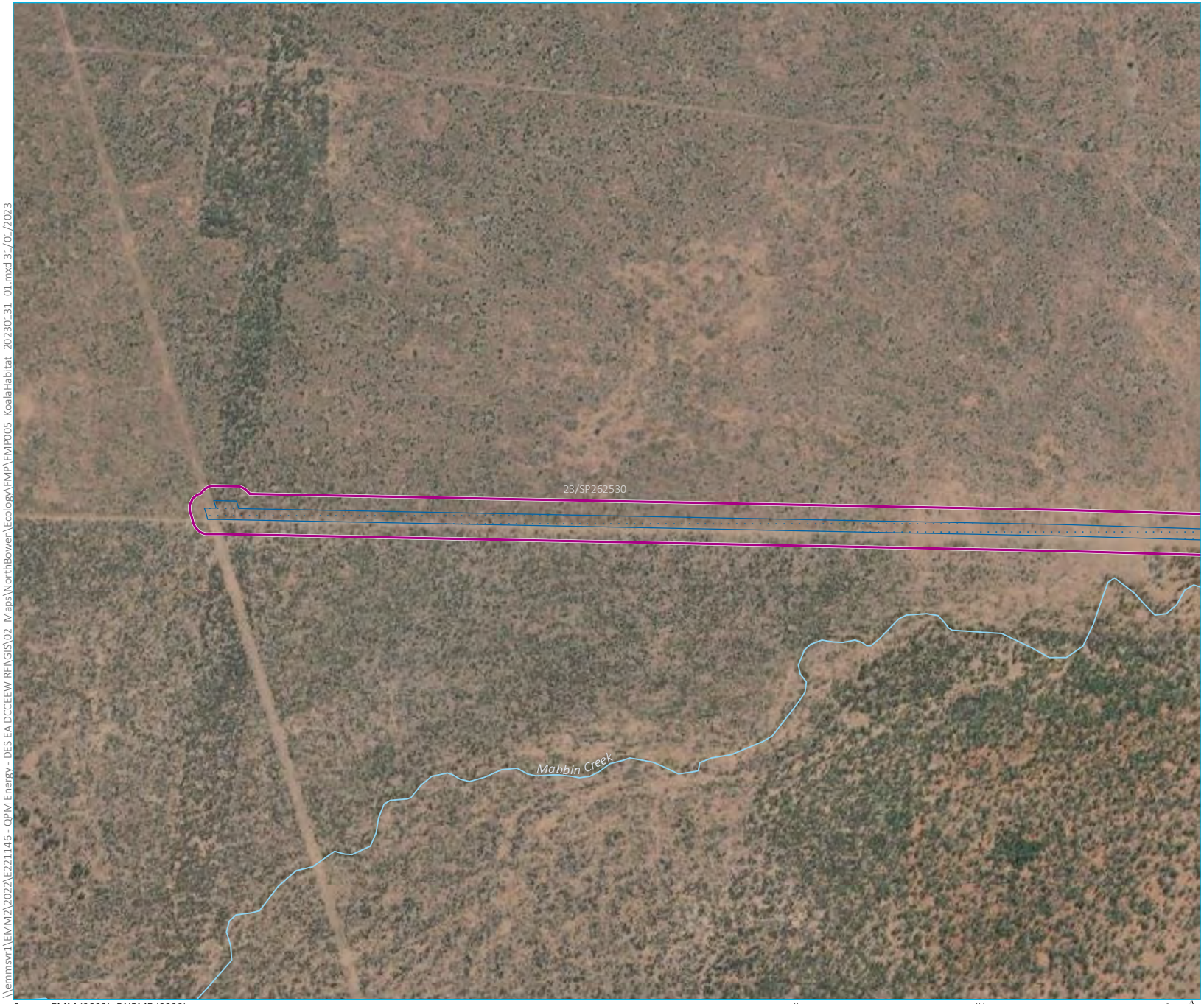
N

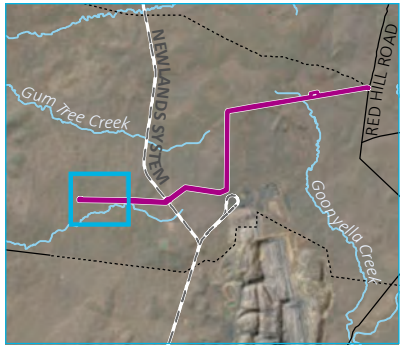
\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP004 SquatterPigeonHabitat 20230131 01.mxd 31/01/2023

Squatter Pigeon habitat within the project area Map 6 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.3

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

GDA 1994 MGA Zone 55

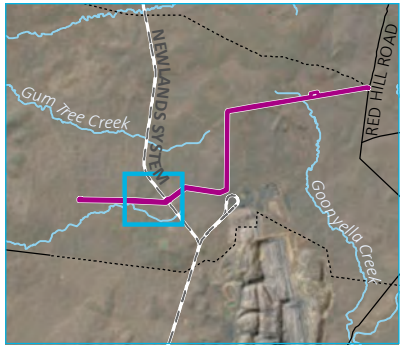
N

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP005 KoalaHabitat 20230131 01.mxd 31/01/2023

Koala habitat within the project area Map 1 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.4

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

GDA 1994 MGA Zone 55

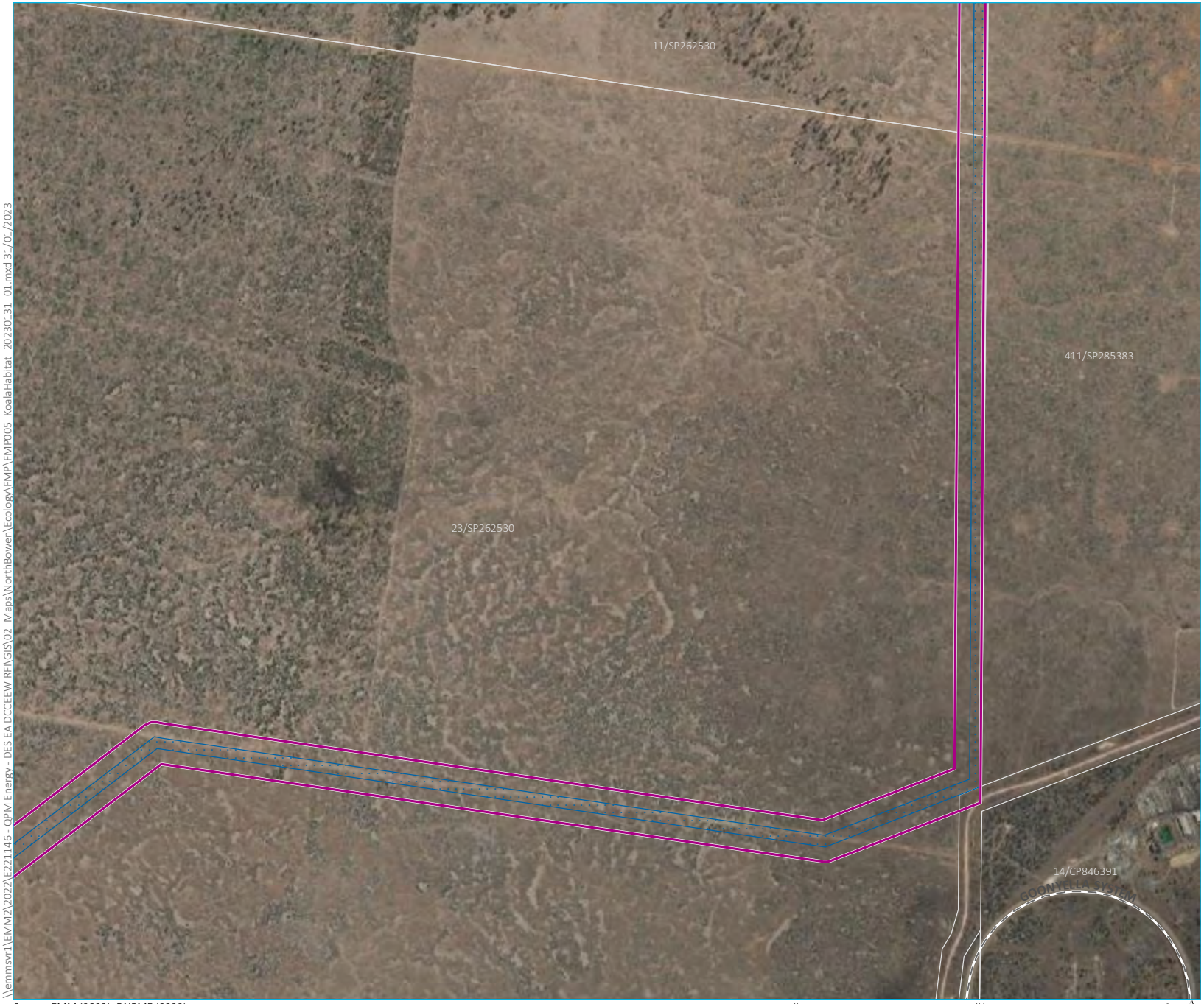
N

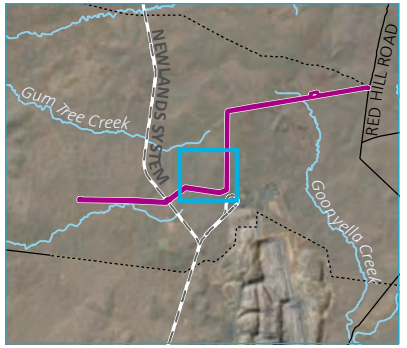
\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP005 KoalaHabitat 20230131 01.mxd 31/01/2023

Koala habitat
within the project area
Map 2 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.4

EMM
creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP005 KoalaHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

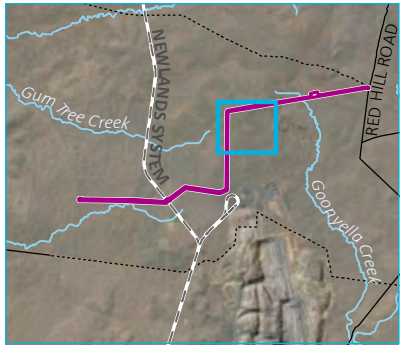
GDA 1994 MGA Zone 55

N

Koala habitat within the project area Map 3 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.4

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary
- Potential Koala habitat

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP005 KoalaHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

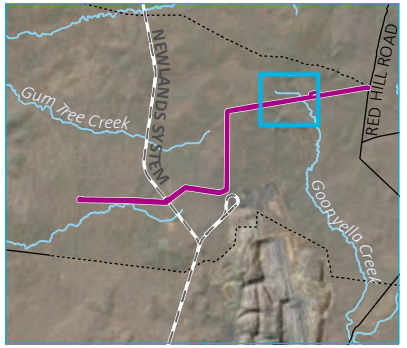
GDA 1994 MGA Zone 55

N

Koala habitat
within the project area
Map 4 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.4

EMM
creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary
- Potential Koala habitat

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP005 KoalaHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022)

0 0.5 1 km

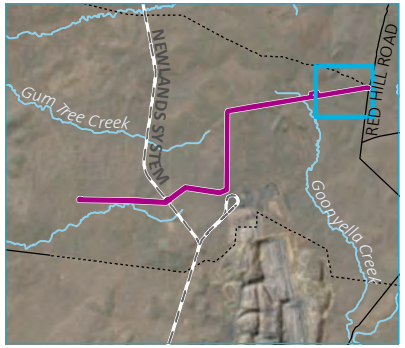
GDA 1994 MGA Zone 55

N

Koala habitat within the project area Map 5 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.4

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\FMP\FMP005 KoalaHabitat 20230131 01.mxd 31/01/2023

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

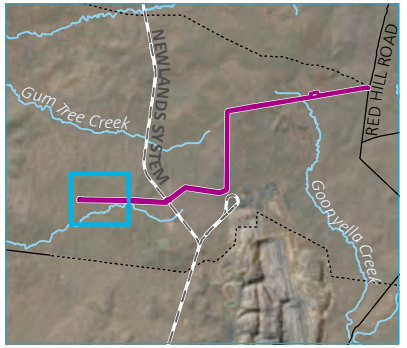
GDA 1994 MGA Zone 55

N

Koala habitat within the project area Map 6 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.4

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- North Queensland Gas Pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary
- Potential Latham's Snipe habitat

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Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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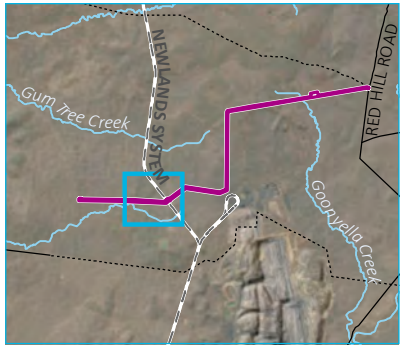
Latham's Snipe habitat within the project area Map 1 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.5

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary
- Potential Latham's Snipe habitat

Latham's Snipe habitat
within the project area
Map 2 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.5

Source: EMM (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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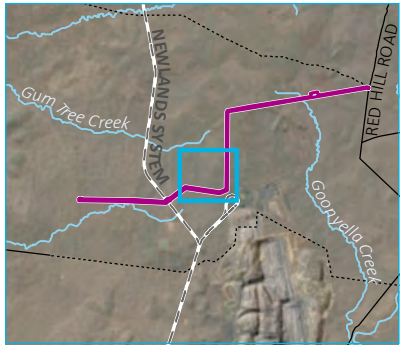
creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary
- Potential Latham's Snipe habitat

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Source: EMM (2023); DNRME (2022)

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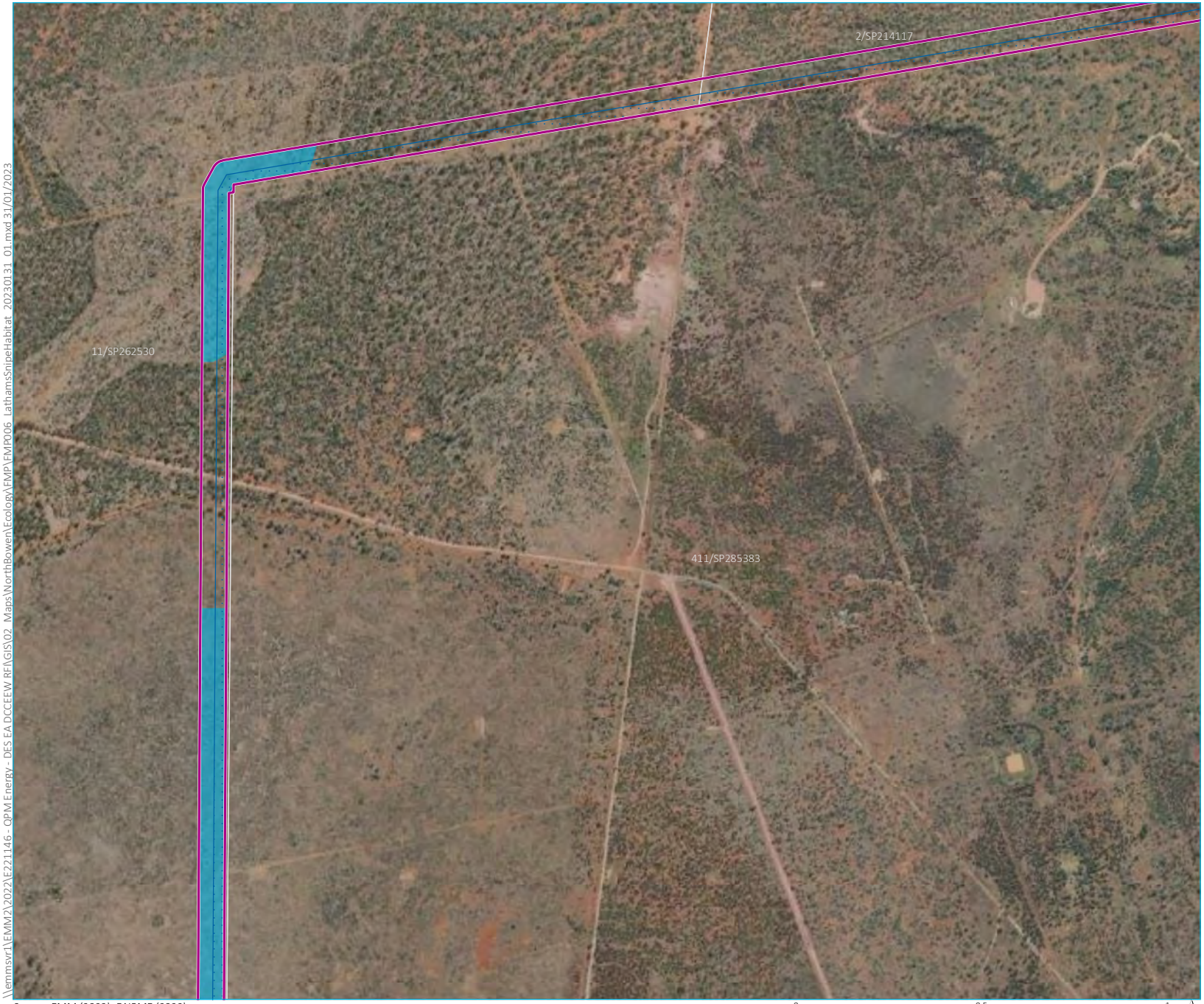
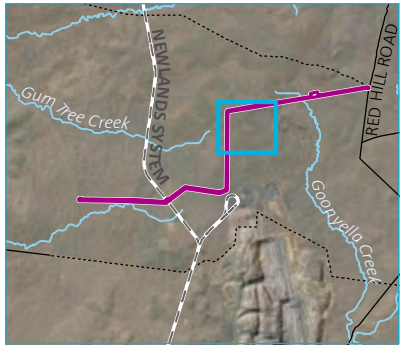
Latham's Snipe habitat within the project area
Map 3 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.5

EMM creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary
- Potential Latham's Snipe habitat

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Source: EMM (2023); DNRME (2022)

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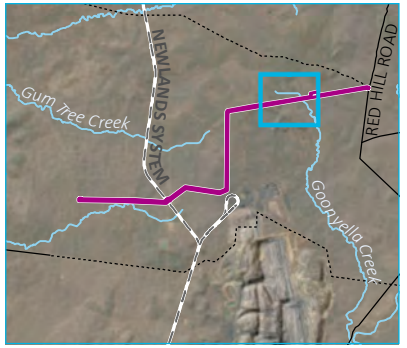
Latham's Snipe habitat within the project area Map 4 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.5

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

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Source: EMM (2023); DNRME (2022)

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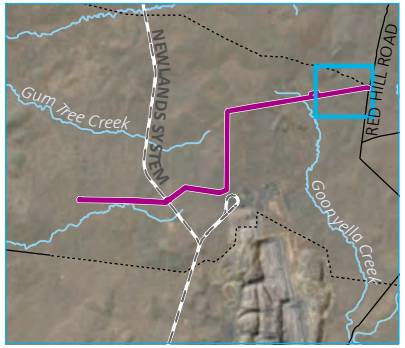
Latham's Snipe habitat within the project area Map 5 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.5

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Electrical transmission line
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

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Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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Latham's Snipe habitat within the project area
Map 6 of 6

QPM Energy Project
Fauna Management Plan
Figure 3.5

EMM
creating opportunities

4 Potential Impacts

QPM Energy will avoid impacts to CEEVNT fauna species and fauna breeding habitats to the greatest extent practicable. The mitigation hierarchy of avoiding, minimising, and mitigating any potential impacts on native vegetation will continue to be followed throughout the design, construction and operation of the Project. Where impacts cannot be avoided, mitigation and management measures will be implemented to reduce residual impacts to the lowest extent practicable. As much of the site has previously been cleared for agricultural purposes, QPM Energy will be able to site infrastructure in a way that will minimise impacts.

The following sections discuss the Project's potential impacts on fauna and fauna habitat.

4.1 Vegetation and habitat clearance

The Project area supports areas of remnant vegetation and regrowth as well as extensive non-remnant areas which are dominated by gilgai.

Clearing of these habitats will reduce breeding, foraging and sheltering habitat for fauna and flora species, and the process of vegetation clearing has potential to result in injury or mortality of native fauna species. Some species which are more sedentary (e.g. reptiles such as Ornamental Snake) are more prone to impact than others. Conversely, mobile species such as Squatter Pigeon and migratory birds, with broader habitat preferences, are unlikely to be impacted from vegetation clearing as they are more mobile and can disperse more easily.

The site layout has evolved to minimise vegetation clearing and impacts on MNES habitats. This has included:

- The location of the compressor facility is in an area of non-remnant vegetation, with shrubby regrowth and weedy understorey. This area is not suitable habitat for any of the target threatened species.
- The high-pressure pipeline alignment will seek to follow existing clearings (e.g. fence lines, pulled and cleared pasture, firebreaks, access tracks) to minimise disturbance on the surrounding environment.
- The chosen access route was deemed as the most viable route due to minimised distance and impact to remnant vegetation.

The total estimated area of vegetation clearing is 8.04 ha od remnant vegetation, 0.37 ha of regrowth vegetation and 56.64 ha of non-remnant areas as outlined in in Table 4.1.

Table 4.1 Summary of ground-truthed Res in the Project footprint

RE	RE description	Remnant (ha)	HVR (ha)
11.5.3	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces	4.74	0
11.4.9	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	3.04	0.37
11.8	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	0.26	0
Non-remnant		56.64	

4.2 Species Mortality

Direct fauna mortality may occur as a result of the Project during vegetation clearing (e.g. through removal of mature trees containing hollows), digging up breeding places such as reptiles residing under rocks, or vehicle collision. In particular for pipeline projects, direct mortality of native fauna may occur through construction of the pipeline trench (through overnight entrapment or direct mortality during earthworks). This will involve removal of ground vegetation, soil and rock which provide fauna habitat.

During trenching activities there is potential for fauna to fall into and become trapped in open trenches, where they may perish or become subject to increased predation risk if not removed in a timely fashion each morning in accordance with normal operating procedures. Particularly susceptible species groups include reptiles, frogs and small mammals.

Increased traffic around the Project area has the potential to kill or injure fauna on impact. Some species may be particularly susceptible to traffic impacts; mainly ground-dwelling or slow-moving species.

Direct mortality of flora may occur through trampling or destruction of individuals from vehicle or personnel movement.

4.3 Fragmentation

Terrestrial habitat connectivity may be reduced as a result of a Project due to clearing which has potential to reduce fauna movement between areas of retained remnant or regrowth vegetation. Such habitat fragmentation is more prominent where clearing widths are larger, such as over 100 m (construction corridor is 30 m wide and largely co-located with existing fencelines), and intersect intact areas of vegetation. Clearing linear widths through habitats also has the potential to increase edge effects (additional light entering forest, weed encroachment, feral animal abundance may increase and increased risk of bushfire) which has a negative impact on ecological functions for those areas.

Some species are more prone to this fragmentation of habitat. Other species such as Squatter Pigeon are not likely to be impacted by these cleared areas as they are known to disperse quite readily across non-remnant areas, and have commonly been found on existing dirt access roads.

Post-construction, the easement will shrink to a 15 m operating width (i.e. 30 ha) which comprises the 11 m to the high-pressure pipeline centreline. This section typically includes a fence and farm track/firebreak running each side of a fenceline plus 4 m to the other side of the pipeline to allow pipeline remediation, if required. This approach will keep occasional inspection access to an existing farm track which will enable the remaining area to rehabilitate.

Terrestrial habitat connectivity in the vicinity of the GCF may be disturbed as a result of the Project by obstructing movement of fauna across the 200 m x 300 m fenced area, although this area contains non-remnant vegetation.

However, much of the proposed disturbance has been focused along existing cleared fence lines in these areas and is considered very unlikely to pose an ongoing issue to habitat connectivity following the construction disturbance and subsequent revegetation and maintenance of the corridor. Any impacts to remnant vegetation that are unavoidable have sought to clear areas adjacent to existing clearance, to avoid further fragmentation.

There is one waterway passing through the alignment – Goonyella Creek. The crossing of this minor watercourse which is perpendicular to the pipeline corridor is unlikely to be impacted in terms of fragmentation.

Large areas of habitat surrounding the alignment will not be impacted and will be retained, including extensive areas of gilgai. This will ensure the EVNT species likely to utilise the Project area still have large areas that be utilised as corridors, including to habitats outside the Project area.

Weed management, pest animal management and bushfire management will be implemented to minimise environmental impacts from the Project on native species and habitats.

Once the project is operational, the operating infrastructure has the potential to influence fauna behaviour particularly the 6 ha compression facility. There may be localised displacement in the area around the Gas Compression Facility due to increased activity in the area and noise. Due to the avoidance of main areas of remnant vegetation in the vicinity, and the lack of particularly sensitive species to barrier effects, this is not anticipated to be a significant issue for the Project.

4.4 Erosion and sedimentation and changed in water quality and hydrology

The main construction activities that could impact on water quality are excavations and earthmoving for construction of the pipeline as well as ancillary infrastructure. This may lead to erosion and sedimentation, reduction in water quality and changes to water flows.

During construction activities, sediment may be mobilised and transported by surface water during rainfall events, ultimately discharging into watercourses and drainage lines and potentially reducing water quality in downstream aquatic habitats. Increased suspended sediments can reduce light penetration into the water column, reducing photosynthesis of aquatic macrophytes, and decreasing dissolved oxygen levels.

Changes in the hydrology of the Project area may occur through alteration of surface flows and stormwater runoff, including obstruction of flow. This can result in scouring or waterlogging occurring in some areas.

The accidental release of pollutants (including spills from construction vehicles and plant, leaks and other uncontrolled releases) into the surrounding environment and waterways has the potential to degrade aquatic habitat quality in the Project area and impact vegetation communities and terrestrial fauna utilising these areas. This includes direct toxic impacts on fauna from ingestion or inhalation. Without mitigation, contaminants may enter waterways including oily wastewater (from heavy equipment cleaning), contaminated runoff from chemical or fuel storage areas and general washdown water. Impacts to groundwater are not anticipated from the Project.

There will be no extraction of groundwater therefore there are no pathways through which the quantity of groundwater can be impacted (earthworks will be at or near ground surface level). Release of pollutants or contaminated runoff from the site have the potential to impact on groundwater quality. However, Project infrastructure will be designed and constructed to ensure that water quality objectives are met, and pathways to impact surface and groundwater quality are minimised.

The proposed water management approach is currently being designed with consideration of several key water management objectives, including:

- progressive rehabilitation of disturbance areas anticipated to minimise the potential for erosion and sediment incidents occurring
- the construction ROW will be reduced to an operating easement, with much of the ROW being rehabilitated (exception of a maintenance road)
- the maintenance road surface material will be fit for purpose to avoid scouring and reduce the potential for increased sediment loads in surface water run-off
- an oily water treatment unit will be installed and utilised during the operational phase of the project to separate oily water
- separated oily water will be trucked off-site and processed at an existing registered water treatment facility and the clean water returned to the relevant mine site to meet their regulatory requirements for water management
- the depth of the high-pressure pipeline has been assessed and is not anticipated to impact on groundwater resources.

A detailed Construction Environmental Management Plan (EMP) will be prepared that identifies erosion and sediment control measures to be implemented during clearing and earthworks. Strict controls will be put in place to ensure sediment does not runoff into watercourses, and erosion of steep batters does not occur.

4.5 Bushfire

Fire is a natural part of the Australian landscape, and most vegetation communities are adapted to periodic fires. However, changes in the natural fire regime may result in changes in the species composition and/or structure of the vegetation. The increased presence of construction vehicles and personnel in the Project area may increase fire risk through use of machinery that may generate sparks, use of flammable liquids and idling vehicles being present in areas of ground vegetation.

An EMP will be prepared that identifies how fire will be avoided and managed during all phases of the Project. It will be important that any fires started from site activities are put out quickly and no unplanned bushfires occur. Fuel loads will need to be managed across the Project area, and bushfire buffers to infrastructure maintained.

4.6 Noise and lighting

Noise may adversely affect fauna by interfering with communication (e.g. territorial bird song), masking the sound of predators and prey, slowing avoidance reactions and motivating displacement from habitat. Construction noise will be generated by the Project through the use of machinery, plant, and vehicles and will vary from short intermittent noise from plant and equipment to more persistent noise from generators and mobile equipment. The generation of construction noise may be in areas which have the potential to support threatened fauna species. Many animals react to new noise initially as a potential threat, but quickly 'learn' that the noise is not associated with a threat (Radle 2007). Individuals that occur on or near the Project area may leave the area of impact. Project construction works and therefore potential noise impacts will be temporary.

Artificial lighting from infrastructure and machinery may impact fauna within the Project area during construction. Artificial lighting can have a range of impacts which vary between species. Artificial light can disrupt patterns of both nocturnal and diurnal species by eliciting responses. Some species may avoid brightly lit areas, potentially due to the perception of being increased risk of predation. Species such as Sugar Glider (*Petaurus breviceps*) have been shown to reduce foraging time under artificial lighting in laboratory conditions (Barber-Meyer 2007). Other potential adverse impacts include disruption of breeding and migratory patterns, disorientation and potential collision with structures.

Conversely, some species such as nocturnal reptiles, frogs and bats may congregate at artificial light sources to feed on insects attracted to light.

Site lighting will be kept to the minimum needed for safety during operation of the Project and very minimal lighting will be required during construction. Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat. The site is not typically manned during night-time which further promotes low lighting.

4.7 Reduced air quality and dust emissions

Increased dust from vegetation clearing, soil stripping and vehicle movements during construction has the potential to temporarily and locally impact flora and fauna values in the vicinity of the Project footprint. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity (also resulting in reduced habitat quality for fauna), alter soil properties impacting on plan species assemblages and reduce water quality in aquatic habitats.

Dust is expected to potentially be an issue during vegetation clearing and construction. Dust levels will be monitored and when needed dust suppression implemented such as wetting down dirt roads or reducing vehicle speeds. These measures will be further defined within the Construction EMP.

4.8 Pests

Project related activities may increase pest fauna abundance in the Project area. This can lead to increased competition with, and predation of native fauna. In addition, habitat degradation may occur through vegetation trampling (e.g. Feral Pig wallowing).

Creation of new access points into areas of intact vegetation may create pathways for feral fauna species to disperse. In addition, the creation of artificial water sources may increase the capacity of the area to support feral species such as Cane Toads. Uncontained waste sources may also attract feral fauna such as Wild Dog.

5 Impact avoidance and minimisation

The approach used to assess Project impacts utilises proven mitigation measures that have been successfully implemented, or are standard practice. Mitigation measures which have not been proven, or are not known to be successful, have not been considered in the management actions outlined below. Without evidence of the effectiveness of mitigation, the precautionary principle is applied. Avoidance and minimisation through design has been prioritised as the most effective measure. In addition to this FMP, the following management plans have been prepared for the Project:

- Vegetation Management Plan (VMP)
- Draft Environmental Management Plan
- Draft Rehabilitation Strategy
- Draft Construction Weed and Pest Management Plan.

QPM Energy and associated contractors will be responsible for implementing all avoidance, mitigation and management measures, except where landowner agreements specify otherwise.

Management and mitigation measures have been developed to align with the S.M.A.R.T principle, to ensure that measures are:

- Specific – prescriptive, with no uncertainty or ambiguity around their purpose or implementation.
- Measurable – the status (i.e. success or failure) and outcomes/results can be measured.
- Achievable – through the chosen method of implementation, by the responsible personnel and within the specified timeframe.
- Relevant – to the action/impact being controlled and to the protected matter.
- Time bound – measures were given specific and achievable timeframes for implementation in relation to specific development activities or stages.

Management measures and performance outcomes are detailed in the management plans prepared and included as appendices to this report.

5.1 Avoidance and minimisation

During early stages of Project design, and following ecological surveys of the Project area, QPM Energy has sought to avoid and minimise ecological constraints wherever practicable. The Project area is heavily disturbed by current and past land use with vegetation being predominantly non remnant with minor areas of remnant vegetation. The following general measures will be implemented to avoid and minimise environmental impacts to the greatest practical extent:

- Vegetation clearing will be limited to those areas required for earthworks and construction of the Project. Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated as part of the construction process. Rehabilitation will be detailed in a VMP to be prepared prior to commissioning of the Project.
- The approved disturbance area will be clearly demarcated prior to clearing to avoid unnecessary clearing of vegetation and to ensure personnel and vehicles stay within the approved footprint. Measures to ensure clearing limits are adhered to will be documented in the EMP and addressed in site inductions.

- Clearing limits will be clearly demarcated on site, including through use of temporary fencing (e.g. flagging tape to mark out areas or plastic mesh fencing installed with star pickets) to avoid unintentional access to retained sensitive environmental areas.
- Large hollow bearing trees should be clearly marked for avoidance during construction if practicable.
- Sequential clearing of remnant vegetation will occur to minimise impacts on native fauna, particularly arboreal fauna which may be using tree hollows.
- Access points have been identified and are limited to approved access roads and tracks.

5.2 Vegetation and habitat clearance

The following measures will be implemented to mitigate and manage impacts as much as practicable during vegetation clearing:

- Develop a SMP (required by DES under the NC Act when impacting on animal breeding places) to identify specific measures to be implemented that will mitigate impacts to threatened fauna species and animal breeding places during clearing, as well as operation of the Project. Measures will include sequential clearing, presence of a fauna spotter catcher and reducing vehicle speeds to minimise any wildlife injuries and to reduce dust.
- Prior to any clearing activities, pre-clearance surveys will be undertaken by a suitably qualified ecologist to:
    - further identify MNES and other native fauna species habitats and clearly demarcate the habitats being retained to ensure no direct or indirect impacts occur during clearing and construction
    - searches for threatened grasses in suitable habitat
    - identify and mark hollow-bearing trees to ensure they are managed by the fauna spotter catcher during clearing phase
    - identify and mark any other active breeding places such as nests, burrows etc to ensure they are managed by the fauna spotter catcher during clearing phase
    - identify suitable release sites should any fauna species need to be captured and released during clearing phase
    - identify presence of weed species and identify if any require treatment prior to clearing.
- A suitably qualified fauna spotter-catcher will be present during clearing activities, working under a DES approved SMP under the NC Act. The fauna spotter-catcher will be responsible to check an area immediately prior to any clearing for; presence of any native fauna including searches of all potential habitats such as terrestrial microhabitats and hollows, etc. Any captured species (excluding Koalas) will be relocated to an agreed release site. The fauna spotter-catcher will then advise the ground staff as to measures that need to be taken to avoid impacts on breeding places and fauna species. Specific threatened species pre-clearance activities within the Project footprint will include:
    - canopy searches in suitable foraging tree species for Koala
    - searches of gilgai habitats for Ornamental Snake
    - searches of open woodland habitat for Squatter Pigeon nests.

- Sequential clearing will occur in areas where remnant vegetation is to be cleared. This involves the following steps:
    - The first phase will consist of removing understorey vegetation and smaller juvenile trees only. Juvenile trees are under 4 m in height or trunk circumference of less than 31.5 cm at 1.3 m above the ground. No hollow-bearing trees will be cleared in Phase 1.
    - After 48 hours the second phase can commence which is to clear the remaining larger trees, including those with hollows. Where practicable hollow bearing trees are to be "soft felled" to minimise the risk to hollow dwelling fauna. They will then be inspected by the fauna spotter-catcher post-felling to ensure no wildlife remain in the hollow. Where practicable fauna will be caught, and released into suitable recipient sites once clearing has stopped. If roosting bats are located they are to be "roosted" during the day in a safe, cool, dark space and released at night in areas of habitat to be retained.
    - Dispersal corridors will be left in place that link vegetation with clearing areas to adjacent areas of retained habitat, and are to be maintained for a further 24 hours, to facilitate overnight dispersal. Such corridors will act as 'stepping stones' to allow any Koala present to depart to retained vegetation.
    - It is important the clearing is done in such a way that arboreal fauna are given the opportunity to disperse from the area once clearing has commenced under their own volition.
    - Any confirmed Koalas will be identified by putting flagging tape and/or marking spray on the tree they are in, and any nearby trees with overlapping crowns or those trees that may impact the Koala's tree during felling will not be cleared until the Koala has moved from the area under its own volition. In most situations the Koala will move from the area overnight.
    - Fell trees away from retained areas of vegetation where practicable. Where trees unavoidably fall into retained areas, leave in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna.
    - Fauna spotter catcher will undertake a final walkthrough ahead of the clearing machinery on the day of clearing checking for breeding places, flipping over timber and peeling bark to relocate fauna, and identifying the potential breeding places marked in the preclearance breeding survey and liaising with the machinery operator over their presence and appropriate clearing techniques.

5.2.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- Fauna spotter catchers will monitor vegetation clearing occurring and ensure that sequential clearing is occurring and clearing limits are being adhered to. Corrective actions include:
    - Replace any fencing or flagging tape that is in poor condition.
    - Where clearing extends outside the approved disturbance limits, a record must be taken of the incident and an investigation will occur.
    - Revegetation of additional cleared areas will be discussed and where required undertaken.

- Any fauna injuries or deaths are required to be reported to DES and/or DCCEEW. Investigate cause of injury or death and implement any changes needed.

5.3 Species mortality

The following measures will be implemented to prevent species mortality during the construction and operational phases:

- All vehicles associated with construction or operational activities will travel at slow speeds to minimise the chance of any fauna strikes occurring. Speed limit signage will be placed at the entrance to the site and other key points.
- A suitably qualified fauna spotter/catcher will be present during clearing activities associated with the vegetation clearance, working under a SMP. The spotter/catcher will be responsible to check an area prior to any slashing, minor vegetation removal, or ground disturbance occurring for; animal breeding places (such as hollow bearing trees, nests, dens and fallen logs) and presence of any fauna species (such as checking for reptiles under fallen logs, and Koalas within eucalypt trees).
- All contractors will be educated on the presence of native fauna including threatened species and need to travel slowly and look out for fauna when driving (especially Squatter Pigeon). This training will form part of mandatory inductions.
- Vehicle traffic will be confined to designated roads and access tracks.
- All fauna encountered (e.g. vehicle strike or during clearing activities) will be recorded in a central register by the Project Environment Manager. Any injured fauna will be reported as required in the SMP that will be in place for the Project.
- Appropriate procedures for managing injured wildlife should be developed and included in the Construction EMP.
- During trenching activities, open trenches will be monitored daily. If species are trapped in the trench they will be released by a fauna spotter-catcher. The amount of open trench will be minimised.
- Escape ramps or planks and/or shelter (e.g. sawdust filled bags) for trapped fauna will be installed in open trenches.
- Any clearing would take place in a way to allow Koalas (if present) to move into adjacent areas of retained vegetation. This will include setting clearing limits per day and allowing escape paths to retained vegetation to be maintained. If Koalas are encountered they are to be left in-situ, works stop in the area, and wait for the animal to move to retained habitat. This will entail:
    - Leaving a 30 m buffer of vegetation around the tree in which the Koala is located and a corridor of vegetation to retained habitat.
    - Monitoring the Koala location and if the animal appears stressed.
    - Allowing the Koala to relocate without assistance unless the animal is in immediate danger or is injured.
    - Ongoing presence will be managed by the fauna spotter catcher under the SMP.

- Spotlighting pre-clearance surveys will occur in mapped areas of Ornamental Snake habitat immediately prior to clearing. If any individuals are caught they will then be released in adjacent suitable habitats which are being retained outside of the Project area.

- For areas where Ornamental Snake were recorded during spotlighting pre-clearance surveys, a fauna spotter catcher will also supervise any earthworks due to the likelihood they could be residing in soil cracks. If any individuals are caught they will then be released that night to adjacent suitable habitats which are being retained outside of the Project area.

- Fauna spotter catcher will undertake a final walkthrough ahead of the clearing machinery on the day of clearing checking for breeding places, flipping over timber and peeling bark to relocate fauna, and identifying the potential breeding places marked in the preclearance breeding survey and liaising with the machinery operator over their presence and appropriate clearing techniques.

5.3.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- During trenching activities, open trenches will be monitored daily. Corrective actions include:
  - If native fauna become trapped in a trench they will be released by a fauna spotter-catcher.
  - If native fauna are identified within the clearing area, the fauna spotter catcher will seek to capture and relocate them to appropriate habitat nearby. This does not apply to Koalas as discussed above.
  - Any fauna injuries or deaths are required to be reported firstly to the Project Environmental Manager and then DES and/or DCCEEW if it involves a threatened species. The cause of injury or death will be investigated and any required changes will be implemented.
- Vehicle speed limits will be monitored and enforced. Corrective actions include:
  - Increased discussion at toolbox talks and enforcement.

5.4 Fragmentation

The following measures will be implemented to mitigate and manage impacts of fragmentation as much as practicable during the construction and operational phases:

- All fencing at the GCF, including security fencing, will give consideration to the movement of fauna where practicable. Fencing design will consider common mitigations to prevent entanglement of wildlife, and not using barbed wire on the top strand of fences, if security or land management practices allow.

- Install fauna exclusion fencing around the GCF to reduce the risk of fauna species being impacted.

- Undertake staged clearing of native vegetation, and retain habitat trees where practicable, to minimise impacts to native fauna species.

- Implement weed and pest control across the Project area to reduce degradation of habitats and edge effects as a result of the Project.

- Retained vegetation will be maintained following a site VMP to reduce hazards from fire, pest species, degradation and other potential impacts. This will assist in maintaining the integrity of the vegetation as habitat and reduce disturbance to surrounding habitat.

5.4.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- All areas of fencing during construction will be inspected as part of regular worksite inspections. Areas of higher risk exclusion fencing will be inspected at least weekly. Corrective actions include:
    - repair of any fencing found to be in poor condition or broken, and inspection of areas inside the damaged fencing to ensure no fauna species such as Koala are trapped.

5.5 Erosion and Sedimentation

The following measures will be implemented to mitigate and manage impacts of erosion and sediment:

- Erosion in active construction areas cannot be eliminated but can be controlled. As part of the construction planning a certified Erosion and Sediment Control Plan (ESCP) will be prepared prior to construction and implemented during on-site activities. Sediment and erosion control measures to prevent soil loss will be developed consistent with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control (BPESC) document. The ESCP will form part of the overall EMP. Particular focus will be given to managing runoff in the vicinity of watercourses.
- Design on site infrastructure to ensure water flows are not impounded or concentrated (e.g. culverts, diversion ditches, etc).
- The only open cut creek crossing location – Goonyella Creek – will take advantage of existing areas of cleared riparian vegetation as far as possible, and be carried out during periods of no flow. It is not a formed creek with defined banks.
- No equipment or materials will be stored across flow paths.
- The extent of the area required to carry out the permitted activity must be limited to the minimum area necessary to reasonably carry out the works.

5.5.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- Daily dust suppression monitoring during clearing and construction. Corrective actions include:
    - further wetting down roads to suppress dust
    - temporary reductions in speed limits.
- Daily weather observation checks during clearing and construction. Corrective actions include:
    - cease works until weather passes to minimise sediment runoff and dust.

- Weekly checks of erosion and sediment control measures to ensure they are in working condition and effective. Corrective actions include:
  - cease works until weather passes to minimise sediment runoff and dust
  - implement additional erosion and sediment control measures if existing measures are not proving effective
  - notify government agencies of any spills and implement clean up measures required.

5.6 Changes to water quality

The following measures will be implemented to mitigate and manage impacts on water quality as far as practicable during the construction and operational phases:

- Construction equipment is to be maintained to minimise risk of spill or leakage.
- All refuelling facilities, or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and comply with Australian Standards (e.g. AS 1940: *The storage and handling of flammable and combustible liquids).* Materials will be stored within bunded areas with a storage capacity of 110% of the storage vessel. Bunding will have floors and walls lined with impermeable material. These areas must be adequately protected from rainfall and stormwater.
- Refuelling should not take place within 50 m of a watercourse.
- Spill control materials such as booms and absorbent materials will be maintained on site, commensurate with the types and volumes of materials in use, and in place where hazardous materials are stored or used.
- Personnel will receive appropriate spill clean-up training.
- Apply appropriate Australian and industry standards and codes of practice for the design of infrastructure associated with the storage of hazardous materials. Reagents and hazardous chemicals will be stored away from sensitive receiving environments and stored, handled and managed in accordance with:
  - relevant workplace health and safety (WHS) legislation
  - AS 1940:2017 *Storage and Handling of Flammable or Combustible Substances*
  - AS 3780:2008 *The Storage and Handling of Corrosive Substances*.
- Chemical storage areas are to be located away from existing drainage lines and have appropriate bunding and waste water collection mechanisms.
- Water and wastewater discharges will be treated to comply with conditions for discharge quality specified in the future environmental authority.
- Runoff from developed areas will be treated to remove pollutant loads before discharging to waterways. The expected pollutant loads from the respective areas will determine the method of treatment.
- During detailed design, issues relating to site runoff entering into drainage lines will be considered. These will include the preparation of a Stormwater Management Plan.
- Water drainage from the site will be managed in accordance with the surface water management design philosophy detailed in (EMM 2022a).

- Safety procedures will be developed to reduce the potential for exposure pathways to contaminated material.

5.6.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions – these will be further defined in the Receiving Environment Monitoring Program to be developed prior to commencement:

- Monitoring will be undertaken surrounding the development to characterise areas of potential contamination and monitor for any releases of contaminants. The monitoring would include soil, sediment, surface water in areas of concern and within down-gradient locations. This may be visual monitoring initially depending on risk profile, but will be confirmed in final EMP prior to construction.

Corrective actions will involve investigation of the source of any contamination, and undertaking of repairs or replacement measures, as well as remedial actions as required.

5.7 Bushfire

The following measures will be implemented to mitigate and manage impacts from bushfire risks as much as practicable during the construction and operational phases:

- As part of the construction planning a certified Bushfire Management Plan will be prepared prior to construction and implemented during on-site activities. This will include details of controlled burning requirements, appropriate to the vegetation types present on the Project area. This will seek to manage the fuel load to reduce the risk of high-intensity fires occurring. The Bushfire Plan key provisions will include:
    - asset protection zones
    - maintaining access tracks to provide a fire break and defendable space to assist in arresting fires
    - bushfire risk mapping (considering slope, vegetation, aspect etc)
    - firefighting equipment being on site
    - emergency evacuation.
- During the bushfire season, the fire danger status will be monitored daily through the Rural Fire Service website. Contact and arrangements will be made with the local fire officers.
- For “hot-work” activities, a risk assessment will be completed considering forecast weather, fire hazard ratings and site conditions.
- Vehicles may not idle or be parked in areas of long grass.
- Smoking will not be permitted on site aside from designated safe zones.

5.7.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions.

- Monthly assessment of fuel loads. Corrective actions include:
  - if fuel loads are increasing due to rainfall, review current measures and increase if required.
- During construction phase, and in the bushfire season, the fire danger status will be monitored daily through the Rural Fire Service website. Corrective actions include:
  - an Emergency Response Plan will be implemented should an uncontrolled fire take place.

5.8 Noise and Lighting

The following measures will be implemented to mitigate and manage impacts from noise and lighting as much as practicable during the construction and operational phases:

- lighting from Project activities will be minimised at night to reduce light spill disturbance to nocturnal fauna
- night lighting will mainly be limited to that required for safety and security. Project lighting will be minimised (i.e. low luminance) as far as possible
- directional lighting should be away from environmentally sensitive areas
- all equipment will be properly maintained onsite in accordance with manufacturers specifications
- implement noise control techniques in accordance with standard industry noise suppression techniques.

5.8.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- Monitor noise levels during construction and determine acceptable noise limits. Corrective actions include:
  - where noise levels go beyond acceptable limits, a record must be taken of the incident and an investigation will occur.

5.9 Air quality and dust emissions

The following measures will be implemented to mitigate and manage impacts from dust as much as practicable during the construction phase:

- areas which have potential to generate airborne dust will be wetted down regularly
- low speed limits will be implemented on site to minimise dust generation
- areas stripped of topsoil not required for operation will be rehabilitated as soon as practicable
- machinery and vehicle tyres will be regularly cleaned to reduce wheel entrained dust emissions or consider use of vibration grids
- design access roads to have a less erodible surface

- water spraying of nearby sensitive vegetation should be considered if visible dust sedimentation is observed
- dust and other emission levels will be adhered to under the State conditions of approval once the Development Application is approved.

5.9.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- Daily dust suppression monitoring during clearing and construction. Corrective actions include:
  - further wetting down roads to suppress dust
  - temporary reductions in speed limits.
- Daily weather observation checks during clearing and construction. Corrective actions include:
  - cease works until weather passes to minimise sediment runoff and dust.

5.10 Pests

The following measures will be implemented to mitigate and manage impacts from weeds and pest animals as much as practicable during the construction phase:

- A Weed and Pest Management Plan will be developed for the Project with specific advice for key identified species. The plan will include management of weed spread, management of pest infestations, and monitoring effectiveness of control measures. The Project area is currently subject to high-levels of weed infestation and, as such, focus is to avoid further impacting the quality of retained areas of habitat along the riparian corridors.
- Parthenium weed (*Parthenium hysterophorus*) is abundant along the pipeline alignment, especially at the eastern end near Red Hill Road. This is a declared pest under the Biosecurity Act (QLD) so weed hygiene protocols will need to ensure it is not spread. It is also common on Denham Park. Additionally, although not recorded in the Project area, Rat's tail grasses (particularly Giant Rat's Tail Grass - *Sporobolus pyramidalis*/ *S. natalensis* are identified as a high risk species for invasion of the Project area which can reduce pasture productivity and cause significant degradation of natural areas. Other high risk species for establishment include Fireweed (*Senecio madagascarensis*).
- Weed hygiene protocols will be implemented such as a dedicated vehicle and machinery cleaning bay. This will not be placed near a watercourse and runoff will be contained and the area treated. The location will be determined by property requirements.
- Hygiene protocols will be implemented to reduce the potential for introduction or spread of weeds. Measures will include:
  - Hygiene checks will focus on ensuring no weed plant material/seed/mud/soil material enters the site (or leaves known infestation areas within the site), with all machinery, vehicles and equipment including footwear will be cleaned prior to entering the site, and when working within a known contaminated area within the site, prior to exiting the contaminated area.

- Onsite waste disposal (especially food waste) to discourage presence of pest fauna. Waste will be stored in covered bins/skips to prevent fauna access.
- Weeds will be identified during pre-clearing surveys, in particular, any large infestations within proposed disturbance areas. Clean and dirty zones should be demarcated on site to facilitate weed management.
- Any materials brought into site (such as gravel) will be certified as weed and disease free.
- Any herbicides used on site must be dispensed by an appropriately trained and qualified weed sprayer.
- Access into retained areas of habitat during construction will be limited and monitoring of weeds in these areas in place.

5.10.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- Record weed species during pre-clearance surveys, and confirm any large infestations required for treatment prior to clearing. Corrective actions include:
  - weed control efforts to be increased if needed
  - weed control methods to be adjusted if current techniques are not proving effective.
- Check wash downs are occurring in an effective manner during regular audits. Corrective actions include:
  - increase hygiene protocol requirements if vehicles or equipment are found to introduce new weeds.
- Check material being brought into site such as gravel is weed and disease free:
  - increase hygiene protocol requirements if vehicles or equipment are found to introduce new weeds.

5.11 Rehabilitation and habitat restoration

The following measures will be implemented to facilitate rehabilitation within the Project area:

- Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated to as soon as practicable following construction.
- Restoration and revegetation will be detailed in a Vegetation Management Plan to be prepared prior to commissioning of the Project. Methods for habitat restoration, will also be described which may include soil stabilisation, direct seeding, managing natural regeneration and weed management.
- Woody debris, logs and rocks will be retained for use in rehabilitation.
- Where seeding and/or revegetation is required select plant species that are found in similar adjacent habitat on site. This may include use of an inert initial colonisation species to assist in groundcover and stabilisation.

In order to undertake all aspects of rehabilitation, decommissioning of infrastructure is likely to be required. This includes the de-mobilisation and removal of buildings, plant and equipment and hard stand areas. The buried pipeline would remain in place. A Rehabilitation and Decommissioning Management Plan will be developed and submitted to the relevant authority 12 months prior to decommissioning occurring.

6 Compliance

6.1 Delegation of authority

QPM Energy will be responsible for the construction of the Project and will manage the main construction contractor. QPM Energy, the principal contractor and all site personnel will be responsible for implementation of measures in the EMP and this FMP.

The personnel outlined in Table 6.1 will be accountable for implementation.

Table 6.1 Responsible personnel

Role	Responsibilities
Project Manager	• Handover of design requirements to Construction Manager. • Ongoing accountability for Project delivery. • Managing construction work and managing Project personnel listed below.
Construction Manager	• Managing construction work of the Project. • Approval of the final FMP. • Approval of design changes and obtaining any required planning approvals. • Reporting and responding to incidents on site. • Ensuring the environmental performance during the construction phase.
Environmental Manager	• Reviewing the FMP and ensuring management and mitigation methods are carried out accordingly. • Delivering site inductions. • Conducting environmental audits. • Monitoring implementation of environmental controls. • Reporting and responding to incidents on site. • Ensuring all appropriate permits are in place.
Traditional Owner	• Cultural Heritage Survey prior to and following clearing. • Identification, documentation and relocation of artefacts. • Identification, documentation and relocation of culturally significant flora.
Suitably qualified ecologist	• Coordinate and lead pre-clearance surveys to identify CEEVNT flora and fauna, animal breeding places and introduced flora.
Fauna spotter-catcher	• Survey areas prior to clearing for Koalas, and presence of other native fauna. • Capture and relocate fauna (where appropriate) to adjacent suitable habitat prior to clearing. • Guide removal of vegetation to ensure it complies with sequential clearing protocols. • Check cleared vegetation for presence of native fauna including within hollows. • Ensure any injured fauna receive appropriate treatment. • Report any incidents including fauna injuries or deaths.
Site personnel	• Reporting incidents, emergencies or other environmental incidents to the Environmental Manager and Construction Manager. • Understand environmental controls. • Conduct activities with environmental due diligence.

6.2 Inductions and training

It is essential that all site personnel, including Managers, are aware of the ecological values within the Project area, the potential for environmental impacts to occur, and the management and mitigation measures that are to be followed to avoid, minimise, and mitigate impacts. The following training methods will be undertaken to ensure personnel are well trained and environmentally aware.

6.2.1 Environmental awareness induction

All site personnel will be required to attend an environmental awareness induction prior to arriving to site. The induction will cover the following aspects:

- Objectives of the FMP and associated environmental controls (including hygiene protocols).
- Briefing on CEEVNT fauna and associated habitats within the Project area.
- Individual's and organisation's environmental obligations.
- Restricted and 'no-go' areas.
- Procedures for responding to environmental incidents and emergencies.
- Responsibilities for environmental monitoring and reporting.

6.2.2 Pre-start meetings

All site personnel will be briefed on environmental requirements, focusing on practical measures, during daily pre-start meetings. Pre-start meetings will cover the following aspects:

- changed environmental conditions
- vegetation clearing demarcations
- any CEEVNT fauna species or sensitive habitats in proximity to the work area
- vehicle speed limits.

6.3 Incident management

An incident investigation procedure and reporting form will be developed by the construction contractor as part of the Construction EMP.

6.4 Emergency response

An Emergency Response Plan will be developed as part of the Construction EMP and will include measures around emergencies directly related to vegetation.

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Appendix A
Species list

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Table A.1 Fauna species list

Class	Scientific name	Common name
Aves	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater
	*Acridotheres tristis**	Common Myna
	Anthus novaeseelandiae	Australasian Pipit
	Antigone rubicunda	Brolga
	Aprosmictus erythropterus	Red-winged Parrot
	Aquila audax	Wedge-tailed Eagle
	Ardea alba	Great Egret
	Ardea pacifica	White-necked Heron
	Ardeotis australis	Australian Bustard
	Artamus cinereus	Black-faced Woodswallow
	Cacomantis pallidus	Pallid Cuckoo
	Centropus phasianinus	Pheasant Coucal
	Chenonetta jubata	Maned Duck
	Chlamydera maculata	Spotted Bowerbird
	Cincloramphus cruralis	Brown Songlark
	Cincloramphus timoriensis	Tawny Grassbird
	Cisticola exilis	Golden-headed Cisticola
	Colluricincla harmonica	Grey Shrikethrush
	Coracina novaehollandiae	Black-faced Cuckooshrike
	Corvus orru	Torresian Crow
	Coturnix ypsilophora	Brown Quail
	Cracticus nigrogularis	Pied Butcherbird
	Cracticus tibicen	Australian Magpie
	Dacelo novaeguineae	Laughing Kookaburra
	Dendrocygna eytoni	Plumed Whistling Duck
	Dicaeum hirundinaceum	Mistletoebird
	Egretta novaehollandiae	White-faced Heron
	Elanus axillaris	Black-shouldered Kite
	Elseyornis melanops	Black-fronted Dotterel
	Entomyzon cyanotis	Blue-faced Honeyeater
	Eolophus rosiecapilla	Galah
	Falco berigora	Brown Falcon

Table A.1 Fauna species list

Class	Scientific name	Common name
	Falco cenchroides	Nankeen Kestrel
	Gavicalis virescens	Singing Honeyeater
	Geopelia placida	Peaceful Dove
	Geophaps scripta scripta	Squatter Pigeon
	Gerygone olivacea	White-throated Gerygone
	Grallina cyanoleuca	Magpie-lark
	Haliastur sphenurus	Whistling Kite
	Himantopus	Pied Stilt
	Hirundapus caudacutus	White-throated Needletail
	Lalage tricolor	White-winged Triller
	Malurus assimilis	Purple-backed Fairywren
	Malurus melanocephalus	Red-backed Fairywren
	Manorina melanocephala	Noisy Miner
	Merops ornatus	Rainbow Bee-eater
	Microeca fascinans	Jacky Winter
	Milvus migrans	Black Kite
	Myiagra inquieta	Restless Flycatcher
	Myiagra rubecula	Leaden Flycatcher
	Ninox novaeseelandiae	Australian Boobook
	Nymphicus hallandicus	Cockatiel
	Ocyphaps lophotes	Crested Pigeon
	Oriolus sagittatus	Olive-backed Oriole
	Pachycephala rufiventris	Rufous Whistler
	Pardalotus striatus	Striated Pardalote
	Petrochelidon ariel	Fairy Martin
	Philemon corniculatus	Noisy Friarbird
	Platycercus adscitus	Pale-headed Rosella
	Plectorhyncha lanceolata	Striped Honeyeater
	Podargus strigoides	Tawny Frogmouth
	Pomatostomus temporalis	Grey-crowned Babbler
	Rhipidura leucophrys	Willie Wagtail

Table A.1 Fauna species list

Class	Scientific name	Common name
	Scythrops novaehollandiae	Channel-billed Cuckoo
	Smicornis brevirostris	Weebill
	Struthidea cinerea	Apostlebird
	Synoicus ypsilophorus	Brown Quail
	Taeniopygia bichenovii	Double-barred Finch
	Taeniopygia guttata	Zebra Finch
	Turnix pyrrhothorax	Red-chested Buttonquail
	Turnix velox	Little Buttonquail
	Tyto javanica	Eastern Barn Owl
	Vanellus miles	Masked Lapwing
Mammalia	*Aepyprymnus rufescens*	Rufous Bettong
	Hydromys chrysogaster	Water Rat aka Rakali
	Leggadina forresti	Forrest's Mouse
	Lepus europaeus	Brown Hare
	Macropus agilis	Agile Wallaby
	Macropus giganteus	Eastern Grey Kangaroo
	Oryctolagus cuniculus	Rabbit
	Petaurus notatus	Krefft's Glider
	Planigale tenuirostris	Narrow-nosed Planigale
	Chalinolobus gouldii	Gould's Wattled Bat
	Chalinolobus morio	Chocolate Wattled Bat
	Chalinolobus nigrogriseus	Hoary Wattled Bat
	Chalinolobus picatus	Little Pied Bat
	Nyctophilus sp (*N. geoffroyi* or *N. gouldi*)	Lesser Long-eared Bat/Gould's Long-eared Bat
	Scotorepens balstoni	Inland Broad-nosed Bat
	Scotorepens greyii	Little Broad-nosed Bat
	Scotorepens sanborni	Northern Broad-nosed Bat
	Vespadelus troughtoni	Eastern Cave Bat
	Miniopterus australis	Little Bent-wing Bat
	Miniopterus orianae oceanensis	Southern Bent-wing Bat
	Chaerephon jobensis	Northern Freetail Bat

Table A.1 Fauna species list

Class	Scientific name	Common name
	Ozimops lumsdenae	Northern Free-tailed Bat
	Ozimops ridei	Eastern Free-tailed Bat
	Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat
	Taphozous troughtoni	Troughton's Sheathtail Bat
Reptilia	*Amphibolurus burnsi*	Burns' Dragon
	Antaresia maculosa	Spotted Python
	Aspidites melanocephalus	Black-headed Python
	Boiga irregularis	Brown Tree Snake
	Carlia vivax	Lively Rainbow Skink
	Cryptophis boschmai	Carpentaria Snake
	Denisonia maculata	Ornamental Snake
	Diplodactylus platyurus	Eastern Fat-tailed Gecko
	Gehyra dubia	Dubious Dtella
	Heteronotia binoei	Bynoe's Gecko
	Nephurus asper	Prickly Knob-tailed Gecko
	Oedura monilis	Ocellated Velvet Gecko
	Paradelma orientalis	Brigalow Scaly-foot
	Pseudonaja textilis	Eastern Brown Snake
	Strophurus wiliamsi	Eastern Spiny-tailed Gecko
	Suta suta	Curl Snake
	Tropidonophis mairii	Keelback
	Vermicella annulate	Bandy Bandy
Amphibia	*Cyclorana alboguttata*	Green-striped Burrowing Frog
	Cyclorana brevipes	Superb Collared Frog
	Cyclorana novaehollandiae	Eastern Snapping Frog
	Limnodynastes tasmaniensis	Spotted Marsh Frog
	Litoria caerulea	Green Tree Frog
	Litoria latopalmata	Broad-palmed Rocket Frog
	Litoria rubella	Ruddy Tree Frog
	Notaden bennettii	Holy Cross Frog
	*Rhinella marina**	Cane Toad

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Appendix J

Draft Environmental Management Plan

QUEENSLAND PACIFIC METALS

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Draft Outline Environmental Management Plan

QPM Energy Project

Prepared for QPM Energy Pty Ltd

March 2023

Draft Outline Environmental Management Plan

QPM Energy Project

QPM Energy Pty Ltd

E221146 RP1

March 2023

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1	22 February 2023	Anna McRae	Susan Lodge	Draft
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Approved by

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Environmental Consultant
9 March 2023

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Abbreviations

The following abbreviations are used in this report:

Abbreviations used in this report

Abbreviation	Term
AS	Australian Standard
ASS	Acid Sulfate Soil
AST	Above-ground Storage Tank
Ca	Calcium
CEMP	Construction Environmental Management Plan
CM	Principal Contractor Construction Manager
DAF	Department of Agriculture and Fisheries
DES	Department of Environment and Science
DSITIA	Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines – 2014
DTMR	Department of Transport and Main Roads
EA	Environmental Authority
EBD	Emergency Blowdown Function
EMM	EMM Consulting Pty Ltd
EMP	Environmental Management Plan
EMR	Environmental Management Register
EP Act	*Environmental Protection Act 1994*
EP Waste Regulation	Environmental Protection Waste Regulation 2019
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
ERA	Environmentally Relevant Activity
ESCP	Erosion and Sediment Control Plan
ESD	Emergency Shutdown Function
ESP	Exchangeable Sodium Percentage
FEED	Front End Engineering a Design Study
FMP	Fauna Management Plan
GCF	Gas Compression Facility
HAZOP	Hazard and Operability Plan
hrs	Hours
HSE Advisor	Principal Contractor Health Safety and Environmental Advisor
IBC	Intermediate Bulk Container

Abbreviations used in this report

Abbreviation	Term
IECA	International Erosion Control Association
kg	Kilograms
km	Kilometres
kPag	Kilopascals gauge
L	Litres
L/day	Litres per day
m	Metres
mbgl	Metres Below Ground Level
Mg	Magnesium
mm	Millimetres
MPa	Megapascals
NATA	National Association of Testing Authorities
NC Act	*Nature Conservation Act 1992*
NCR	Non-Conformance Report
NEPM	National Environmental Protection Measures
NOx	Nitrogen dioxide
NQGP	North Queensland Gas Pipeline
OEMP	Operational Environmental Management Plan
OM	Operations Manager
PASS	Potential Acid Sulfate Soil
PC	Principal Contractor
PFL	Petroleum Facility Licence
P&G Act	*Petroleum and Gas (Production and Safety) Act 2004*
PJ/a	Petajoules per annum
PLC	Program Logic Controller
PM	Principal Contractor Project Manager
PPL	Petroleum Pipeline Licence
PSF	Package Shutdown Function
QPM	Queensland Pacific Metal Pty Ltd
ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition

Abbreviations used in this report

Abbreviation	Term
SDS	Safety Data Sheet
SSMP	Soil Stripping Management Plan
SWMP	Soil and Water Management Plan
t/ha	Tonnes per hectare
TCP	Traffic Control Plan
TECH	Townsville Energy Chemicals Hub
TEG	Tri-Ethylene Glycol
TJ/d	Terajoule per day
TMP	Traffic Management Plan
UN Number	United Nations Number
VMP	Vegetation Management Plan
WHS Act	*Work Health and Safety Act 2011*
WHS Regulation	Work Health and Safety Regulation 2011

1 Introduction

1.1 Overview

Queensland Pacific Metals (QPM) Energy is the proponent of the QPM Energy Project (the Project). The Project involves the design, construction, and operation of a gas compression facility (GCF) and a high-pressure pipeline that links the proposed GCF to the nearby existing and operational North Queensland Gas Pipeline (NQGP).

The Project proposes to collect waste coal mine gas at the proposed GCF via waste gathering lines from existing adjacent mines. At the GCF, waste coal mine gas will be dehydrated and filtered, with the remaining clean gas then compressed and transported via high-pressure pipeline to the existing and operational NQGP. The NQGP will then transport the compressed gas north to Townsville, where it will be depressurised and distributed, by a third party, to industrial users, including QPM's Townsville Energy Chemicals Hub (TECH) Project.

This draft Outline Environmental Management Plan (EMP) establishes the environmental management framework for delivery of the Project.

The Project has lodged Petroleum Pipeline Licence (PPL) and Petroleum Facility Licence (PFL) applications beneath the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act), and an Environmental Authority (EA) application for environmentally relevant activities relating to petroleum resource activities under the *Environmental Protection Act 1994* (EP Act).

The Project is also a 'controlled action' for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), with the controlling provisions being listed threatened species and communities (EPBC 2022/09329).

1.2 Purpose and structure

This EMP provides an environmental management framework to enable the identified environmental outcomes to be achieved for the detailed design, construction and operation of the Project. It also establishes the process for Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) to be prepared and implemented.

Following completion of the PPL, PFL, EA and EPBC applications, this EMP will be updated to reflected conditions of approval.

This EMP:

- describes the key elements and delivery phases of the Project
- describes the environmental management framework for the design, construction and operation of the Project
- describes the relationship between this EMP, CEMP and OEMP
- describes monitoring, reporting, auditing, review and documentation requirements
- describes processes for dealing with a non-compliance, including corrective actions
- includes requirements for training and awareness
- outlines the complaints management and response process.

This EMP includes the following sub-plans:

- land resources
- flora and fauna
- air quality
- surface water
- groundwater
- noise and vibration
- traffic.

1.3 QPM Environmental Policy

QPM's environmental management objectives are outlined in the Queensland Pacific Metals Environment and Community Policy (Queensland Pacific Metals, 2021). The commitments relevant to the EMP include:

- managing adverse environmental impacts through identification, setting objectives and targets, and implementing mitigation programs
- ensuring construction complies with environmental laws, regulations, and codes of practice
- fostering continuous improvement of our environmental management systems and practices to meet ISO 14001
- engaging with QPM employees, customers and investors on environmental issues and report on our environmental performance.

2 Project description

2.1 Summary

Queensland Pacific Metals (QPM) Energy is the proponent of the QPM Energy Project (the Project). The Project involves the design, construction, and operation of a gas compression facility (GCF) and a high-pressure pipeline that links the proposed GCF to the nearby existing and operational North Queensland Gas Pipeline (NQGP).

The Project proposes to collect waste coal mine gas at the proposed GCF via waste gathering lines from existing adjacent mines. At the GCF, waste coal mine gas will be dehydrated and filtered, with the remaining clean gas then compressed and transported via high-pressure pipeline to the existing and operational NQGP. The NQGP will then transport the compressed gas north to Townsville, where it will be depressurised and distributed, by a third party, to industrial users, including QPM's Townsville Energy Chemicals Hub (TECH) Project.

Access to the GCF will be provided via the construction of a 2.8 km all-weather access road from Red Hill Road.

Ancillary activities will also occur within the defined project area.

The Project is defined by limits which include:

- road connection to Red Hill Road
- GCF inlet flange/s to the facility from gas gathering systems on adjacent mining tenures
- connection to the NQGP (via hot tap)
- GCF clean water pipeline flange returning water to the relevant existing mine water management system
- rainfall run-off from an on-site settling basin
- high-pressure pipeline easements (30 m wide right of way (ROW) during construction and reduced to 15 m ROW during operations from 3.2 km from the GCF boundary).

2.1.1 GCF

The GCF, located on Dabin Station, adjacent to North Goonyella Mine, will receive gas at a normal pressure of 138 kilopascals gauge (kPag) from the upstream field system, and deliver at a maximum delivery pressure of 15,300 kPag. Waste coal mine gas will be dehydrated using a high boiling point Tri-Ethylene Glycol (TEG) dehydration unit to remove water vapour in the incoming gas and produce distilled water. The incoming gas is filtered to remove particulates.

The clean gas will be compressed using small 5.5 terajoule per day (TJ/d) compressor units powered by gas-fired turbocharged engines using clean gas.

The GCF is proposed to include:

- gas filtration
- gas compression
- gas dehydration
- custody transfer metering
- gas flare

- oily water separation
- clean water transfer to adjacent mines
- utilities.

The GCF will be powered by two gas engines, each with 100% capacity. A further backup diesel generator is installed for emergencies.

2.1.2 Pipeline

The high-pressure pipeline will traverse from the outlet of the GCF, moving generally west for 4.5 km before turning south for 4.5 km and then heading west for 8 km, finishing at the Hot Tap connection to the NQGP.

The high-pressure pipeline, constructed in accordance with Australian Standard (AS)2885 – 1997, will be sized for the full 24 Petajoule per annum (PJ/a) which is intended to be the plant capacity at full operation. It will cross Goonyella Creek, Denham Park access track, two water pipelines (Sunwater Burdekin and Eungella pipelines) and the Newlands to Goonyella Rail System before connecting with the NQGP.

The design for the high-pressure pipeline is DN200, ASME Class 900 with the line pipe material proposed to be in accordance with API 5L with X52 PSL2 HFW material specification. The design including pipe diameter and class will be refined in detailed design studies.

Corrosion protection for this line will be a 3-layer polyethylene coating system and cathodic protection system. A split hot tap tee will be specified to meet the mechanical requirements for the material and pressure rating of the NQGP at the connection location. The fitting will be welded to the high-pressure pipeline and the hot tap will be carried out under strict operating conditions.

The minimum depth of cover through this area will range between 750 to 900 mm. Crossings will be deeper, between 2,000 and 3,000 mm. The rail crossing will require a depth of cover of 3,000 mm below the lowest points which could be optical fibre within the rail corridor.

There are four crossing points proposed:

- Goonyella Creek at 460 m – will be crossed using conventional dry season open cut and remediation operations in accordance with waterway crossing regulations.
- Farm access road at 5,320 m – will be crossed using conventional trenching methods.
- Sunwater pipelines (side by side) at 12,008 and 12,012 m – the allowable crossing method permits the pipelines to be exposed via excavation and the high-pressure pipeline to be located under the pipelines at a 90-degree alignment to the Sunwater pipelines.
- Newlands to Goonyella Rail System at 12,080 m – access to the 70 m rail easement is typically not permitted, consequently thrust boring is required below the entire easement width. This would take place from the western side. Above rail access for vehicles is nominated via a conveniently located existing crossing 50 m south of the rail crossing. The potential crossing depth must be 3 m below the lowest point in the crossing. This will require potentially a 3 to 4 m deep working platform for equipment to carry out the boring operation. Based on a 4 to 1 batter, access to the trench may be 16 m. Consequently, the working width in the vicinity of the rail has been increased to 50 m.

2.2 Proposed activities

2.2.1 Construction

i GCF

Construction of the GCF will occur in three stages and include the following activities:

- mobilisation of construction equipment
- establishment of the 2.8 km access road from Red Hill Road to the Project footprint
- establishment of access to water supply, via the high-pressure pipeline corridor
- site bulk earthworks including cut and fill and compaction to design levels
- installation of steel piles and concrete pads
- installation of all equipment items, skids and buildings
- installation of associated steel structures, prefabricated piping, electrical equipment, instrumentation and controls
- supply and install communication and controls infrastructure
- demobilisation of construction equipment
- rehabilitation of temporary disturbance areas
- pre-commissioning and commissioning of GCF.

ii Pipeline

The 16.8 km high-pressure pipeline would be constructed in accordance with AS2885-1997 Part 1 Pipelines Gas and Liquid Petroleum. A conventional ROW width of 30 m has been identified to facilitate construction operations. Additional width is required in the vicinity of the Newlands to Goonyella Rail System.

The high-pressure pipeline would comprise lengths of coated steel pipe to be welded together and buried with a depth of cover of at least 750 mm to 900 mm.

Construction activities for the high-pressure pipeline would involve:

- Clearing of vegetation and stockpiling of topsoil containing the seed bank on the furthest edge of the ROW.
- Grading of the ROW and stockpiling adjacent to the Seed Bank. This will establish a safe construction working area.
- Separation and stockpiling of topsoil and subsoil.
- Creation of a trench in which to lay the high-pressure pipeline. This would be undertaken by a trenching machine, rock saws, or excavator and may involve rock hammers or blasting in hard rock terrain. Spoil will be placed to the other side of the trench to retain passing lanes and operating areas to string pipe for welding and burying.
- Welding of pipe sections together to form ‘a string’ approximately 1 km in length.

- Placing the high-pressure pipeline string into the trench and placing padding (e.g. screened trench sub-soil) around the pipe to protect the coating from external damage.
- Returning the subsoil and topsoil to their original horizons.
- Testing the integrity of the high-pressure pipeline (hydrotesting) by filling it with water and pressurising it to above the operating level.
- Clearing up and restoring the construction ROW and all temporary facilities.

2.2.2 Operation

i GCF

Typical operations will involve minor maintenance, calibrations, inspections, equipment performance checks, or equipment repair if needed. Operational activities will be typically carried out during daylight hours, unless an emergency requires urgent works at night. The operator will carry out inspections ranging from daily inspections to more rigorous inspections that may vary from one month to four years apart, dependent on the works and in conformance with detailed maintenance and operational integrity plans.

Callout for unplanned activities or responding to process upset may occur throughout the operational life of the facility. The response time for operators to arrive on site for intervention is expected to be one hour. Key operating data and equipment operating status will be viewable from site Supervisory Control and Data Acquisition (SCADA) system. The control system setpoints and functions can be remotely changed or tuned from site SCADA. In general, site SCADA is the local control room which works the same as the remote Main Control Room.

This facility is designed to fail in a safe position. Some process equipment can be remotely started or stopped from site SCADA. During operation gas flow and pressure would be monitored from the GCF and at the gas delivery points.

ii Pipeline

Inspection of the high-pressure pipeline easement for issues such as erosion, weeds, subsidence, and lack of revegetation or third-party activity would be carried out on a regular basis using ground access via the easement. This would also include periodic inspection of the corrosion protection (cathodic) system.

The high-pressure pipeline would be operated with a maximum allowable operating pressure of 15.3 megapascals (MPa).

An allowance for a conventional 30 m construction ROW has been made. Post-construction, the easement will shrink to a 15 m operating width after 3.2 km from the GCF.

Given that the high-pressure pipeline would be underground, land users would be able to resume previous land use activities on top of the high-pressure pipeline provided that they did not include excavation activities. Whilst deep rooted vegetation cannot be re-established directly across the high-pressure pipeline, due to the potential for damage to the high-pressure pipeline, grasslands can be re-established.

Hydrostatic testing procedures, including water sourcing and disposal, will be determined during the detailed design and construction phase.

Disposal of hydrostatic testing water will depend on the initial water quality, nature of any additives, the rate of application, the site of application and the robustness of the receiving ecosystem. The preferred method of use is to recycle water for hydrotesting down the high-pressure pipeline as it is constructed.

The disposal of the water will occur via the Council regulated water treatment facility.

2.2.3 Rehabilitation

Restoration would be undertaken in such a way as to ensure that:

- Topsoil cover containing the original seed bank is re-established and all land and waterways disturbed by Project activities are returned to a stable condition as soon as possible after construction.
- Land is returned as close as possible to its previous productivity.
- Stable landforms are re-established to original topographic contours.
- Natural drainage patterns are reinstated.
- Erosion control measures (e.g. contour banks, filter strips) are installed in erosion prone areas.
- The pre-construction environment is reinstated, and disturbed habitats recreated with the exception of a 15 m easement in which the high-pressure pipeline is located where deep-rooted tree growth is discouraged. Typically for a large part of the high-pressure pipeline easement, this corresponds to existing cleared land, cleared fenceline and firebreaks located across existing cleared land.

A Pipeline Restoration Management Plan will be prepared by QPM Energy prior to construction commencing.

3 Roles and responsibilities

Table 3.1 outlines the roles and responsibilities of the key personnel working on this Project.

Table 3.1 Roles and responsibilities

Role	Responsibilities
QPM Energy (proponent)	• Obtain relevant approvals and permits. • Oversee all works during construction/operation. • Provision of sufficient resources and support required to implement the Project's environmental obligations and commitments. • Appoint consultants to assist in overseeing works and monitoring compliance with conditions of relevant permits. • Ensure that the environmental and social obligations and commitments for execution are included in the Project procurement process and as a part of the signed contracts.
Principal contractor (PC)	• Prepares, maintains and implements the CEMP and OEMP. • Delivers the Project in accordance with all laws, including conditions of approval. • Ensures all staff (including subcontractors) are appropriately briefed on the requirements of the CEMP/OEMP prior to starting any works. • Ensure appropriate training is undertaken by all site personnel and maintain a record of all training completed. • Provides copies of the CEMP/OEMP to all relevant project staff with nominated responsibilities. • Audit work scope and proposed methodology against plans. • Implement environmental controls and mitigation measures as described in the EMP and environmental approval, permits and licences. • Management of Subcontractors and employees. • Attend all environmental training and inductions, adhere to the principals covered and seek additional guidance as required to remain vigilant and competent.
PC Project Manager (PM)	• Determine the resources necessary to conduct specific activities and achieve environment objectives. • Ensure mitigation actions agreed as part of the risk assessment process are included in the CEMP/OEMP, supporting plans, and procedures. • Provide for training to ensure that each member of the project team is competent to implement this EMP. • Produce environment objectives, tasks, and targets for the contract. • Be the primary avenue of communication between PC and QPM Energy on environment matters, including incidents.
PC Health Safety and Environment Advisor (HSE Advisor)	• Coordinate the activities of site environment personnel. • Coordinate/facilitate field-based inspections and audits on project activities and subcontractors. • Participate in the development of hazard identification and control mechanisms. • Review training records and qualifications to ensure each person is competent to perform tasks associated with their position. • Ensure that the personnel understand the specified environment requirements and are provided with the necessary instructions and support to perform their tasks in a manner which minimises any potential impact on the natural environment. • Encourage environment incident reporting by all site personnel to ensure that information gained from the incident is used to best effect in ensuring preventative actions are implemented. • Notify the PM and commence preparation of an Incident Report.

Table 3.1 Roles and responsibilities

Role	Responsibilities
PC Construction Manager (CM)	• Be responsible for the environment issues relating to construction. • Be responsible for ensuring that sufficient resources are available for the implementation of this EMP. • Identify and implement any specialised training for the construction crew required in relation to environment protection. • Be responsible for the movement of personnel and all plant and equipment and liaise with the QPM Energy Site Representative and local authorities in exercising this responsibility to ensure the natural environment is not affected. • Be responsible for the implementation of environment related procedures during all construction activities. • Implement disciplinary actions for the breach of Project environment requirements. • Report all environment incidents to the PM and QPM Energy Representative. • Ensure that a documented preliminary incident report is completed and provided to the PM within 24 hours of a significant incident. • Ensure environment investigation forms are accurately completed and closed out and involved employees have been informed. • Review the quality, thoroughness, and adequacy of corrective actions for each investigation.
Operations Manager (OM)	• Same as PC CM, but during operations.
PC Project Engineer	• Accountable to the PM. • Responsible for all factors relating to the natural environment on the project, including facilitating the implementation of environment management planning and coordination. • The project EMP is developed and implemented, and regularly reviewed. • Work affecting the natural environment are in compliance with all current statutory obligations. • Copies of relevant legislation, codes of practice, codes and standards are readily accessible. • Environment hazards are identified, and risk assessment procedures are instigated. • Subcontractors have suitable experience and knowledge to conduct any potential work scope in compliance with project environment requirements. • Performance is monitored, documented, and reported to PM. • Procedures are established for distribution, reporting, and reviewing environment issues. • Adequate and effective training programs are developed and implemented. • Adequate resources are available for elected environment representative.
Workers and subcontractors	• Adhere to QPMs' environmental management system, including the requirements and procedures outlined in this EMP. • Comply with and observe statutory requirements in relation to environmental protection and other relevant legislation. • Attend all environmental training and inductions, adhere to the principles covered and seek additional guidance as required to remain vigilant and competent.

4 Inductions, training and awareness

All personnel involved with the Project, including contractors, subcontractors, consultants, and visitors, will be required to undertake an induction before commencing any site activities. The intention is to communicate project-specific environmental management information and understand their responsibilities as identified within the CEMP and OEMP.

Inductions will address:

- CEMP/OEMP requirements
- relevant imposed conditions
- statutory duties in regard to notification of environmental harm
- environmental incident notification procedures
- complaints management procedures
- key environmental risks and issues
- location of sensitive receptors, environmentally sensitive areas and no-go zones
- cultural heritage and cultural awareness training
- permissible hours of work
- key environmental contacts
- roles and responsibilities
- washing, refuelling, storage and maintenance areas for vehicles and equipment.

Environmental education of environmental risks and issues such as dust and air quality, erosion and sediment controls, fauna awareness during clearing phases will be communicated as relevant (such as seasonal, work activity etc) by the following methods:

- environmental induction programs and training
- daily prestart meetings
- weekly toolbox meetings
- risk workshops
- management meetings
- noticeboards.

Records of induction and training will be maintained on the Project and include:

- names of the person who completed the induction or training
- date of attendance
- evidence the person who completed the induction or training understood the content through a scored means or signed declaration.

5 Incident and emergency and response

Effective prevention of incidents is achieved through proactive planning, monitoring, supervision, and training. During operation activities, inspections, and preventative action to be performed by contractors will include and may not be limited to:

- inspections of work areas
- completion of routine environmental checklists
- issue and quick close-out of non-compliance notices
- prompt maintenance and repairs
- maintenance of constant supervision onsite
- ongoing environmental training
- environmental audits of work sites, subcontractors, and compliance issues.

Sections 320 to 320G of the EP Act outline the requirements of the duty to notify of environmental harm. Pollution incidents and activities that cause or threaten to cause serious environmental harm or material environmental harm must be reported within 24 hours to the Department of Environment and Science (DES) (or current administering authority of the EP Act), and other stakeholders as required, so that appropriate action can be taken to prevent or limit possible environmental harm.

All staff and contractors will be required to report any environmental incidents (including complaints) or breaches of the approval conditions in accordance with the requirements and timeframes set out in the CEMP.

Project-specific Incident Management Procedures will also be developed to detail the process and resources required to respond to and manage incidents and emergencies during construction and operation.

If an environmental incident occurs, the CM/OM will advise personnel on the immediate actions, which may include but is not limited to:

- stop work and isolate the area
- take prompt action to minimise and control the environmental harm
- notify the relevant authorities and members of the leadership team in accordance with the EP Act
- organise remedial works to be undertaken
- ensure the ongoing safety of personnel is maintained.

Table 5.1 contains a list of key contacts; this list will be maintained and available to all site personnel.

Table 5.1 Emergency contacts

Contact	Phone Number	Address
DES Pollution Hotline	1300 130 372 (press option 2)	21 Langton Street, Garbutt 4810
QLD Ambulance	000	Ambulance Centre, 9 Griffin Street Moranbah, QLD, 4744
QLD Fire and Rescue	000/(07) 4941 7770	13 Griffin Street, Moranbah QLD 4744
QLD Police	000/(07) 4941 6200	St Francis Drive, Moranbah QLD 4744
SafeWork QLD	1300 362 128	Level 5, Verde Central 44 Nelson Street, Mackay QLD 4740
Isaac Regional Council	1300 472 227	Batchelor Parade, Moranbah QLD 4744
Vet/wildlife carer Fauna Rescue Whitsunday	4941 7001 4947 3389	33 Mills Ave, Moranbah QLD 4744 http://www.frw.org.au/contacts.html

6 Monitoring, auditing and reporting

Inspections, monitoring, auditing and reporting will be undertaken to document compliance with imposed conditions, the CEMP and OEMP. Where monitoring and auditing determines that the existing management measures are not effective, corrective and preventative measures will be developed and implemented as soon as practicable.

6.1 Environmental inspections

The CEMP and OEMP will include requirements for inspections of construction sites to ensure compliance with imposed conditions and other management plans.

During construction, the effectiveness of environmental control measures will be assessed regularly by the PC. Contractors will be required to monitor construction work areas within their control. This will require daily inspections to ensure continual compliance with the CEMP and relevant approval and permits conditions.

The HSE Advisor will examine all construction work areas on a weekly basis, at minimum, and provide feedback in the form of an Environmental Inspection Checklist. The purpose of the environmental inspections is to:

- provide an observation tool to ensure relevant environmental control measures are effectively implemented
- proactively identify where issues may arise and facilitate early resolution of problems
- identify where environmental management practices are not being implemented.

The environmental performance data will be incorporated into weekly and monthly progress reports submitted to the proponent and PM team.

General monitoring aspects and corrective actions triggers include but are not limited to the items detailed in Table 6.1. Any non-conformances identified through the environmental inspection process will be outlined in the Environmental Inspection Checklist, and if applicable corrective actions will be described. Non-conformances will be actioned and resolved in a timeframe agreed to between the PC and proponent.

Table 6.1 Environmental inspection aspects and corrective action triggers

Monitoring	Timeframe	Corrective Action Trigger
• Visual inspection of site condition including: – air quality, dust generation and mitigating controls – stormwater management – erosion and sediment controls – noise and vibration control measures – waste management practices – chemical storage, hazardous substances, and dangerous goods – housekeeping and general pollution control – fencing, signage, and general preservation of no-go zones.	• At minimum weekly by the HSE Advisor.	• Triggers may include: – excessive dust emissions – noticeable odour – erosion – observed spill – inadequate spill kits – sediment build-up – fauna in the work area – excessive noise – waste in the incorrect bin – waste containers not closed – chemical storage outside bunds – refuelling and washing of vehicles in undesignated areas – disturbance of no-go zones.

Table 6.1 Environmental inspection aspects and corrective action triggers

Monitoring	Timeframe	Corrective Action Trigger
• Review of relevant work approvals and permits.	• At minimum weekly by the HSE Advisor.	• Non-compliance with the conditions of works approvals and permits.
• Register complaints and incidents in relation to project works.	• As required.	• Complaint or incident associated with project works.

6.2 Monitoring

Environmental monitoring programs will be developed for the construction and operation stages of the Project. These monitoring activities will be conducted by a person who is suitably trained, qualified and experienced. Monitoring will be carried out in accordance with relevant guidelines. All monitoring equipment will be maintained and calibrated in accordance with manufacturers' instructions which will ensure reliability of equipment and data.

Environmental samples will be sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis, unless otherwise stated in a sub-plan. The results would be interpreted and reviewed regularly with non-compliance investigated and resolved.

6.3 Audits

During construction and operation, environmental audits will be completed to assess compliance with all applicable environmental requirements. This will include internal audits (to be completed once a quarter by the HSE Advisor) and external audits by a third party.

The internal audit will include but is not limited to:

- compliance with the CEMP/OEMP
- compliance with conditions of approval, permits and licences
- compliance with construction method statements and procedures
- complaints management
- corrective actions
- training records
- monitoring results
- inspections and environmental performance reporting.

An internal audit plan will be developed as part of the CEMP and OEMP.

Third-party independent audits will be completed on an annual basis and likely to be conditioned as part of the EA, administered by DES.

6.4 Reporting

The HSE Advisor will prepare a detailed Environmental Performance Report on a quarterly basis, containing an update on the Project's environmental performance and relevant environmental matters for that period. Each report will be provided to the PM and OM and made available to the greater project leadership team.

The environmental report will include details on:

- summary of relevant work undertaken
- incidents and non-compliances that occurred
- implementation action plans
- completed environmental inspections and key findings
- monitoring results
- complaints received and actions taken
- audit conducted
- external inspections.

6.5 Corrective actions

Corrective actions must be undertaken where observation, monitoring, or validated complaints indicates a non-conformance. The HSE Advisor must issue routine Environmental Inspection Reports that include corrective actions as required. The HSE Advisor will issue Environmental Improvement Notices and Environmental Incident Reports in response to non-conformance with this CEMP and outlined performance criteria, non-compliance with conditions of approvals or permits, inappropriate work methods or other concerns.

If the non-conformance is significant, corrective actions are not implemented, or the contractor is found to be non-compliant on multiple instances, a Non-Conformance Report (NCR) will be issued.

In the event of a non-conformance:

- if appropriate, work must be ceased until appropriate remedial actions are taken
- the event must be investigated by the HSE Advisor and CM/OM, this may include visual inspections, interviews, and monitoring
- advice may be sought from a specialist
- the effectiveness of controls and procedures must be reviewed and updated as necessary
- appropriate preventative and corrective actions must be implemented. Strategies will be identified to prevent reoccurrence
- the event must be recorded in the Project database.

7 Complaints management

A complaints management system and register will be established and maintained on the Project. It will be the responsibility of the PC or assigned delegate to receive, log, track and respond to complaints within specified timeframes. The following details must be recorded in the register:

- date and time
- means of communication (telephone, letter, meeting, etc)
- name, address, and contact number of the complainant
- nature of complaint
- action taken in response, including who the complaint was referred to (if not resolved immediately)
- details of any monitoring or investigation undertaken to confirm that the complaint has been satisfactorily resolved.

The PC will notify the proponent immediately of any issues of complaints raised.

An initial response must be provided to the complainant within 24 hours, confirming that the matter is being addressed. A detailed response will be provided within ten working days.

A Complaints Response Report must be provided to the PM and HSE Advisor within two working days of receiving a complaint about any environmental issue. The Complaints Response Report must provide details of the action taken, further action planned to alleviate the problem, and dates when these actions will be completed. The PM, CM/OM and HSE Advisor will review this report and provide feedback. Feedback from the PM to the delegate with required measures, including those to prevent the reoccurrence, must be submitted to the delegate within five working days. The delegate will have two working days to reissue the report, incorporating the provided feedback.

8 Document control

The Project team must maintain the following records:

- safety work method statements
- complaints, correspondence, and reports
- environmental inspections
- erosion and sediment control plans
- employee training records
- environmental monitoring results
- sediment basin checklists and release records
- environmental incidents investigations reports
- non-conformance and corrective action reports
- waste quantity reports
- waste disposal documentation
- fuel consumption records
- audit schedule and reports
- check sheets and field sheets
- management review minutes and action taken.

The Project will safely retain all records for at least five years after the date of completion, and all records must be accessible to the PM.

9 Environmental management approach

This section provides discipline-specific Draft Outline EMP sub-plans, drawing on the outcomes of the environmental assessments documented in the EA application. The sub-plans establish a framework for sub-plans that will be prepared as components during the next phase of the Project.

The following plans will be prepared in detailed design:

- Vegetation Management Plan
- Species Management Program
- Erosion and Sediment Management Plan
- Stormwater Management Plan
- Safety and Emergency Response Management Plan
- Air Quality Management Plan
- Traffic Management Plan
- Noise and Vibration Management Plan
- Weed and Pest Management Plan
- Bushfire Management Plan
- Waste Management Plan
- Nuisance and Complaint Management Plan.

Each Outline EMP sub-plan includes:

- performance outcomes
- mitigation measures.

9.1 Land resources

9.1.1 Performance outcomes

- avoid, minimise or mitigate impacts to soils
- maintain soil quantity and quality
- restore land to its pre-activity use but that it is also returned to its pre-activity productive capacity or potential productive capacity as soon as possible following completion of the activity
- return the land to a stable landform (i.e. no subsidence or major erosion) with no greater management inputs than those required prior to land disturbance.

9.1.2 Proposed mitigation measures

Table 9.1 Mitigation measures – land resources

Delivery phase	Aspect	Proposed mitigation measure
Detailed design	Erosion and sediment control	• Prepare Erosion and Sediment Control Plans (ESCPs) in accordance with Appendix P – Land-based pipeline construction (IECA 2015). • The ESCPs shall be prepared by a Certified Professional in Erosion and Sediment Control with appropriate professional experience. The ESCP will include construction, inspection and maintenance requirements for all drainage, erosion, and sediment control measures. • ESCPs will include appropriate erosion and sediment controls for all stages of soil disturbance. They will be appropriate for the erosion risk posed by potentially dispersive or non-cohesive site soils and adjusted to account for weather events such as high winds or rainfall. • ESCPs will also set out roles and responsibilities for personnel and procedures to be followed if there is a failure in the adopted control measures. • Prepare a Soil Stripping and Management Plan (SSMP). Overarching principles within the SSMP are to include or consider: – preserve as much of the topsoil and subsoil materials as possible – ensure soil materials, especially topsoil, are not degraded during construction and following reinstatement – ensure soil is not contaminated with other soil and spoil materials – during soil handling ensure that structural degradation/compaction of the soil is minimised for example by designating access routes and minimising trafficking and compaction of stockpiles – management of weeds and biosecurity – effort should be made to reduce the time between excavation and backfill to minimise soil exposure – monitor for dispersion and erosion, particularly of exposed sodic subsoils. Any evidence of erosion may require the addition of ameliorants such as gypsum or lime.
	Disturbance of existing contamination	• Prior to excavation works, contact DES regarding the location of any historical livestock dips or spray races which were listed on the Environmental Management Register (EMR). The landholders for these land parcels should also be consulted to confirm the location of historical and current livestock dip or spray race activity, and land disturbances related to waste dumping/tipping. If historical livestock dipping/spray race activities and/or waste dumping/tipping are in close proximity to the proposed disturbance footprint, limited shallow soil sampling should be conducted to inform risk to construction workers and sensitive receptors. • Ensure the CEMP developed for the site includes procedures for suspected contaminated soils or materials (i.e. asbestos or hydrocarbon impact associated with the Newlands rail corridor). Safety procedures will be developed to reduce the potential for exposure pathways to contaminated material.
Construction	Pre-stripping and stockpiling of top soil	• Stockpiles should be in an area above the top of the bank where it will not be buried or damaged i.e. free of traffic, topsoil and sub-soil material to be stockpiled separately. Topsoil along the pipeline corridor will be pushed to the furthest edge for subsequent post construction use. • Movement of excavated topsoil or subsoils to different areas of the Project footprint should be minimised to reduce the potential exposure of workers or sensitive receptors to contaminated soils.

Table 9.1 Mitigation measures – land resources

Delivery phase	Aspect	Proposed mitigation measure
	Erosion and sediment control	• Implementation of the SSMP and ESCP. • Install sediment controls to protect sensitive waterways and lands. • Remove groundcover vegetative material from the alignment prior to construction and reinstate following construction to provide seed stock and/or organic matter to assist revegetation. • If suitable, vegetation that is cleared and mulched may be used to provide a thin surface mulch to protect the topsoil and mitigate erosion hazards. • An inventory of soils to be stripped, including soil types, stripping areas, depths and volumes. • A topsoil and subsoil stripping and excavation procedure. • Contractor Site Environmental Advisor (or relevant person) to identify, record and indicate (to plant operators) the stripping depth during stripping operations. • Where available, strip topsoil to a minimum recommended depth as per Table 9.1 or a minimum of 0.1 m. • Remove and stockpile subsoil separately from topsoil (Table 9.1) to prevent mixing. • Avoid soil stripping activities when the soil structure is saturated. • Topsoil stockpiles not to exceed 2 m in height to minimise degradation of topsoil, maintain biological capital and maintain fertility. • Stockpiles preferably not be stored for periods greater than 3 months and should be vegetated with suitable vegetative cover if so. • Topsoil stockpiles (particularly silty or dispersive soil materials) should be sprayed with a soil binding agent to stabilise the surface against rain (when forecast) or wind erosion whilst protective vegetative cover is absent. • Leave gaps between stockpiles at appropriate intervals to allow for drainage, and permit the movement of vehicles and fauna. • Place stockpiles away from water discharge zones where they are not disturbed by other activities. • Topsoil should not be stockpiled against fences or vegetation and should be retained separately from mulch (apart from a surface layer). • Monitor and control weeds on the stockpiles to prevent establishment and spread. Control should not reduce vegetative cover such that the stockpile erodes due to exposure of the soil. • Stockpile excess subsoil (if present) separately for disposal by burial in borrow pits or quarries, or as fill on the property owner's land if requested by the property owner, or for other infrastructure uses. However, prior to the use as fill or for other infrastructure uses that may expose the material to erosion, the material should be analysed to assess its suitability for the purpose. • Use trench breakers on sloping sections of the pipeline, waterway crossings and where dispersive soils are present to minimise tunnel erosion along the trench. Where dispersive soils are present, the trench breakers shall be laterally excavated into the in-situ soils either side of the trench to minimise the potential for flanking.

Table 9.1 Mitigation measures – land resources

Delivery phase	Aspect	Proposed mitigation measure
		• Prepare individual ESCP's for each drainage line crossing. • Minimise the extent and duration of disturbance across watercourses and on flood prone land. • Install sediment controls to protect sensitive waterways and lands. • Where open trenching methods are used in waters and flow in existing or anticipated, place water filled coffer dams either side of the disturbed area and pump clean flows around the disturbed construction area in accordance with arrangement details in Appendix P – Land-based pipeline construction (IECA 2015). • Stabilise topsoil and subsoil stockpiles with soil stabilising polymer to minimise dust generation. • Water and/or apply trafficable soil stabilising polymers to the alignment and unsealed access tracks and roads to reduce dust emissions.
	Imported fill	• Topsoil is not required under the current design. If topsoil is required, it will be commercially purchased and transported from the nearest supplier. Topsoil will be sampled at a rate of one sample per 500 m^3 or per batch (whichever is lower) for compliance with AS4419 and must be certified free of restricted or prohibited biosecurity materials. • The proponent should request evidence from suppliers of imported aggregate or fill that the materials are not contaminated. • Limited verification sampling of imported fill and aggregate should be considered.
	Construction Water supply	• Use of water from the existing Sunwater pipeline will be the primary water source during construction. If construction water needs to be trucked to site, evidence of water sample analyses will be requested periodically from the water carrier to ensure imported water is free of potential contaminants. Local groundwater resources will not be utilised for water supply.
	Soil amelioration	• All ameliorants sufficiently mixed with the soil to be effective. • Soil ameliorants are applied with a suitable purpose and rate, to ameliorate sodic or dispersive soils. • Proposed rates aim to improve soils with an exchangeable sodium percentage (ESP) of >5% and/or a Ca:Mg ratio at <1. Gypsum application should be considered for: • Surface topsoil either prior to surface topsoil stripping, or following surface topsoil re-spreading and incorporated to approximately 0.1 m (topsoil stripped area). • Trench areas during subsoil reinstatement before compaction. Application on the subsoil stockpile following trenching allows for mixing during trench filling. Ensure thoroughly incorporated prior to compaction and surface topsoil placement; areas where topsoil has been stripped and subsoil with a required gypsum application rate is disturbed or where runoff with high turbidity needs to be controlled. Apply at 1 t/ha. • Any areas of disturbed subsoil.

Table 9.1 Mitigation measures – land resources

Delivery phase	Aspect	Proposed mitigation measure
	Contamination and spills	• Spill kits will be available at all active work areas, and in vehicles and machinery. • Bulk chemicals for use during construction will be stored within the Project footprint at locations suitably distanced from sensitive receiving environments (i.e. surface water bodies) and will be managed in accordance with: – the *Work Health and Safety Act 2011* (WHS Act) and regulation – AS 1940:2017 Storage and Flammable or Combustible Substances – AS 3780:2008 The storage and Handling of Corrosive Substances. • Refuelling of mobile plant and vehicles will occur at designated areas within the Project footprint with appropriate bunding and an oil-water separator installed where applicable. These areas will be suitably distanced from surface water bodies and drainage lines. Spill kits for chemical and hydrocarbon spills will be available at refuelling points. • Vehicles and plant maintenance will be conducted at designated paved laydown areas as much as practicable to minimise spills and leaks reaching soils, surface water bodies or shallow aquifers via seepage. • Ensure the CEMP developed for the site includes emergency response procedures for spills and discharges of contaminants of potential concern.

Table 9.1 Mitigation measures – land resources

Delivery phase	Aspect	Proposed mitigation measure
	Rehabilitation	• Develop Rehabilitation Management Plan. • Develop Pipeline Restoration Management Plan. • Rehabilitation of disturbed areas will commence progressively as soon as practicable during and after construction and will be carried out in accordance with SWMP and ESCP. • Rehabilitate areas not required for ongoing operation and maintenance of project as soon as practicable following construction. • Retain woody debris, logs and rocks for use in rehabilitation. • Topsoil cover containing original seed bank is re-established. • All land and waterways disturbed by the Project returned to stable condition as soon as possible after construction. • Reuse seed banks contained in topsoil. • Natural drainage patterns reinstated. • Reinstate soil profiles in sequence order according to their soil management layers (i.e. subsoil then topsoil). • Following subsoil reinstatement place topsoil and re-spread to the topsoil strip depth so that there is no exposed sub-surface material. • Respread topsoil to a minimum depth of 0.1 m of cover over the entire disturbed area to be reinstated. • Compact reinstated subsoil material adequately with a trench roller within the trench to ensure minimal subsidence or potential for tunnel erosion. • Ripping or cultivation of the reinstated subsoil may be required to overcome any compaction that occurs during stockpiling and the reinstatement procedure. • Remove soil compaction in upper subsoil by cultivation prior to spreading topsoil, if required. • Remove soil compaction in topsoil following respreading.
Operation	Rehabilitation	• Rehabilitation of disturbed areas will commence progressively as soon as practicable during and after construction and will be carried out in accordance with SWMP and ESCP.
	Erosion and sediment control	• Inspect the right of way following rain to identify areas of erosion, subsidence an/or tunnelling and repair as required.

Table 9.1 Mitigation measures – land resources

Delivery phase	Aspect	Proposed mitigation measure
	Contamination and spills	• Diesel storage using above ground storage tanks (AST) will be appropriately bunded and designed to industry standards. Spill kits to be available at all fuel storage and refuelling locations. The handling of stored fuels will be in accordance with: – the WHS Act and regulation – AS 1940:2017 *Storage and Flammable or Combustible Substances*. • Refuelling of diesel tanks will occur at designated areas suitably distanced from surface water bodies and drainage lines. Spill kits for chemical and hydrocarbon spills will be available at all refuelling points. • All mobile plant and vehicles will be equipped with spill kits. • Oil storage with pumps for the gas compressors and engines are to be bunded. • Maintenance of vehicles and mobile plant will be conducted regularly at designated laydown areas to minimise spills and leaks reaching shallow aquifers via seepage or surface water. • All hazardous chemicals are to be stored inside appropriately bunded areas and within lined or paved areas. • Bulk chemicals will be stored within the Project footprint at locations as far from sensitive receiving environments as practicable (i.e. landholder bores or surface water bodies). • Reagents and hazardous chemicals to be managed in accordance with: – the WHS Act and regulation – AS 1940:2017 *Storage and Flammable or Combustible Substances* – AS 3780:2008 *The storage and Handling of Corrosive Substances*. • Site operations will adhere to an EMP which details appropriate response management procedures of any spills or uncontrolled release of hazardous materials. • In the event of a large spill, the site will be investigated, managed and remediated in accordance with contaminated land provisions in the EP Act.
	Clean water system	• Clean water will be returned to the raw gas suppliers pro-rata to their relative amount of gas supplied to the GCF.
	Oily water system	• The oil separated from the Oily Water Separation Package will be stored and trucked off-site to a licensed facility. • Concrete bunding will be used for the oily water package.
	Solid/hazardous wastes	• All contaminated waste materials must be transported and disposed of in accordance with the EP Act through a licensed waste transported and licenced disposal facility. • Solid wastes should be sampled and analysed appropriately to inform waste disposal options under the Environmental Protection Regulation 2019 and the DES Model operating conditions: Environmentally Relevant Activity (ERA) ERA 60—Waste disposal activities.

Table 9.1 Mitigation measures – land resources

Delivery phase	Aspect	Proposed mitigation measure
	Stormwater and overland flow	• Stormwater from upstream catchments and clean water runoff areas will be diverted around the premises to reduce loading on the internal water management system. • Provide water quality treatment to enable water reuse to reduce any residual water quality risks or to treat stormwater to an acceptable level (based on agreed water quality objectives) to mitigate potential water quality impacts to downstream environments and environmental values. • Retain, manage and treat contaminated water within the site that cannot be safely discharged.

9.2 Flora and fauna

9.2.1 Performance outcomes

- Project works are designed and managed to minimise impacts to existing ecological values.
- Presence of feral animals and weeds are minimised throughout the project area.

9.2.2 Proposed mitigation measures

Table 9.2 Mitigation measures – flora and fauna

Delivery phase	Aspect	Proposed mitigation measure
Detailed design	Weed and pest management	A Weed and Pest Management Plan will be developed for the Project with specific advice for key identified species. The plan will include management of weed spread, management of pest infestations, and monitoring effectiveness of control measures. Implement weed hygiene protocols in accordance with the Biosecurity Act and DAF guidelines.

Table 9.2 Mitigation measures – flora and fauna

Delivery phase	Aspect	Proposed mitigation measure
	Bushfire management	• As part of the construction planning a certified Bushfire Management Plan will be prepared prior to construction and implemented during on-site activities. This will include details of controlled burning requirements, appropriate to the vegetation types present on the Project area. This will seek to manage the fuel load to reduce the risk of high-intensity fires occurring. The Bushfire Plan key provisions will include: – asset protection zones – maintaining access tracks to provide a fire break and defendable space to assist in arresting fires – bushfire risk mapping (considering slope, vegetation, aspect etc) – firefighting equipment being on site – emergency evacuation.
	Vegetation and fauna management	• Prepare a Vegetation Management Plan (VMP) for implementation in construction and operation. • Prepare a Fauna Management Plan (FMP) for implementation in construction and operation. • Develop a Species Management Program (required by DES under the NC Act when impacting on animal breeding places) to identify specific measures to be implemented that will mitigate impacts to threatened fauna species and animal breeding places during clearing, as well as operation of the Project. Measures will include sequential clearing, presence of a fauna spotter catcher and reducing vehicle speeds to minimise any wildlife injuries.
Construction	Fencing	• All fencing at the GCF, including security fencing, will allow the movement of fauna where practicable. Fencing design will consider common mitigations to prevent entanglement of wildlife, and not using barbed wire on the top strand of fences if security or land management practices allow. • Fauna exclusion fencing will be installed around the GCF to reduce the risk of fauna species being impacted.
	Pre-clearance	• Prior to any clearing activities, pre-clearance surveys will be undertaken by a suitably qualified ecologist to: – Identify MNES, MSES and other native fauna species habitats and clearly demarcate the habitats being retained to ensure no direct or indirect impacts occur during clearing and construction searches for threatened grasses in suitable habitat. – Identify and mark hollow-bearing trees to ensure they are managed by the fauna spotter catcher during clearing phase. – Identify and mark any other active breeding places such as nests, burrows etc to ensure they are managed by the fauna spotter catcher during clearing phase. – Identify suitable release sites should any fauna species need to be captured and released during clearing phase. – Identify presence of weed species and identify if any require treatment prior to clearing. • Spotlighting pre-clearance surveys will occur in mapped areas of Ornamental Snake preferred habitat prior to vegetation and topsoil clearing taking place in the summer months (October to March). If any individuals are caught they will be released in adjacent suitable habitats which are being retained outside of the Project area away from clearing.

Table 9.2 Mitigation measures – flora and fauna

Delivery phase	Aspect	Proposed mitigation measure
	Vegetation clearance	• Vegetation clearing will be limited to those areas required for earthworks and construction of the Project. Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated as part of the construction process. Rehabilitation will be detailed in a Vegetation Management Plan (VMP) to be prepared prior to commissioning of the Project. • The approved disturbance area will be clearly demarcated prior to clearing to avoid unnecessary clearing of vegetation and to ensure personnel and vehicles stay within the approved footprint. Measures to ensure clearing limits are adhered to will be documented in the CEMP and addressed in site inductions. • Clearing limits will be clearly demarcated on site, including through use of temporary or GPS fencing (e.g. flagging tape to mark out areas or plastic mesh fencing installed with star pickets) to avoid unintentional access to retained sensitive environmental areas. • Large hollow bearing trees should be clearly marked for avoidance during construction if practicable. • Sequential clearing of remnant vegetation will occur to minimise impacts on native fauna, particularly arboreal fauna which may be using tree hollows. • Access points have been identified and are limited to approved access roads and tracks. • A suitably qualified fauna spotter-catcher will be present during clearing activities, working under a DES approved Species Management Program under the NC Act. The fauna spotter-catcher will be responsible to check an area immediately prior to any clearing for; presence of any native fauna including searches of all potential habitats such as terrestrial microhabitats and hollows, etc. Any captured species (excluding Koalas) will be relocated to an agreed release site. The fauna spotter-catcher will then advise the ground staff as to measures that need to be taken to avoid impacts on breeding places and fauna species. Specific threatened species pre-clearance activities within the Project footprint will include: – Canopy searches in suitable foraging tree species for Koala. – Searches of gilgai habitats for Ornamental Snake. – Searches of open woodland habitat for Squatter Pigeon nests. • All fauna encountered (e.g. vehicle strike or during clearing activities) will be recorded in a central register by the Project Environment Manager. Any injured fauna will be reported as required in the Species Management Program that will be in place for the Project. • Appropriate procedures for managing injured wildlife should be developed and included in the CEMP and OEMP. • During trenching activities, open trenches will be monitored daily. If species are trapped in the trench they will be released by a fauna spotter-catcher. The amount of open trench will be minimised. • Escape ramps or planks and/or shelter (e.g. sawdust filled bags) for trapped fauna will be installed in open trenches.

Table 9.2 Mitigation measures – flora and fauna

Delivery phase	Aspect	Proposed mitigation measure
		• Any clearing would take place in a way to allow Koalas (if present) to move into adjacent areas of retained vegetation. This will include setting clearing limits per day and allowing escape paths to retained vegetation to be maintained. If Koalas are encountered they are to be left in-situ, works stop in the area, and wait for the animal to move to retained habitat. This will entail: – Leaving a 30 m buffer of vegetation around the tree in which the Koala is located and a corridor of vegetation to retained habitat. – Monitoring the Koala location and if the animal appears stressed. – Allowing the Koala to relocate without assistance unless the animal is in immediate danger or is injured. Ongoing presence will be managed by the fauna spotter catcher under the Species Management Program. • Undertake staged clearing of native vegetation, and retain habitat trees where practicable, to minimise impacts to native fauna species. • Retained vegetation will be maintained following a site VMP to reduce hazards from fire, pest species, degradation, and other potential impacts. This will assist in maintaining the integrity of the vegetation as habitat and reduce disturbance to surrounding habitat. The Project VMP will be developed prior to construction.

Table 9.2 Mitigation measures – flora and fauna

Delivery phase	Aspect	Proposed mitigation measure
	Sequential clearing	• Sequential clearing is to be undertaken in the following manner: – The first phase will consist of removing understorey vegetation and smaller juvenile trees only. Juvenile trees are under 4 m in height or trunk circumference of less than 31.5 cm at 1.3 m above the ground. No hollow-bearing trees will be cleared in Phase 1. – After 48 hours the second phase can commence which is to clear the remaining larger trees, including those with hollows. Where practicable hollow bearing trees are to be "soft felled" to minimise the risk to hollow dwelling fauna. They will then be inspected by the fauna spotter-catcher post-felling to ensure no wildlife remain in the hollow. Where practicable fauna will be caught, and released into suitable recipient sites once clearing has stopped. If roosting bats are located they are to be "roosted" during the day in a safe, cool, dark space and released at night in areas of habitat to be retained. – Dispersal corridors will be left in place that link vegetation with clearing areas to adjacent areas of retained habitat, and are to be maintained for a further 24 hours, to facilitate overnight dispersal. Such corridors will act as 'stepping stones' to allow any Greater Glider or Koala present to depart to retained vegetation. – If any native fauna are injured they will be taken to a local vet/wildlife carer for treatment. – It is important the clearing is done in such a way that arboreal fauna are given the opportunity to disperse from the area once clearing has commenced under their own volition. – Any confirmed Koalas will be identified by putting flagging tape and/or marking spray on the tree they are in, and any nearby trees with overlapping crowns or those trees that may impact the Koala's tree during felling will not be cleared until the Koala has moved from the area under its own volition. In most situations the Koala will move from the area overnight. – Fell trees away from retained areas of vegetation where practicable. Where trees unavoidably fall into retained areas, leave in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna. – Fauna spotter catcher will undertake a final walkthrough ahead of the clearing machinery on the day of clearing checking for breeding places, flipping over timber and peeling bark to relocate fauna, and identifying the potential breeding places marked in the preclearance breeding survey and liaising with the machinery operator over their presence and appropriate clearing techniques.

Table 9.2 Mitigation measures – flora and fauna

Delivery phase	Aspect	Proposed mitigation measure
	Weed and pest management	• Appropriate decontamination procedures for vehicles, machinery, and equipment coming to site. A dedicated light vehicle cleaning bay will be situated at the main entrance, large vehicles will require a cleanliness certificate to minimise the local cleaning bay load. • Implement weed and pest control across the Project area to reduce degradation of habitats and edge effects as a result of the Project. • Hygiene checks will focus on ensuring no weed plant material/seed/mud/soil material enters the site (or leaves known infestation areas within the site), with all machinery, vehicles and equipment including footwear will be cleaned prior to entering the site, and when working within a known contaminated area within the site, prior to exiting the contaminated area. • Onsite waste disposal (especially food waste) to discourage presence of pest fauna. Waste will be stored in covered bins/skips to prevent fauna access. • Weeds will be identified during pre-clearing surveys, in particular, any large infestations within proposed disturbance areas. Clean and dirty zones should be demarcated on site to facilitate weed management. • Any materials brought into site (such as gravel) will be certified as weed and disease free. • Any herbicides used on site must be dispensed by an appropriately trained and qualified weed sprayer. • Access into retained areas of habitat during construction will be limited and monitoring of weeds in these areas in place.
	Rehabilitation	• Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated as soon as practicable following construction. • Woody debris, logs and rocks will be retained for use in rehabilitation. • Where seeding and/or revegetation is required select plant species that are found in similar adjacent habitat on site. Reuse of seed banks contained in topsoil that has been pushed aside for later use will have priority.
Construction/ operation	Noise and lighting	• Lighting from Project activities will be minimised at night to reduce light spill disturbance to nocturnal fauna. • Night lighting will mainly be limited to that required for safety and security. Project lighting will be minimised (i.e. low luminance) as far as possible. • Directional lighting should be away from environmentally sensitive areas. • All equipment will be properly maintained onsite in accordance with manufacturers specifications. • Implement noise control techniques in accordance with standard industry noise suppression techniques.

Table 9.2 Mitigation measures – flora and fauna

Delivery phase	Aspect	Proposed mitigation measure
	Bushfire	• As part of the construction planning a certified Bushfire Management Plan will be prepared prior to construction and implemented during on-site activities. This will include details of controlled burning requirements, appropriate to the vegetation types present on the Project area. This will seek to manage the fuel load to reduce the risk of high-intensity fires occurring. The Bushfire Plan key provisions will include: – asset protection zones – maintaining access tracks to provide a fire break and defendable space to assist in arresting fires – bushfire risk mapping (considering slope, vegetation, aspect etc) – firefighting equipment being on site – emergency evacuation. • During the bushfire season, the fire danger status will be monitored daily through the Rural Fire Service website. Contact and arrangements will be made with the local fire officers. • For "hot-work" activities, a risk assessment will be completed considering forecast weather, fire hazard ratings and site conditions. • Vehicles may not idle or be parked in areas of long grass. • Smoking will not be permitted on site aside from designated safe zones.
	Dust mitigation	• Areas which have potential to generate airborne dust will be wetted down regularly. • Low speed limits will be implemented on site to minimise dust generation. • Areas stripped of topsoil not required for operation will be rehabilitated as soon as practicable. • Machinery and vehicle tyres will be regularly cleaned to reduce wheel entrained dust emissions or consider use of vibration grids. • Design access roads to have a less erodible surface. • Water spraying of nearby sensitive vegetation should be considered if visible dust sedimentation is observed. • Dust and other emission levels will be adhered to under the State conditions of approval once the Development Application is approved.
Operation	Weeds and pests	• Appropriate decontamination procedures for vehicles, machinery, and equipment coming to site. A dedicated light vehicle cleaning bay will be situated at the main entrance. • Implement weed and pest control across the Project area to reduce degradation of habitats and edge effects as a result of the Project.

9.3 Air quality

9.3.1 Performance outcomes

- The activity will be operated in a way that protects the environmental values of air.
- Fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised.
- Contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air.
- Releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.

9.3.2 Proposed mitigation measures

Table 9.3 Mitigation measures – air quality

Delivery phase	Aspect	Proposed mitigation measure
Detailed design	Refine emissions profile	Review all emissions profile for stacks and include additional measures as appropriate e.g. use of low Nitrogen Dioxide (NOx) engines and catalytic converters.

Table 9.3 Mitigation measures – air quality

Delivery phase	Aspect	Proposed mitigation measure
Construction	Dust generation during construction	• Maintain a logbook throughout the construction phase, to include: – any complaints relating to dust, and where a dust complaint is received the response actions – any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the response actions – the results of site inspections. • Limit the extent of clearing of vegetation and topsoil to the designated footprint for construction. • Erect cloth barriers around potentially dusty activities such as trench excavations and material stockpiles where practicable. • Avoid dry sweeping of large areas. • Provide an adequate water supply on the construction site for effective dust suppression/mitigation, including: – keeping site fencing and barriers clean using wet methods – deploying water carts to ensure that exposed areas and topsoils/subsoil are kept moist – washing vehicle wheels prior to on-site movement and exit onto public roads. • Seal all road surfaces, where practical, to minimise the potential for dust release and/or use of water carts to prevent dust. • Impose a maximum-speed-limit relevant to the conditions on all internal roads and work areas during construction. • Ensure proper maintenance and tuning of all equipment engines. • Limit construction activity during periods of adverse weather (hot, dry and windy conditions) and when dust is seen leaving the site. • Minimise drop heights from loading or handling equipment. • Ensure vehicle loads entering and leaving sites are covered to prevent escape of materials during transport. • Control (reduce) trips and trip distances where possible, such as by coordinating delivery and removal of materials. • Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
	Visual monitoring	• Undertaking daily on-site and off-site inspections to monitor dust. The inspection results should be recorded in a specific log. Inspection should include regular dust soiling checks of surfaces such as street furniture and cars. • At the commencement of each day's activities, the local meteorological forecast should be reviewed, including the timing of notable increases in wind speed and/or temperature. Appropriate increased intensity or additional mitigation measures should be planned for the day based on this forecast review. The likely meteorological conditions and implications for dust emissions and impacts should be discussed at the morning toolbox meeting. • Increasing the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. Should notable visual dust emissions be observed leaving the site boundary, increased intensity or additional mitigation measures should be deployed.

Table 9.3 Mitigation measures – air quality

Delivery phase	Aspect	Proposed mitigation measure
Operation	Minimise emissions	• Use of low NOX engines or catalytic convertors for compressors. • Minimise the use of stripping gas as far as practicable for reboiler stacks. • Use of low NOX engines or catalytic convertors for gas generators. • Minimise the use of diesel generators as far as practicable (noting they are only used as backup). • Minimise the use of flares as far as practicable.

9.4 Surface water

9.4.1 Performance outcomes

- There is no actual or potential discharge to waters of contaminants that may cause an adverse effect on an environmental value from the operation of the activity.
- The storage and handling of contaminants will include effective means of secondary containment to prevent or minimise releases to the environment from spillage or leaks.
- Contingency measures will prevent or minimise adverse effects on the environment due to unplanned releases or discharges of contaminants to water.
- The activity will be managed so that stormwater contaminated by the activity that may cause an adverse effect on an environmental value will not leave the site without prior treatment.
- The disturbance of any acid sulfate soil (ASS), or potential acid sulfate soil (PASS), will be managed to prevent or minimise adverse effects on environmental values.
- Acid producing rock will be managed to ensure that the production and release of acidic waste is prevented or minimised, including impacts during operation and after the environmental authority has been surrendered.
- Any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland.
- The activity will be managed so that adverse effects on environmental values are prevented or minimised.

9.4.2 Proposed mitigation measures

Table 9.4 Mitigation measures – surface water

Delivery phase	Aspect	Proposed mitigation measure
Detailed design	Final design	• Design of the Goonyella Creek crossing and selection of suitable rehabilitation methods will be informed by local hydraulic conditions. • Chemical storage areas are to be located away from existing drainage lines and have appropriate bunding and wastewater collection mechanisms. • Design on site infrastructure to ensure water flows are not impounded or concentrated (e.g. culverts, diversion ditches, etc). • The only open cut creek crossing location – Goonyella Creek – will take advantage of existing areas of cleared riparian vegetation as far as possible and be carried out during periods of no flow. It is not a formed creek with defined banks. • No equipment or materials will be stored across flow paths. • The extent of the area required to carry out the permitted activity must be limited to the minimum area necessary to reasonably carry out the works.
	Vegetation clearance and landforms	• Development and implementation of construction stormwater management measures as part of an overarching SWMP or similar, consistent with best practise including DES 2021b and IECA 2008, 2015. Key principles include: – Diversion of upslope runoff around worksites and infrastructure. – Avoid disturbance to existing watercourses and overland flow paths where possible. – Grading to minimise earthworks and minimise changes to existing flow paths/regimes. – Stabilise disturbed areas using hardstand and equivalent impervious surfaces and gravel or similar pervious surfaces to promote infiltration where suitable. – Maximise sheet flow and minimise concentrating flows. – Use of scour protection measures as required. – Progressive rehabilitation will be undertaken to ensure disturbance areas and temporary diversions are as small as reasonably practicable at all times. – Permit to disturb and clear to be issued prior to impact works. – Suitably trained personnel responsible for the issuing of permit to disturb and clear vegetation. – Routine and event-driven monitoring of soil and water management measures as well as condition of existing drainage lines downstream of worksites, prompt rectification as required. – Personnel to be trained through inductions and toolbox talks.
Construction	Vegetation clearing and landform	Implementation of SWMP.

Table 9.4 Mitigation measures – surface water

Delivery phase	Aspect	Proposed mitigation measure
	Flooding	• Design of the Goonyella Creek crossing and selection of suitable rehabilitation methods will be informed by local hydraulic conditions. • Construction of the GCF to incorporate measures to divert and manage local overland flows around the facility, with the objective of minimising offsite flooding impacts. • Ground levels along the high-pressure pipeline will be reinstated to match existing, with no potential to impact local flow paths and flood behaviour. • Construction of the below-ground high-pressure pipeline to consider the potential for concentrated overland flows along the length of the corridor and incorporate topographic modelling to ensure replicate prior runoff patterns from local depressions and overland flow paths.
	Contamination and spills	• Suitable controls to be incorporated into construction SWMP and implemented, including: – Hazardous materials (chemicals, fuels, lubricants, etc) will be stored and managed in accordance with relevant regulations and standards. – Spill events are to be contained, cleaned, and recorded as per emergency response procedure. – Spill kits and suitable control materials such as booms and absorbent materials will be always maintained onsite and in accessible locations, commensurate with the types and volumes of materials in use, and in place where hazardous materials are stored or used. – Refuelling and maintenance activities to be completed in designated areas and located at least 50 m away from watercourses. – Primary bunds to be installed on specific plant and equipment (e.g. doubled skinned where necessary). – Tertiary bunds to be installed around high-risk areas (e.g. concrete aprons). – Scheduled maintenance of all plant and equipment to be completed as per manufacturer specifications. – Routine and event-driven monitoring of hazardous materials storage and control measures, and prompt rectification as required.
	Erosion and sediment control	• Development and implementation of ESC measures consistent with best practise including IECA 2008, 2015 and documented in PESCPs. Key principles to include: – Disturbance area to be minimised as far as reasonably practicable. – Progressive rehabilitation will be undertaken to minimise disturbance areas and temporary diversions. – Sediment basins/sumps installed where practical to capture surface water runoff and minimise sediment transport offsite. – Routine and event-driven monitoring of ESC measures to confirm effectiveness as well as condition of existing drainage lines downstream of worksites, and prompt rectification as required. – Design considers seasonal weather and completes high risk work during appropriate months (e.g. crossing of Goonyella Creek during dry season). – Personnel to be trained through inductions and toolbox talks.

Table 9.4 Mitigation measures – surface water

Delivery phase	Aspect	Proposed mitigation measure
	Unauthorised discharge	• Discharge permits to be issued prior to the release of captured/process water. • Additional treatment to be applied to improve water quality suitable for discharge. Water unsuitable for beneficial reuse to be disposed of offsite at licensed facility. • Suitably trained personnel responsible for the testing and issuing of discharge permit. • Personnel to be trained through inductions and toolbox talks.
	Re-use of contaminated water	• Discharge/transfer permits to be issued prior to the release of clean process water. • Suitably trained personnel responsible for the testing and issuing of discharge/transfer permit. • Additional treatment to be applied to improve water quality suitable for reuse/return to mine users. Water unsuitable for reuse to be disposed of offsite at licensed facility. • Personnel to be trained through inductions and toolbox talks.
	Acid sulfate soils	• In the unlikely event that suspected PASS is encountered during excavations, the material will be stockpiled, lined, and covered to minimise infiltration of rainfall and subsequent leaching. • Suspected PASS will be managed in accordance with the *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines – 2014* (DSITIA, 2014).
	Effluent management	• High-level alarms to be installed on ablutions blocks. • Routine inspections to be completed to assess volume. • Ablution blocks to be appropriately sized for relevant manning numbers. • Suitably qualified contractor to be engaged to remove effluent to a licenced. • Facility able to accept waste.

Table 9.4 Mitigation measures – surface water

Delivery phase	Aspect	Proposed mitigation measure
Operation	Contamination and spills	• Suitable controls to be incorporated into SWMP and implemented, including: – Hazardous materials (chemicals, fuels, lubricants, etc) will be stored and managed in accordance with relevant regulations and standards. – Spill events are to be contained, cleaned, and recorded as per emergency response procedure. – Spill kits and suitable control materials such as booms and absorbent materials will be always maintained onsite and in accessible locations, commensurate with the types and volumes of materials in use, and in place where hazardous materials are stored or used. – Refuelling and maintenance activities to be completed in designated areas and located at least 50 m away from watercourses. – Primary bunds to be installed on specific plant and equipment (e.g. doubled skinned where necessary). – Tertiary bunds to be installed around high-risk areas (e.g. concrete aprons). – Scheduled maintenance of all plant and equipment to be completed as per manufacturer specifications. • Routine monitoring of hazardous materials storage and control measures, and prompt rectification as required. • Construction equipment is to be maintained to minimise risk of spill or leakage.
	Re-use of contaminated water	• Discharge/transfer permits to be issued prior to the release of captured/process water. • Runoff from developed areas will be treated to remove pollutant loads before discharging to waterways. The expected pollutant loads from the respective areas will determine the method of treatment. • Additional treatment to be applied to improve water quality suitable for return to mine users. Water unsuitable for transfer to be disposed of offsite at licensed facility. • Suitably trained personnel responsible for the testing and issuing of discharge/transfer permit. • Personnel to be trained through inductions and toolbox talks.

9.5 Groundwater

9.5.1 Performance outcomes

- There will be no direct or indirect release of contaminants to groundwater from the operation of the activity.
- There will be no actual or potential adverse effect on groundwater from the operation of the activity.
- The activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.

9.5.2 Proposed mitigation measures

Table 9.5 Mitigation measures – groundwater

Delivery phase	Aspect	Proposed mitigation measure
Construction	Trenching (high-pressure pipeline)	• With exception to the Sunwater pipeline infrastructure, trenching works will be completed at 2 mbgl and above the water table. • Trenching works will be completed at a depth of 4 mbgl below Sunwater pipeline infrastructure. • Where works intercept groundwater temporary inflows will be contained on-site in sumps.
	Open cut excavation (high-pressure pipeline)	• Works within Goonyella Creek will: – occur during the dry season – remove alluvial sediments to a maximum depth of 2 mbgl. • Where works intercept groundwater temporary inflows will be contained on-site in sumps.
	Construction of GCF	• Excavation and construction of footings will be limited to 4 mbgl. • Where works intercept groundwater temporary inflows will be contained on-site in sumps.
	Pipeline hydrostatic pressure testing	• Water will be transferred to site and stored in lined facilities or above ground tanks for use during hydrostatic pressure testing of the high-pressure gas pipeline. • Water that is generated by this activity will be returned back to the lined facility or above ground tanks for reuse in hydrostatic testing. • Water will be tested and reused at site for dust control or transferred offsite for disposal at an appropriate facility. • uncontrolled releases of pressurised water which may exit at various points along the pipeline will be monitored and if possible, contained.
Construction and operation	Chemical and fuel spills Hazardous goods storage	• chemicals and fuels will be appropriately stored in bunded designated areas of the GCF as per the supplier recommendations detailed in the material Safety Data Sheets (SDS). • Refuelling of diesel will again take place in a controlled and bunded area, limiting interaction with the environment. • QPM Energy will monitor the performance of engineered bunds to ensure the migration of chemicals and diesels does not interact with the environment. • Plant and equipment will be audited on a weekly basis to limit the potential for oil and fuel leaks when operating across the Project footprint, and specifically adjacent to Goonyella Creek. • Spills will be contained and remediated as required following detailed site investigation.

Table 9.5 Mitigation measures – groundwater

Delivery phase	Aspect	Proposed mitigation measure
Operation	Temporary storage and transfer of contaminated wastewater	• Wastewater from dehydration and compression processes at the GCF will be managed in a closed loop stream. The oily water separation facility separates the oil content of water removed from the gas product which will be temporarily stored in an oil loadout tank to be removed by truck via a licenced waste disposal operator. • Should, the Project encounters an uncontrolled release of contaminated wastewater from the GCF, QPM Energy will contain the spill and remediate as required following a detailed site investigation.

9.6 Noise and vibration

9.6.1 Performance outcomes

- Sound from the activity is not audible at a sensitive receptor.
- The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

9.6.2 Proposed mitigation measures

Table 9.6 Mitigation measures – noise and vibration

Delivery phase	Aspect	Proposed mitigation measure
Detailed design	Noise emissions	• The proximity of the project to residential dwellings has been maximised as practically possible whilst remaining within the bounds of the developable area. • Locate noisy equipment away from sensitive receivers, i.e. along the southern edge of the project, maximising distance to the nearest noise sensitive receiver. • Selecting the quietest possible plant equipment for each task. • Acoustically treat plant equipment using shrouds, enclosures, and screens. • Use of pre-packaged engine enclosures for compressor motors and site power generation

Table 9.6 Mitigation measures – noise and vibration

Delivery phase	Aspect	Proposed mitigation measure
Construction	Noise and lighting	• Avoid intensive construction during the night-time period and avoiding significant volumes of heavy vehicles. • During the night-time period, the quietest plant and equipment will be selected for each task, where practicable. This may include: – low noise fans on cooling equipment (e.g. chillers and cooling towers) – acoustically treated plant and equipment using shrouds, enclosures, and screens. • Selecting the quietest possible plant equipment for each task. • Develop and implement a Construction Noise and Vibration Management Plan. • All equipment will be properly maintained onsite in accordance with manufacturers specifications. • Implement noise control techniques in accordance with standard industry noise suppression techniques.
Construction	Complaints management	• A complaints management system will be put in place that documents: – name of persons receiving complaint – name of person making the complaint – date and time of complaint – nature of the complaint – actions taken to rectify – actions to minimise risk of reoccurrence – name of person(s) responsible for undertaking the required actions. • Nearby landholders will be provided a dedicated point of contact for the duration of the project. • The existing stakeholder engagement plan will continue to be implemented to facilitate ongoing consultation with relevant stakeholders, including local businesses, throughout the project so that stakeholders have access to information regarding the nature of the proposed project activities and their likely impacts.
Operation	Noise emissions	• Avoid intensive operations during the night-time period, such as reducing the output of plant and avoiding significant volumes of heavy vehicles. • Avoid intensive operations during the night-time period. For example, planned shutdown periods for maintenance is to be undertaken during the day to minimise noise impacts from flaring. • Planned use of the flares (e.g. statutory maintenance) is to be undertaken during the day-time period.

Table 9.6 Mitigation measures – noise and vibration

Delivery phase	Aspect	Proposed mitigation measure
Operation	Complaints management	• A complaints management system will be put in place that documents: – name of persons receiving complaint – name of person making the complaint – date and time of complaint – nature of the complaint – actions taken to rectify – actions to minimise risk of reoccurrence – name of person(s) responsible for undertaking the required actions. • Nearby landholders will be provided a dedicated point of contact for the duration of the project. • The existing stakeholder engagement plan will continue to be implemented to facilitate ongoing consultation with relevant stakeholders, including local businesses, throughout the project so that stakeholders have access to information regarding the nature of the proposed project activities and their likely impacts. • Notification of affected stakeholders in the event of an emergency shutdown and consultant as to likely duration of shutdown and subsequent flaring.

9.7 Traffic

9.7.1 Performance outcomes

- Project construction traffic is managed to avoid or minimise adverse impacts on road safety and traffic flow.

9.7.2 Proposed mitigation measures

Table 9.7 Mitigation measures – traffic

Delivery phase	Aspect	Proposed mitigation measure
Detailed design	Traffic management plan (TMP)	• Prepare a traffic management plan prepared to mitigate the risk associated to the operation of the construction vehicles. A site plan showing the site access from the public roads will show the heavy vehicle manoeuvrability to/from and within the site. Documentation on management of the debris on the road during the construction, by enforcing the use of wheel wash and load covering prior to leaving the site will be detailed.
	Driver's code of conduct	• To avoid driver fatigue particularly during the construction period, driver's code of conduct is to be developed, implemented and followed, effectiveness of the measures will be reviewed regularly. • The Driver's Code of Conduct will be required to be read and signed by all light and heavy vehicle drivers prior to operation of vehicles. This will be in addition to regular safety briefings and updates. The Driver's Code of Conduct will address all relevant site and locality road safety and traffic management measures including: – compliance with all road rules and regulations – commuter traffic routes – vehicle speeds – driving to local road conditions – driver behaviour near schools, residential and shopping areas – courtesy to other road users – fatigue management – dangers of mobile phone use while driving – checking vehicles and covering loads – the appropriate use of compression braking – safety procedures for accidents and breakdowns.
	Traffic control plan	• A Traffic Control Plan (TCP) will be developed by the contractor in accordance with the Australian Standards and relevant Department of Transport and Main Roads (DTMR) guidelines.
Construction	TMP	• Implement the construction TMP.
	Driver's code of conduct	• Implementation of the driver's code of conduct.
Construction/ operation	Dangerous goods	• Hazardous and dangerous goods will be transported in accordance with the *Australian Dangerous Goods Code*.

Table 9.7 Mitigation measures – traffic

Delivery phase	Aspect	Proposed mitigation measure
	Fauna strikes	• All vehicles associated with construction or operational activities will travel at slow speeds to minimise the chance of any fauna strikes occurring. Speed limit signage will be placed at the entrance to the site and other key points. • All contractors will be educated on the presence of native fauna including threatened species and need to travel slowly and look out for fauna when driving (especially Squatter Pigeon). This training will form part of mandatory inductions. • Vehicle traffic will be confined to designated roads and access tracks.

9.8 Waste management

Waste will be managed at the project during the construction and operational phases of development for the GCF, high-pressure pipeline alignment and at ancillary facilities. Waste will be segregated and characterised prior to its removal from site in accordance with the practices outlined in Section 9.8.1.

9.8.1 Waste management hierarchy

In accordance with the DES' preferred approach for waste management operations, the project activities will follow the waste and resources management hierarchy which intends to:

- avoid
- reduce
- reuse
- recycle
- treat
- dispose.

9.8.2 Waste management practices

Several waste management practices have been developed with respect to the waste management hierarchy described in the section above. Regulated waste items generated during the construction and operational phases of the project, such as the GCF waste stream, will be segregated, stored and disposed of at a licenced facility by a reputable contractor. Information relating to the quantity of waste, transportation and disposal facility approvals will be tracked accordingly. Information relating to the recording of waste will include:

- Waste generators name, address, local government area and contact details.
- Approval number under which the waste is being generated.
- Name and contact detailed of the QPM representative generating the waste.
- Date and time the waste is collected.
- The nominated receiving facility.
- Waste description.
- Waste volume.
- Waste category (i.e. solid, liquid and gas).
- Waste code (prescribed under the Environmental Protection Waste Regulation 2019 (EP Waste Regulation)).
- Waste origin code (prescribed under the EP Waste Regulation).
- United Nations number, class and packaging group (if applicable and as prescribed under the Australian Dangerous Goods Code) – if applicable.

- Identify if the waste is being transported in bulk, otherwise the number of packages.

All waste materials, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods must be stored and handled in accordance with the relevant Australian Standard. Where no relevant Australian Standard exists, all materials must be stored within an effective on-site containment system that prevents contamination of land and/or waters. Further, information within the SDS for the storage and handling of chemicals is to be strictly adhered to. Accordingly, appropriate spill kits should be available depending on the substance. Spill kits for non-oil based liquids, oils and acids should be made available on-site, and relevant training to be provided to relevant personnel onsite.

General waste streams such as soil/spoil, office debris and other putrescible items will be stored onsite within the designated receptacles. Recyclable material will be segregated from landfill, where considered feasible and removed from site by personnel. Construction waste will be classified and if required, disposed of lawfully at a licensed waste facility. If transport is required across state or territory borders, the National Environmental Protection Measures (NEPM 2013) guidelines will be adhered to as well as local regulations. If required, waste will be placed in sealed containers for transport to the locations once waste streams have been identified and confirmed. All contaminated waste will be removed as required.

Activities that have the potential to generate waste or adversely impact on sensitive receptors including workers and the environment due to waste include:

- Ablutions, food scraps and general personal waste from personnel, and associated odours caused by the inappropriate management and disposal of putrescible and sewage waste streams.
- Draining or loss of containment of process fluids.
- Oils, greases, and fuels associated with plant and equipment.
- Paints, lubricants, and general construction chemicals.
- Poor housekeeping causing occupational health and safety risks to workers.

Waste management is intended to:

- Ensure contractual and regulatory compliance.
- Ensure a waste management hierarchy and principles based on waste avoidance, reuse, recycling, recovery, treatment, and disposal as a last resort are used when making waste management decisions.
- Ensure that the community is not negatively affected by waste generation.
- Ensure all waste, including chemicals are stored, collected, transported, and disposed of in accordance with the applicable standards.
- Adhere to waste tracking procedures for designated waste streams.
- Minimise impacts to the environment from the management of waste.
- Maintain a safe, efficient, and amenable workplace by minimising fire risk, odours, hazards and obstructions.

Table 9.8 summarises the waste management practices that will be implemented to manage waste generated through the project construction and operational phases.

Table 9.8 Waste types and mitigation measures

Waste	Mitigation Measures
General waste	• Scrap timber and large items of general waste shall be collected in a general waste skip designated for this purpose. • Designated waste receptacles will be used. • Smaller or lighter general waste items, wastepaper and food waste/scraps shall be collected in local, lined bins. Upon emptying, waste shall be fully contained and tied within suitable garbage bags prior to placement in the general waste skip to prevent escape due to wind. • As appropriate, general waste skip shall be collected/replaced by contractor. • No wastes will be burnt or buried on site. • General wastes will be stored in bins provided for that purpose, which should be covered. • Regular inspections will be carried out to ensure operational sites are well maintained. • Waste storage will not be placed in a position that has the potential for the wastes to enter a waterway or any sensitive receptor.
Recyclables	• Aluminium cans, plastic water and other beverage bottles shall be collected in a designated recycling bin for donation. • Cardboard and paper waste shall be separated in designated bins and removed by a licenced contractor where feasible to do so. • Metal waste generated throughout construction and operations activities will be segregated and removed by a licenced contractor where feasible to do.
Hydrotest water	• Hydrotest water shall be collected. • For anticipated quantity of hydrotest water less than 100 L, untreated test water may be disposed of via the greywater system. Operations to be contacted to confirm grey water can handle the quantity at the time of disposal. • Larger volumes to be used for dust control. • Third party may be required to dispose if site cannot handle the additional volume.
Soil/spoil	• Prior to the removal of soil/spoil offsite, the material will need to be assessed, tested, and characterised by a suitably qualified person. • Soil/spoil shall be removed from site by civil contractor, transported to and disposed at an authorised location/facility.
Contaminated soil/spoil	• Prior to the removal of soil/spoil offsite, the material will need to be assessed, tested, and characterised by a suitably qualified person. • Contaminated soil shall be removed and stockpiled for disposal at a suitably licensed facility. • Where necessary, appropriate measures such as bunding, lining and covering of the contaminated material will be undertaken in accordance with suitably qualified persons advice. • Regulated wastes will be transported off site by a person holding appropriate licences and permits. • Waste transport certificates shall be completed as per legislative requirements.

Table 9.8 Waste types and mitigation measures

Waste	Mitigation Measures
Hydrocarbon waste: • oily rags/filters • oily water • diesel drums.	• Bunding (i.e. primary and tertiary) will be implemented to ensure all stored chemicals are appropriately contained. • The storage of contaminated waste is not to be located in proximity to waterways/watercourses. • Spill kits are to be in designated locations with appropriate type and quantity of equipment required for the storage of contaminated material. • Oily rags shall be collected in a designated oily rag/filter receptacle. • Oily filters shall be collected in a designated oily rag/filter receptacle. • Contaminated material will be disposed of by a suitably contractor at a licenced facility. • A water treatment plant will be established onsite to treat process water. Clean water will be discharged in accordance with project conditions. Oily waste generated by the activity will be segregated and disposed of by a reputable contractor at a licenced facility. • Wastes will be segregated, stored, and managed according to their classification. • Waste transport certificates shall be completed as per legislative requirements.
All other regulated wastes: • batteries • chemical packaging/ drums/ intermediate bulk container (IBC) • used spill kit material.	• Bunding (i.e. primary and tertiary) will be implemented to ensure all stored chemicals are appropriately contained. • The storage of contaminated waste is not to be located in proximity to waterways/watercourses. • Spill kits are to be in designated locations with appropriate type and quantity of equipment required for the storage of contaminated material. • All packaging with chemical residue will be appropriately segregated and stored (i.e. primary and tertiary bunds). • Wastes will be segregated, stored, and managed according to their classification. • Contaminated material will be disposed of by a suitably contractor at a licenced facility. • Waste transport certificates shall be completed as per legislative requirements.
Sewage and greywater during construction	• To be collected in designated tanks, supplied, and plumbed for this purpose, attached to ablutions and lunchroom facilities. • Regular scheduled emptying of tanks shall be completed by an authorised contractor. • Contaminated material will be disposed of by a suitably contractor at a licenced facility. • Waste transport certificates shall be completed as per legislative requirements.

9.9 Hazard and risk

9.9.1 Natural hazards

Existing natural hazards have the potential to introduce risk to Project activities and require identification and mitigation measures. The risk and corresponding mitigation measures are discussed in Table 9.9.

Table 9.9 Identified potential impacts arising from natural events

Potential hazard	Risk	Mitigations measure(s)
Bushfire	• Impact to the safe construction and operation of the GCF and pipeline. • Damage to project infrastructure. • Major environmental incident resulting from excessive heat/combustion.	• Emergency response plan • Engagement with emergency services during design phase and ongoing through construction and operational phases. • Regular inspections of firebreaks. • Scheduled inspections to ensure the easement is kept free of excess fuel and ignition sources (e.g. branches, leaves). • Supervisory Control and Data Acquisition (SCADA) used for remote shutdown of plant. • Fire service site to be regularly checked to assess the likelihood of fire. • Water trucks present during construction, particularly on the pipeline corridor.
Extreme rainfall and flooding	• Impact to the safe construction and operation of the GCF and pipeline. • Damage to project infrastructure (e.g. erosion, subsidence and/or inundation).	• Assessment of historical data completed during the design process. • Design to consider heavy and prolonged weather events against relevant legislative criteria. • Scheduled inspection of GCF and pipeline alignment to be completed. • Surface water management plan. • The construction works have been planned during the dry season for the pipeline and especially the crossing of Goonyella Creek (watercourse) to limit impact as far as reasonably practicable.
Extreme climatic conditions	• High winds may result in impacts to flare capabilities. • Ongoing windy conditions may result in more scheduled maintenance of air filters, plant and equipment. • Extended exposure to heat resulting from the sun or cold may result in excess maintenance to pipeline and project equipment.	• High velocity flare. • Emergency response plan. • Safety management plan. • Scheduled maintenance of plant and equipment. • Design considers elemental conditions and products required for the GCF and pipeline.

Table 9.9 Identified potential impacts arising from natural events

Potential hazard	Risk	Mitigations measure(s)
Wildlife	• Wildlife may impact above ground structures through strike or impact (e.g. flare, vehicle collision).	• Design has aimed to install the pipeline underground (minimal above ground structures expected) to minimise as far as practicable impacts on wildlife. • Fences are to be installed around above ground structures, including the GCF and pig receival facility. • Fauna management plan. • Fauna spotter catcher to be present during relevant activities.
Biosecurity	• Existing weed species spread because of disturbance to impacted areas. • Pest fauna species increase due to presence of waste resulting from project works.	• Segregation of topsoil from all other material. • Topsoil to be stockpiled appropriately. • Plant, machinery and equipment to be washed/cleaned prior to entering site. • Weed and Pest Management Plan. • Declarations and relevant permits from suitable suppliers to be received prior to any weed and pest carrier material entering site.
Seismic activity	• No natural seismic activity is expected to occur. • Blasting resulting from nearby mine works impact the structure and/or operations of the GCF and pipeline.	• Design to consider likelihood and impact of seismic activity through assessment of historical data. • QPM Energy to engage mine operators to receive mine blasting notifications and to implement appropriate access advice to vehicles leaving or coming to site.

9.9.2 Project hazards

Activities associated with the construction and operation phases of the Project have the potential to cause harm to surrounding environmental, community and other sensitive receptors. The risk and corresponding mitigation measures are discussed in Table 9.10.

Table 9.10 Identified potential impacts arising from the Project

Potential hazard	Risk	Mitigations measure(s)
Health (e.g. worker fatigue, noise, vibration, dust)	• Impact to worker health and safety. • Impact to surrounding environment and ecosystems. • Construction and operation noise exceeds allowable limits.	• Fatigue management plan outlining requirements for workforce. • Noise and vibration management plan. • Suppressors on plant and equipment where feasible. • SCADA system to limit close interaction with plant and equipment. • Air quality management. • Filters installed on plant and equipment and maintenance to occur as per manufacturer specifications. • Water truck used to control dust during construction. • Operate all equipment in-line with manufacturer specifications. • Design and locality of plant and equipment modelled. • Comply with the Environmental Protection (Noise) Policy 2019. • Time limit restrictions. • Conduct noise monitoring to validate modelling.
Road incident	• Vehicle rollover or incident resulting from improper road compaction for construction vehicles. • Vehicle collision impacts health and safety of personnel and/or road network.	• Design and confirmation of access road and maintenance paths. • Traffic management plan. • Emergency response procedure to be developed. • Fatigue management plan. • Relevant permits to be obtained from the road authority prior to works occurring. • Traffic routes and speed limits defined and posted. • Farm track speed limits imposed. • Geotechnical assessment to be completed to assess access road surface is appropriately designed for construction and operational vehicles. • Barriers and proximity markers installed to protect personnel and infrastructure. • Safety inductions to be completed for all personnel. • Equipment to be fitted with rollover protection (ROPS).

Table 9.10 Identified potential impacts arising from the Project

Potential hazard	Risk	Mitigations measure(s)
Rail Incident	• Malfunction of the pipeline leads to damage to the Newland Rail System resulting in delays the operator.	• Ongoing engagement with the asset owner. • Relevant permits to be obtained from the rail authority prior to impact works occurring. • Wayleave agreement protocols implemented. • Scheduled maintenance of pipeline. • Authority representative to be present during impact works. • Safety inductions to be completed for all personnel (site and specific if required).
Infrastructure and services – interface with services or transmission lines	• Temporary impact or shutdown to infrastructure (e.g. rail line, water infrastructure). • Damage to existing infrastructure. • Increased maintenance and inspections of existing infrastructure by asset owner due to new introduced risk (e.g. high pressure pipeline).	• Relevant permits to be obtained from the asset owner prior to impact works occurring. • Ongoing engagement with the asset owner. • Scheduled maintenance to occur at GCF and along the pipeline alignment.
Storage, handling, use and transport of dangerous goods	• Material not managed in accordance with manufacturer specifications. • Impact to health and safety of personnel resulting from incident. • Impact to environment resulting from spill. • Legislative implications due to types and quantities of material stored onsite. • Refuelling and maintenance activities.	• Manifest of all chemicals to be onsite and up to date. If threshold quantities are exceeded relevant approvals are to be obtained. • All chemicals will be stored onsite in accordance with relevant conditions stated within AS, Codes of Practice and SDS. • Relevant equipment to have primary bunding. • Tertiary bunding will be installed around large containers where considered necessary. • Spill kits will be stocked and readily available in the event of an incident. • All incidents of spills will be recorded. • Contaminated material will be segregated, stored and disposed of by a reputable contractor at a facility licenced to accept waste. • Licenced contractors must be engaged for the transportation of hazardous materials. • Inductions and training to be completed for all personnel entering site. • Refuelling to occur in designated areas (sealed surface) away from drainage lines and sensitive environments. • Maintenance activities to occur in designated area/s. • Regular inspections of storage facilities, tanks and containers for serviceability and integrity (including pipework and fittings where appropriate).

Table 9.10 Identified potential impacts arising from the Project

Potential hazard	Risk	Mitigations measure(s)
Leaks and spills causing contamination	• Spill of material resulting from incident. • Impact to health and safety of personnel resulting from incident. • Impact to environment resulting from spill. • Refuelling and maintenance activities. • Effluent leak from ablution block.	• All chemicals will be stored onsite in accordance with relevant conditions stated within AS, Codes of Practice and SDS. • Relevant equipment to have primary bunding (e.g. double skinned bladder/self-bunded). • Tertiary bunding will be installed around large containers where considered necessary. • Spill kits will be stocked and readily available in the event of an incident. • All incidents of spills will be recorded. • Contaminated material will be segregated, stored and disposed of by a reputable contractor a facility licenced to accept waste. • Licenced contractors must be engaged for the transportation of hazardous materials. • Inductions and training to be completed for all personnel entering site. • Refuelling to occur in designated areas (e.g. sealed/bunded surface) away from drainage lines and sensitive environments. • Maintenance activities to occur is designated area. • Scheduled maintenance to occur on all relevant plant, equipment and vehicles. • Suitably qualified subcontractor to be engaged to remove effluent to a facility licenced to accept waste. • Regular inspections completed to monitor capacity of effluent tanks. • Regular inspections of storage facilities, tanks and containers for serviceability and integrity (including pipework and fittings where appropriate). • Design to cater for appropriate equivalent persons for ablution blocks.
Poor air quality causing health issues	• Air quality impacted by the following activities: – gas flare – dust generation (construction or vehicle movements) – fumes from plant and equipment – ventilation in GCF – chemical storage.	• Progressive rehabilitation to occur. • Speed limits and suitable material installed for trafficable routes (coarse stabilised materials). • Water truck used during construction to lower dust. • Scheduled maintenance of plant and equipment. • All chemicals to be stored in accordance with relevant conditions stated within AS, Codes of Practice and SDS. • Air quality monitoring to be completed to validate the model.
Re-used process water does not meet specifications	• Oily water does not comply with legislative requirements for re-use (e.g. mine operations, dust suppression).	• Suitable licenced contractor to be engaged to remove process water which does not comply with re-use requirements.

Table 9.10 Identified potential impacts arising from the Project

Potential hazard	Risk	Mitigations measure(s)
Slugging activities	• Activity produces more water than the oily water treatment system can process.	• Feed gas specification and design to quantify maximum flow/capture rates. • Secondary containment to be installed in case of an emergency. • Reduce or stop gas inflow from the offending gas supplier. • Contractor to be engaged in case of emergency to remove material.
Pigging and scraper activities	• Excess water and waste material produced from activities. • Pig becomes stuck during operations.	• Design to quantify maximum flow/capture rates. • Secondary containment to be installed in case of an emergency. • Contractor to be engaged in case of emergency to remove material.
GCF plant unable to process contaminants within gas	• Existing GCF design unable to compress and refine gas to required specification for exportation.	• Sampling undertaken of gas extracted. • Design GCF to ensure suitable equipment is available to process export gas. • Reduce or stop gas inflow from the offending gas supplier.
Fire	• Plant and/or equipment causes fire. • Personnel actions result in fire.	• Scheduled maintenance of plant and equipment to occur. • Designated smoking area to be established. • Approved fire alarm, detection, suppression and fighting systems designed and installed in consultation with the relevant fire authorities. • Emergency Response Procedure. • Safety Management System. • SCADA. • Inductions and training to be completed for all personnel entering site. • QPM Energy to liaise with landholders and relevant authorities with respect to fire breaks and ongoing maintenance programs. • Limit ignition and fuel storage areas. • FEED control philosophy. • Emergency shutdown function (ESD) installed.

Table 9.10 Identified potential impacts arising from the Project

Potential hazard	Risk	Mitigations measure(s)
Gas leak	• Faulty equipment results in gas leak.	• Gas detection system installed in GCF. • Metering and monitoring equipment installed. • Safety Management System. • SCADA. • FEED control philosophy. • ESD function installed.
Shutdown or incident occurs with NQGP	• Excess gas results in incident. • Incident occurs when tying into the hot tap.	• Engagement with asset owner. • Front End Engineering a Design (FEED) report. • Safety Management System. • Hazard and Operability Plan (HAZOP). • Flare to burn excess gas to atmosphere. • Emergency response plan. • SCADA.

9.9.3 Fuel and chemical storage and management

Fuels and chemicals will be supplied to site via fuel/chemical tankers. All chemicals will be stored in accordance with AS1940: 2017 Flammable Liquid Storage and Handling. Manufacturer specifications for the handling and management will be strictly adhered to.

The replenishment of chemicals will be undertaken periodically throughout the construction and operational phases of the Project. The replenishment will occur via the following medians:

- Diesel – small tanker direct filling to the diesel drive storage tank which is located adjacent to the road where truck deliveries take place.
- TEG will be supplied in IBCs (1,100 kg bulk containers) and pumped into the integrated storage tank supplied with the TEG package. The ISO tankers are returned and reused.
- Lubricant is supplied in IBCs (1,100kg bulk containers) and pumped into each of the on-skid storage tanks.

Major equipment such as compressor and TEG dehydration packages will be supplied with skid bunds. Concrete bunding is provided for the oily water package and lubricating oil storage area. A Contamination Management Plan will be generated to inform the procedures for the handling and management of hazardous substances. Key items within the document will include:

- inventory of potential hazardous materials/liquids to be used on the Project
- spill response and reporting procedures
- locations where hazardous chemicals will be stored during the construction and operational phases of development
- site layout and design for key infrastructure locations, spill kits, site boundaries and holding locations.

9.9.4 Emergency management and response commitments

i Emergency Plan

An Emergency Management Plan will be developed to identify and outline the procedures required in the instance of an emergency event onsite. The plan will be created to address the following components:

- an analysis of the key incidents likely to take place for each operational area
- an assessment of the degree of impact likely to occur
- an assessment of what constitutes an emergency for the particular operation
- an on-site plan to handle incidents
- an off-site plan with reference to emergency services needed
- communication, emergency responsibilities, control centre establishment
- post emergency procedures, including recovery, debriefing and review of plan
- testing of plan under emergency-like conditions.

The mitigations measures that will be employed during the construction and operational phases of the Project as part of the Emergency Management Plan are shown in Table 9.11.

.

Table 9.11 Emergency management and mitigation measures

Mitigation measure(s)	Description
Emergency Response Plan	Designated first aid and emergency rescue facilities and equipment will be available during the construction, operational and decommissioning phases. Appropriately trained personnel will be on-site throughout the life of the Project to provide first aid and to respond to on-site emergencies. First aid response and provision will be included in the site induction training that will be provided to all staff members. The Project will have a safety management system that can be accessed remotely during the operational phase. This system will allow appropriately trained personnel to shutdown the required sections of the GCF, pipeline and ancillary facilities from a safe and secure location. Gas and fire detection system approved by relevant authorities will be utilised. All fire-fighting facilities and equipment will be appropriately installed, serviced, maintained in accordance with the relevant AS and inspected by a certified body. First aid and fire-fighting equipment (handheld extinguishers and fire hoses) will be installed at strategic points within each building. Fire-fighting equipment and exit locations will be signed in accordance with AS1319-1994. All work areas will be within the required distance to reach emergency exits. Induction training will include fire response techniques. Site firefighting capabilities are also addressed in the Emergency Management Plan. Schedule fire, gas and emergency shutdown drills will be undertaken on a regular basis. Permanent facilities, such as fuel storage areas, will have a dedicated fire alarm, suppression and fire-fighting systems.

Table 9.11 Emergency management and mitigation measures

Mitigation measure(s)	Description
Supervisory control and data acquisition	**Shutdown Functions** Callout for unplanned activities or responding to process upset may occur throughout the operational life of the facility. The response time for operators to arrive on site for intervention is expected to be one hour. Key operating data and equipment operating status will be viewable from site SCADA system. The control system setpoints and functions can be remotely changed or tuned from site SCADA. In general, site SCADA is the local control room which works the same as the remote Main Control Room. This facility is designed to fail in a safe position. Some process equipment can be remotely started or stopped from site SCADA. During operation, gas flow and pressure would be monitored from the GCF and at the gas delivery points. These will include: • Emergency shutdown functions (ESD) – The purpose of the ESD is to isolate and de-energise the GCF to prevent a process upset or unplanned gas release from further escalation. • Emergency blowdown functions (EBD) – The purpose of the EBD is when ESD is not considered sufficient to control the emergency and requires the facility to be rapidly blown down. • Package shutdown functions (PSF) – The purpose of the shutdown function within a package is to isolate and de-energise the unit to prevent a process upset or unplanned gas release from further escalation. The package shutdown is achieved by the hard-wired electrical connections and is expected to de-energise the complete unit immediately, if initiated. Note, that compressor packages also come with programmed shutdown functions programmed in the package Program Logic Controller (PLC) which may perform a sequential shutdown logic (controlled shutdown) or have a different shutdown class. **Fire and Gas Detection Systems** The purpose of the fire and gas functions is to detect the presence of gas leak or fire, and to provide means of mitigation. Due to the nature of a gas fire and as an unmanned plant, there is no fire suppression equipment on site. The fire protection philosophy is to detect and to isolate the fuel. The purpose of the Fire Detection System is to shut down the system exposed to a fire and prevent the fire event from further escalation. Note that Project provides fire detectors in the compressor packages and TEG unit. The purpose of the gas detection system is to provide an early warning of the gas leak and to prevent the gas leak event from further escalation. The gas detection system will only be provided for the compressor packages. Gas detection system vendor has been consulted and it is understood that gas leaks in the open area will be difficult to detect.

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Appendix K

Draft Rehabilitation Strategy

QUEENSLAND PACIFIC METALS

EMM
creating opportunities

Rehabilitation Strategy

QPM Energy Project

Prepared for Queensland Pacific Metals Pty Ltd

March 2023

Rehabilitation Strategy

QPM Energy Project

Queensland Pacific Metals Pty Ltd

E221165 RP1

March 2023

Version	Date	Prepared by	Approved by	Comments
1	20 February 2023	Andrew Jensen	Anna McRae	
2	9 March 2023	Andrew Jensen	Anna McRae	

Approved by

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TABLE OF CONTENTS

Tables

Figures

Abbreviations

The following abbreviations are used in this report:

Abbreviations used in this report

Abbreviation	Term
AHD	Australian Height Datum
API	American Petroleum Institute
AS	Australian Standard
ASME	American Society of Mechanical Engineers
BS Act	*Biosecurity Act 2014*
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DN	Diameter Nominal
EA	Environmental Authority
EMM	EMM Consulting Pty Ltd
EO Act	*Environmental Offsets Act 2014*
EP Act	*Environmental Protection Act 1994*
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
ERA	Environmentally Relevant Activity
ESCP	Erosion and Sediment Control Plan
GBO	General biosecurity obligation
GCF	Gas Compression Facility
GIS	Geographical Information Systems
ha	Hectare
HFW	High frequency welding
HVR	High value regrowth
km	Kilometres
kPag	Kilopascal gauge
L	Litres
LV	Low voltage
m	Metres
mm	millimetre
ML	Mining Lease
MNES	Matters of National Environmental Significance
MoU	Memorandum of Understanding

Abbreviations used in this report

Abbreviation	Term
MSES	Matters of State Environmental Significance
NC Act	*Nature Conservation Act 1992*
NQGP	North Queensland Gas Pipeline
PJ/a	Petajoule per annum
PLC	Programmable logic controller
PMST	Protected Matters Search Tool
PSL	Product Standard Level
QPM	Queensland Pacific Metal Pty Ltd
RE	Regional ecosystems
RFI	Request for Information
RMP	Rehabilitation Management Plan
ROW	Right of way
SCADA	Supervisory Control and Data Acquisition
SEVT	Semi-evergreen Vine Thicket
TEC	Threatened ecological communities
TECH	Townsville Energy Chemicals Hub
TEG	Tri-Ethylene Glycol
TJ/d	Terajoule per day
VMP	Vegetation Management Plan
WoNS	Weed of National Significance

1 Introduction

1.1 Background

Queensland Pacific Metals (QPM) Energy is the proponent of the QPM Energy Project (the Project). The Project involves the design, construction, and operation of a gas compression facility (GCF) and a high-pressure pipeline that links the proposed GCF to the nearby existing and operational North Queensland Gas Pipeline (NQGP).

The Project proposes to collect waste coal mine gas at the proposed GCF via waste gathering lines from existing adjacent mines. At the GCF, waste coal mine gas will be dehydrated and filtered, with the remaining clean gas then compressed and transported via high-pressure pipeline to the existing and operational NQGP. The NQGP will then transport the compressed gas north to Townsville, where it will be depressurised and distributed, by a third party, to industrial users, including QPM's Townsville Energy Chemicals Hub (TECH) Project.

EMM Consulting Pty Limited (EMM) has been commissioned to undertake ecological assessments for the Project including the identification of environmental matters prescribed at Commonwealth and State levels across the Project area and associated impact assessments. EMM has been working with QPM Energy and has contributed to the Project design including identification of appropriate mitigation measures to reduce environmental impacts and maximise beneficial environmental outcomes.

1.2 Purpose of this report

The purpose of this Rehabilitation Strategy is to describe the rehabilitation proposed for the Project, seeking to achieve a safe, non-polluting stable landform for areas used in construction not required in operation. The strategy describes rehabilitation objectives of areas within the Project area not required for operation which will be managed to restore current land uses, including restoration of habitat for threatened fauna species.

This Rehabilitation Strategy aims to:

- describe the values of the Project area
- outline rehabilitation requirements, measures and practices
- describe how these activities will be monitored and evaluated.

This Rehabilitation Strategy has been developed to satisfy the requirements of the Department of Climate Change, Water, Energy and the Environment (DCCEEW) Request for Information (RFI) issued 21 November 2022 (Section 5 of the RFI), as described in Table 1.1.

Prior to commencing construction activities, a detailed Rehabilitation Program will be prepared by a suitably qualified person, in accordance with Environmental Authority (EA) conditions, legislation and standards.

Table 1.1 DCCEEW RFI requirements relating to rehabilitation

Requirements	Section of strategy addressed
The details of any rehabilitation activities proposed to be undertaken, including any activities required through other Commonwealth, State and/or local government approvals. All commitments must be drafted using committal language (e.g. 'will' and 'must') when describing the proposed activities.	Chapter 5
The proposed final landform, including rehabilitation completion criteria, and its relation to the pre-disturbance vegetation community. Include an assessment of the expected or predicted effectiveness of the proposed rehabilitation activities.	Section 5.2

Table 1.1 DCCEEW RFI requirements relating to rehabilitation

Requirements	Section of strategy addressed
Provide detailed mapping of the project site that clearly identifies areas to be rehabilitated	Section 5.2 and Figure 5.1
Information on the timing, frequency and duration of proposed rehabilitation activities to be implemented, including anticipated time to completion.	Section 5.2
Details of ongoing management and monitoring programs, including timing, to validate the effectiveness of proposed rehabilitation activities and demonstrate that completion criteria will be, or have been, achieved.	Chapter 6
Details of tangible, on-ground corrective actions that will be implemented, including timing, in the event that monitoring programs indicate that the completion criteria have not been, or will not be, achieved.	Chapter 6

1.3 Project details

1.3.1 Project area

The Project is proposed 43 km north of Moranbah, a coal mining town and locality within the Isaac Regional Council local government area (LGA).

The region is heavily disturbed with extensive mining (both open cut and underground) and grazing activities throughout.

The proposed high-pressure pipeline is situated over two properties, comprising the following lot/plans:

- Lot 23 on SP262530, herein named Lot 23 (Denham Park)
- Lot 11 on SP262530, herein named Lot 11 (Denham Park)
- Lot 2 on SP214117, herein named Lot 2 (Dabin Station).

The high-pressure pipeline also crosses (via underboring, with no surface impacts):

- Lot 100 on SP235905 (operational railway, Goonyella System)
- the Sunwater Moranbah and Eungella pipelines.

The Project area also includes a 40 m buffer from the proposed high-pressure pipeline corridor which is 30 m in width (total width surveyed along the alignment is 110 m). This buffer also intersects a small portion of Lot 14 on CP846391 (Burton Downs), herein named Lot 14, as well as Lots 23, 11 and 2.

The proposed GCF and access road are located on Lot 2, and is also buffered by 40 m, for the purpose of the ecological assessment.

Additionally, a 20 km buffer from the project area has been applied and is referred to as the study area. The project area is shown on Figure 1.1.

For the purpose of this report, the following definitions are used:

- Project footprint – the location of the proposed pipeline, GCF and ancillary facilities and the area which will be directly disturbed by the project.
- Project area – is the project footprint within a 40 m buffer from the pipeline corridor, GCF and access track.

- Study area – 20 km buffer from the project footprint.

The proposed high-pressure pipeline is situated over two properties (Denham Park and Dabin Station), comprising the following lot/plans – Lot 23 on SP262530, herein named Lot 23, Lot 11 on SP262530, herein named Lot 11 both located on Denham Park, and Lot 2 on SP214117 located on Dabin Station, herein named Lot 2. The pipeline also crosses Lot 100 on SP235905 (Goonyella rail system) which will be underbored with no surface impacts and also crosses underneath the Sunwater Moranbah and Eungella pipelines.

The Project area also includes a 40 m buffer from the proposed high-pressure pipeline corridor which is 30 m in width (total width surveyed along the alignment is 110 m). This buffer also intersects a small portion of Lot 14 on CP846391 located on Burton Downs, herein named Lot 14, and Lots 23, 11 and 2.

The proposed GCF and access road is located on Lot 2.

The Project is defined by limits which include:

- road connection to Red Hill Road
- GCF inlet flange/s to the facility from gas gathering systems on adjacent mining tenures
- connection to the NQGP (via hot tap)
- GCF clean water pipeline flange returning water to the relevant existing mine water management system
- rainfall run-off from an on-site settling basin
- high-pressure pipeline easements (30 m wide right of way (ROW) during construction and reduced to 15 m ROW during operations from 3.2 km from the GCF boundary).

1.3.2 Project components

Table 1.2 describes the key components of the Project.

Table 1.2 Project components

Component	Description
Gas Compression Facility	• Captures and converts waste coal mine gas to clean gas. • Proposed to be located at Dabin Station on the southern boundary of Lot 2 SP214117 and 2.7 km west of the Red Hill Road reserve. • Sited on a 200 m by 300 m area. • 6 ha disturbance footprint.
High-pressure pipeline	• High-pressure pipeline to transport clean gas from the GCF to the NQGP. • 16.8 km in length, running along cleared areas, fence lines and fire breaks along property boundaries. • During construction, a 30 m wide construction right of way (disturbance area of 51 ha). • During operations, a 15 m wide operating easement (disturbance area of 25 ha) from 3.2 km from the GCF.
Access road	• Road to provide all-weather access to the GCF from Red Hill Road reserve. • 2.8 km long and 30 m wide. • 8 ha disturbance footprint

The Project is defined by limits which include:

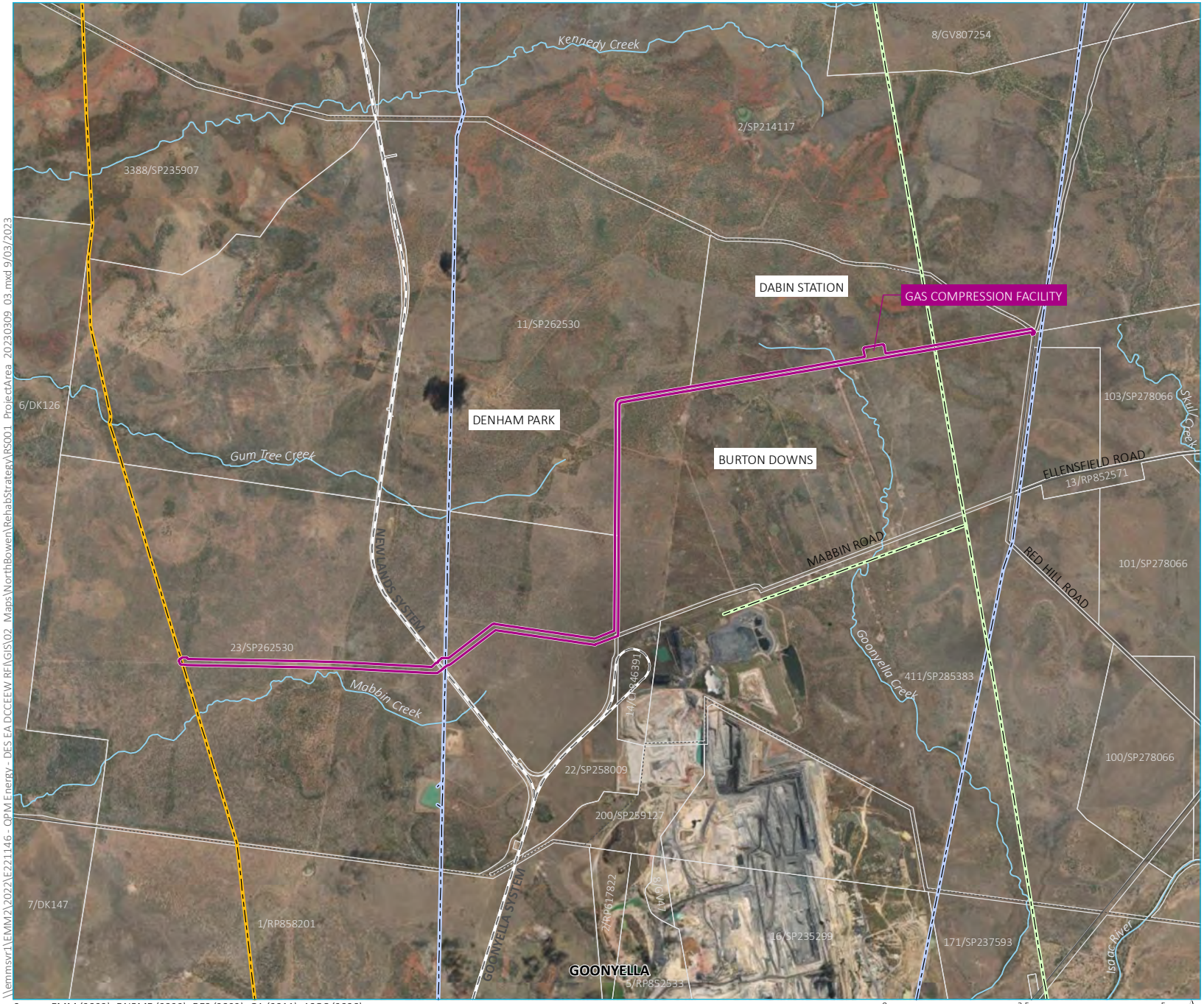
- road connection to Red Hill Road
- GCF inlet flange/s to the facility from gas gathering systems on adjacent mining tenures
- connection to the NQGP (via hot tap)
- GCF clean water pipeline flange returning water to the relevant existing mine water management systems
- rainfall run-off from an on-site settling basin.

i high-pressure pipeline easements (30 m wide Right of Way (ROW)) during construction and reduced to 15 m ROW during operations from 3.2 km from the GCF boundary).

1.3.3 Operational life

The GCF and pipeline have an average design life of more than 25 years. It is expected that the GCF and pipeline life will be extended through integrity management. When, and if, the proposed project is no longer required, it would be decommissioned in accordance with the regulatory requirements and accepted environmental best practices at that time.

Upon completion of the Project, the Project footprint will be rehabilitated via progressive rehabilitation to ensure reinstatement of vegetation is equal to or better than pre-construction status.



KEY

- Project area
- Electrical transmission line
- North Queensland Gas Pipeline
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Named watercourse
- Cadastral boundary

INSET KEY

- Main road
- National park
- State forest

Project area

QPM Energy Project
Rehabilitation Strategy
Figure 1.1

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\RehabStrategy\RS001 ProjectArea 20230309 03.mxd 9/03/2023

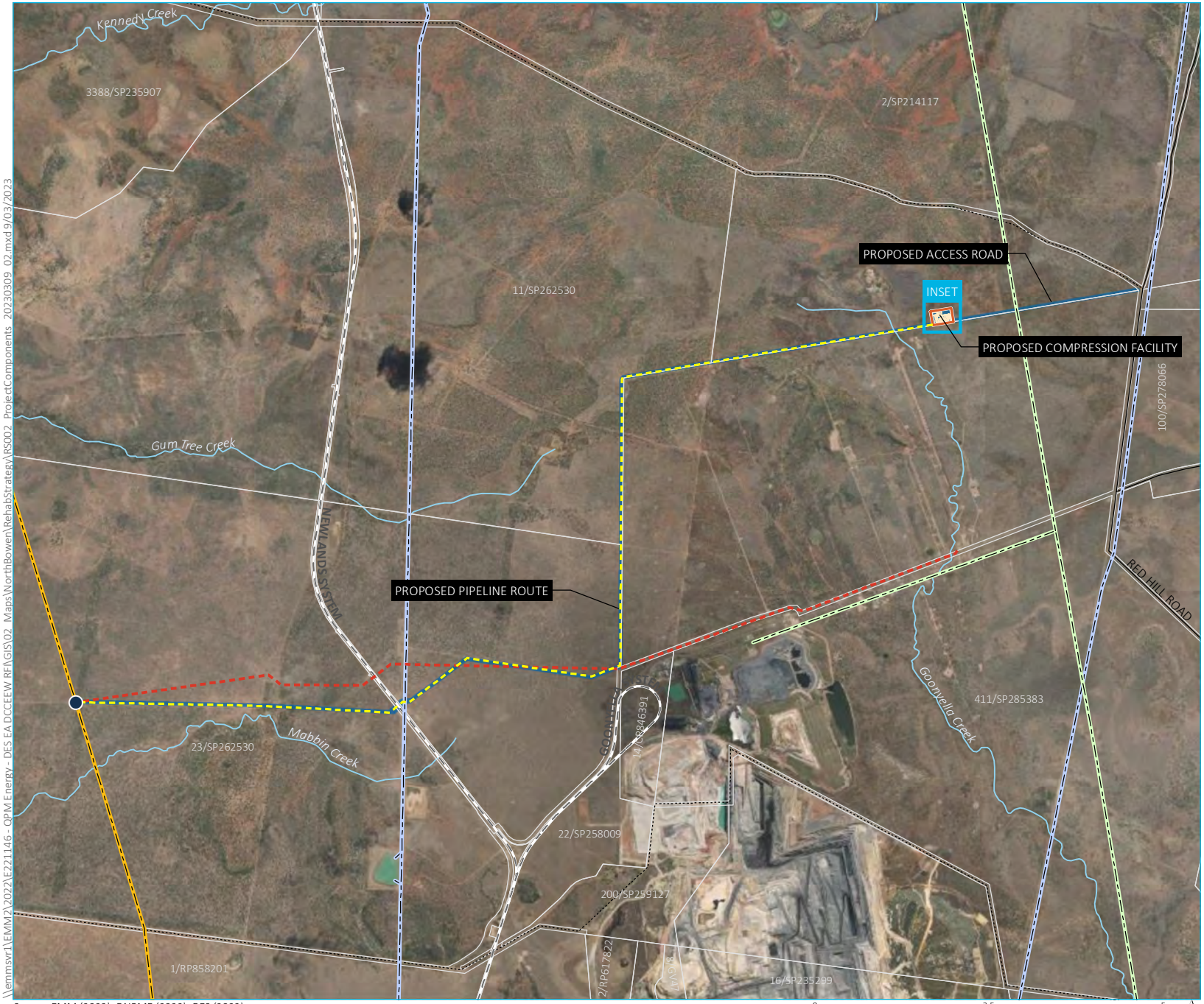
Source: EMM (2023); DNRME (2022); DES (2022); GA (2011); ASGC (2006)

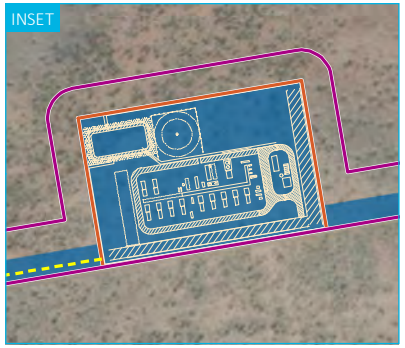
0 2.5 5 km

GDA 1994 MGA Zone 55

N

EMM creating opportunities





KEY

- Hot tap
- Project area (see inset)
- Proposed pipeline route
- Old pipeline route (March 2022 surveys)
- Proposed compression facility layout
- Proposed compression facility
- Proposed disturbance footprint

Existing environment

- Electrical transmission line
- North Queensland Gas Pipeline
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Named watercourse
- Cadastral boundary

Source: EMM (2023); DNRME (2022); DES (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\RehabStrategy\RS002 ProjectComponents 20230309 02.mxd 9/03/2023

Project components

QPM Energy Project
Rehabilitation Strategy
Figure 1.2

EMM
creating opportunities

2 Legislation

Primary approvals for the Project are being sought under the EPBC Act and the *Environmental Protection Act 1994* (QLD) (EP Act). These approval processes are being progressed concurrently.

A summary of the key legislation, policies and guidelines that have informed the design and implementation of field ecology surveys and impact assessments is provided in the following sections.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places – defined in the EPBC Act as matters of national environmental significance (MNES).

There are known MNES within the Project area, including threatened flora, fauna, and migratory species. A referral to the DCCEEW (EPBC2022/09329) was lodged and on 3 November 2022, a delegate of the Minister for the Environment determined that the Project to be a controlled action and to be assessed through the preliminary documentation pathway.

DCCEEW issued an RFI on 21 November 2022 which stipulated requirements relating to rehabilitation (Section 5 of the RFI). These are described in Table 1.1. This strategy responds to the RFIs.

2.2 State

2.2.1 *Environmental Protection Act* 1994

The Project will require a material change of use for an environmentally relevant activity (ERA). The ERA will require an environmental authority (EA) to be issued under the *Environmental Protection Act 1994* (QLD) (EP Act). As part of the application, an environmental impact assessment is required to be undertaken to assess the potential for environmental impacts, and identify how those impacts will be avoided, reduced and mitigated. As part of the impact assessment, the presence of matters of state environmental significance (MSES) within the proposed impact areas will need to be identified, and determination made as to whether the proposed actions would result in a 'significant' residual impact to MSES.

If a significant impact is considered likely to occur to MSES, environmental offsets will be conditioned through the EA, and they will need to be delivered in accordance with the *Environmental Offsets Act 2014* (EO Act). This will be assessed applying the Significant Residual Impact Guideline (DEHP 2014).

2.2.2 *Nature Conservation Act 1992*

The objective of the *Nature Conservation Act 1992* (NC Act) is the conservation of nature, and the Act provides for the gazettal of protected areas including nature refuges, prescribes classes of wildlife and sets out restrictions on the taking or harm to native wildlife without a valid permit. As part of the MNES impact assessment (EMM 2022b), threatened flora and fauna species have been assessed in terms of those with potential to occur in the Project area, and habitat mapping prepared.

QPM Energy's commitment to rehabilitate within the Project area is made to minimise impacts on these species.

3 Existing environment and ecological values

3.1 Field survey activities

An initial walkover of the Project area was undertaken between 6–9 December 2021 by Sandra Walters and supported by Daniel Kelly. The walkover included general habitat assessments, incidental threatened flora, and fauna searches.

The second round of field surveying occurred between 7–12 March 2022, led by Sandra Walters and Andrew Jensen and supported by Daniel Kelly and Elliot Leach. The March survey represents a late wet season/autumn seasonal survey for the Brigalow Belt bioregion under the 'Terrestrial Vertebrate Fauna Survey Guidelines for Queensland' (Eyre et al. 2018). This coincides with an active period for fauna including dispersal and migration of many species. It is also more likely to be moist from summer rainfalls, than during the spring to early summer period, and overlaps with grass reproduction and propagation, which is important for granivores.

Further surveying was completed between 28 June – 1 July 2022, led by Sandra Walters and supported by Elliot Leach. These surveys focussed on verification of regional ecosystems present, potential for threatened ecological communities (TEC) and species habitat mapping.

A final field survey was completed by a team of two EMM ecologists, led by Elliot Leach and supported by Rachel Scott between 21–24 November 2022 on Lot 11 and Lot 2, to undertake spotlighting for MNES species potentially present, particularly Koala, Greater Glider and Ornamental Snake.

A summary of the flora survey methods and results are outlined in the MNES Preliminary Documentation (EMM 2023), and key findings are detailed below.

3.2 Project area values

The Project area is in the Brigalow Belt North Bioregion and Northern Bowen Basin sub-region. Surface elevations across the Project area range from approximately 290 m Australian Height Datum (AHD) at the high-pressure pipeline entry to the NQGP to approximately 330 m AHD at Red Hill Bluff, 2 km west of the GCF. Generally, the terrain is flat open grazing country.

The Project area is divided by the Burdekin Basin and Fitzroy Basin. The western part of the alignment is in the Burdekin Basin catchment and generally drains into the Suttor River and heads north. The eastern part of the alignment is in the Fitzroy Basin catchment and drains into the Isaac River.

The buried high-pressure pipeline alignment crosses Goonyella Creek which is a stream order 1 watercourse. Within the Project area, Goonyella Creek is an ephemeral drainage feature with no discernible banks.

3.3 Regulated vegetation communities

3.3.1 Regional Ecosystems

A summary of the ground-truthed regional ecosystems (REs), their description and status are provided below in Table 3.1.

Table 3.1 Ground-truth REs within Project area

RE code	Description	VM Class	Remnant (ha)	HVR (ha)
11.4.9	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered	4.74	0

Table 3.1 Ground-truth REs within Project area

RE code	Description	VM Class	Remnant (ha)	HVR (ha)
11.5.3	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces	Endangered	3.04	0.37
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	Least Concern	0.26	0
Non-Remnant		56.64		

Note: HVR = High value regrowth

3.3.2 Threatened Ecological Communities

Field surveys confirmed that the Poplar Box and Semi-evergreen vine thicket (SEVT) threatened ecological communities (TECs) are not present on Lot 23 or Lot 411.

REs that are analogous with the Brigalow, SEVT and Grassland TECs are mapped within the Project area in the State mapping on Lot 23 (Brigalow TEC only), Lot 11 and Lot 2. However, ground-truthing has confirmed that SEVT and Grassland TECs are not present. Small patches of vegetation communities analogous with Brigalow TEC are present on Lot 411 and Lot 2.

3.4 Flora

3.4.1 Threatened flora species

Threatened flora species were searched for across the Project area. No threatened species were recorded during these surveys. *Eucalyptus raveretiana* (Black Ironbox), which is a tree, occurs in riparian (river) habitats, which is not present in the Project area, and this species was confirmed to be absent. Likewise, *Samadera bidwillii* (Quassia), a shrub, grows in dry rainforest and vine thicket. This habitat is also absent, and Quassia was not present in the Project area.

Three species of threatened grass, *Dichanthium queenslandicum* (King Bluegrass), *Dichanthium setosum* (bluegrass) and *Digitaria porrecta* (Finger Panic Grass) were identified in database searches or the Protected Matters Search Tool (PMST) as potentially occurring within the Project area. The December 2021 surveys of Lot 411 confirmed that the majority of the grassed extents within Lot 411 are dominated by introduced grasses and forbs. Several grasses were sampled and lodged with the Queensland Herbarium from a patch of grassland immediately west of Goonyella Creek. These samples were confirmed as not belonging to these threatened species.

Targeted searches for these grasses were completed during the post-wet season March 2022 survey on Lot 411 and Lot 23. On Lot 411, meanders were completed through the natural grassland, as well as the mapped grassland RE (11.8.11/11.8.5) in close proximity. No threatened species were located, and the majority of grassland patches were in degraded condition, with Buffel Grass in abundance. Significant rain had fallen prior to the March 2022 survey, and grasses were in flower at the time of survey, including species of *Dichanthium* and *Digitaria* genera.

During the June/July 2022 survey, on Lot 23, Lot 11 and Lot 2, meanders for the target threatened grasses were completed whilst undertaking quaternary assessments, as well as in transit through the high-pressure pipeline alignment between sites. On Lot 11 and Lot 2, the high-pressure pipeline alignment was searched thoroughly on foot by two ecologists for the threatened grasses wherever suitable habitat was present (i.e. heavy clay soils and/or stony red-brown loam). Due to preceding rains, the majority of grasses were flowering at the time, including *Dichanthium* and *Digitaria* species, so there was a high level of confidence in the detectability of these species. A total of 43 quaternary sites were completed within suitable habitat on Dabin Station and Denham Park, and no threatened grasses were recorded Grazing, clearing and weed invasion are known threats to all three species (DCCEEW, 2023a; DCCEEW, 2023b; DoE, 2008; DoE, 2013), and all are significant ecological drivers within the Project area. As such, it is considered unlikely that any occur within the Project area.

3.4.2 Weeds and pests

Due to the highly disturbed nature of the Project area a number of weed species were recorded. Open (non-remnant) areas were dominated by groundcover weeds, primarily Parthenium (*Parthenium hysterophorus*).

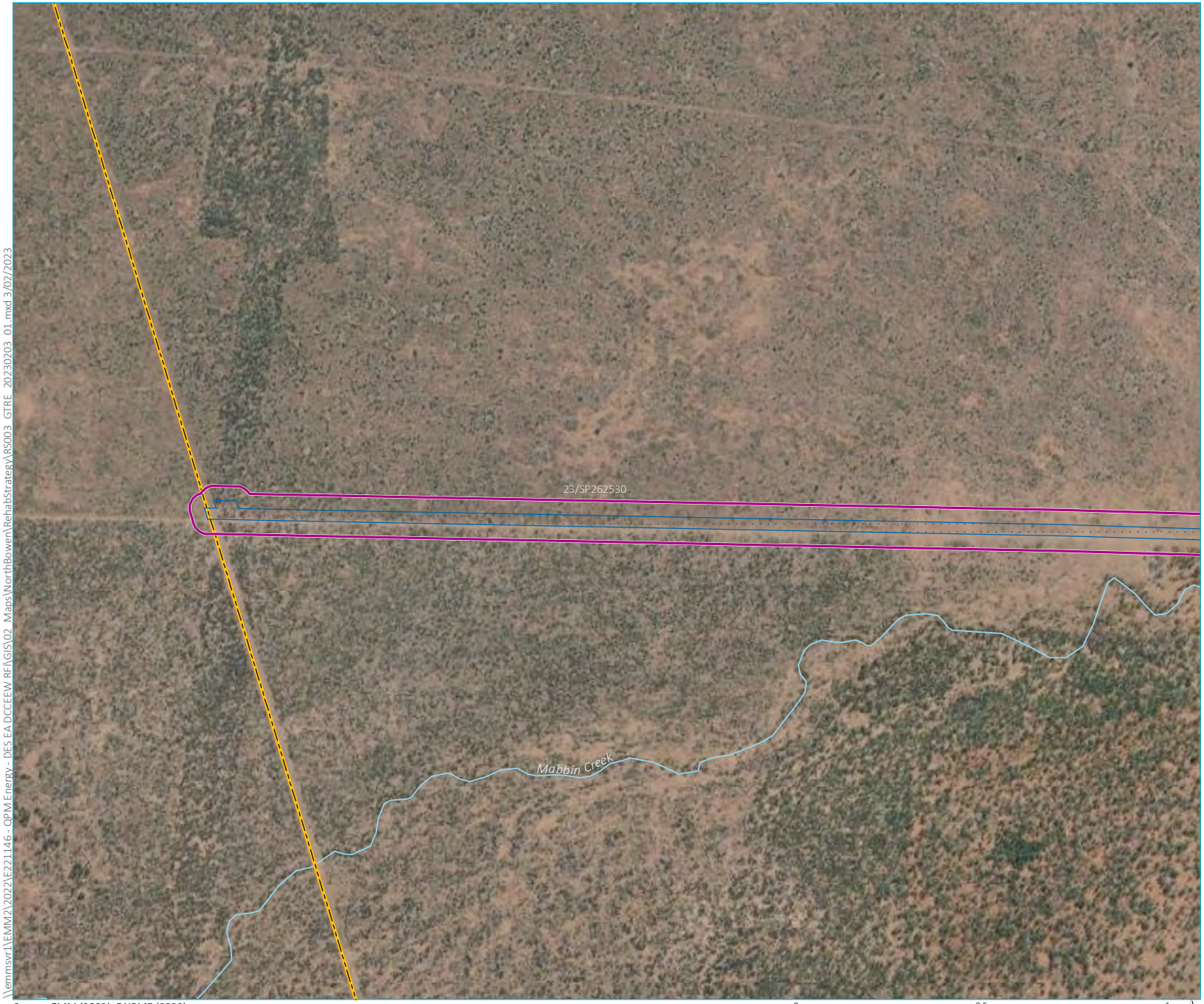
Parthenium is a category 3 restricted invasive plant under the *Biosecurity Act 2014*, and was recorded on all subject Lots within the Project area. It is particularly dense in the black soil sections of Lot 23 (Denham Park Station) and Lot 2 (Dabin Station). It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). Parthenium is also a Weed of National Significance (WoNS) at Commonwealth level.

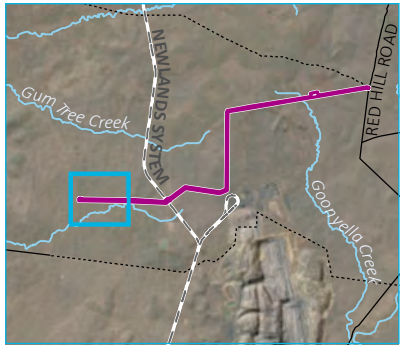
Additionally, Harrisia Cactus (*Harrisia martini/Harrisia tortuosa*) and Prickly Pear (*Opuntia sp*) were recorded at a number of locations in the Project area.

Harrisia Cactus and Prickly Pear are also category 3 restricted invasive plants under the *Biosecurity Act 2014* (BS Act), and was recorded at widespread locations throughout the Project area albeit not in high densities. Prickly Pear is also a WoNS at Commonwealth level.

Additionally, although not recorded in the Project area, Rat's tail grasses (particularly Giant Rat's Tail Grass – *Sporobolus pyramidalis/S. natalensis* are identified as a high risk species for invasion of the Project area which can reduce pasture productivity and cause significant degradation of natural areas. Other high-risk species for establishment include Fireweed (*Senecio madagascarensis*).

The grazing areas are dominated by the introduced pasture grass, Buffel Grass (*Cenchrus cilliaris*).





KEY

- Project area
- Proposed disturbance footprint
- North Queensland Gas Pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

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Ground-truthed regional ecosystems
Map 1 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 3.1

EMM
creating opportunities

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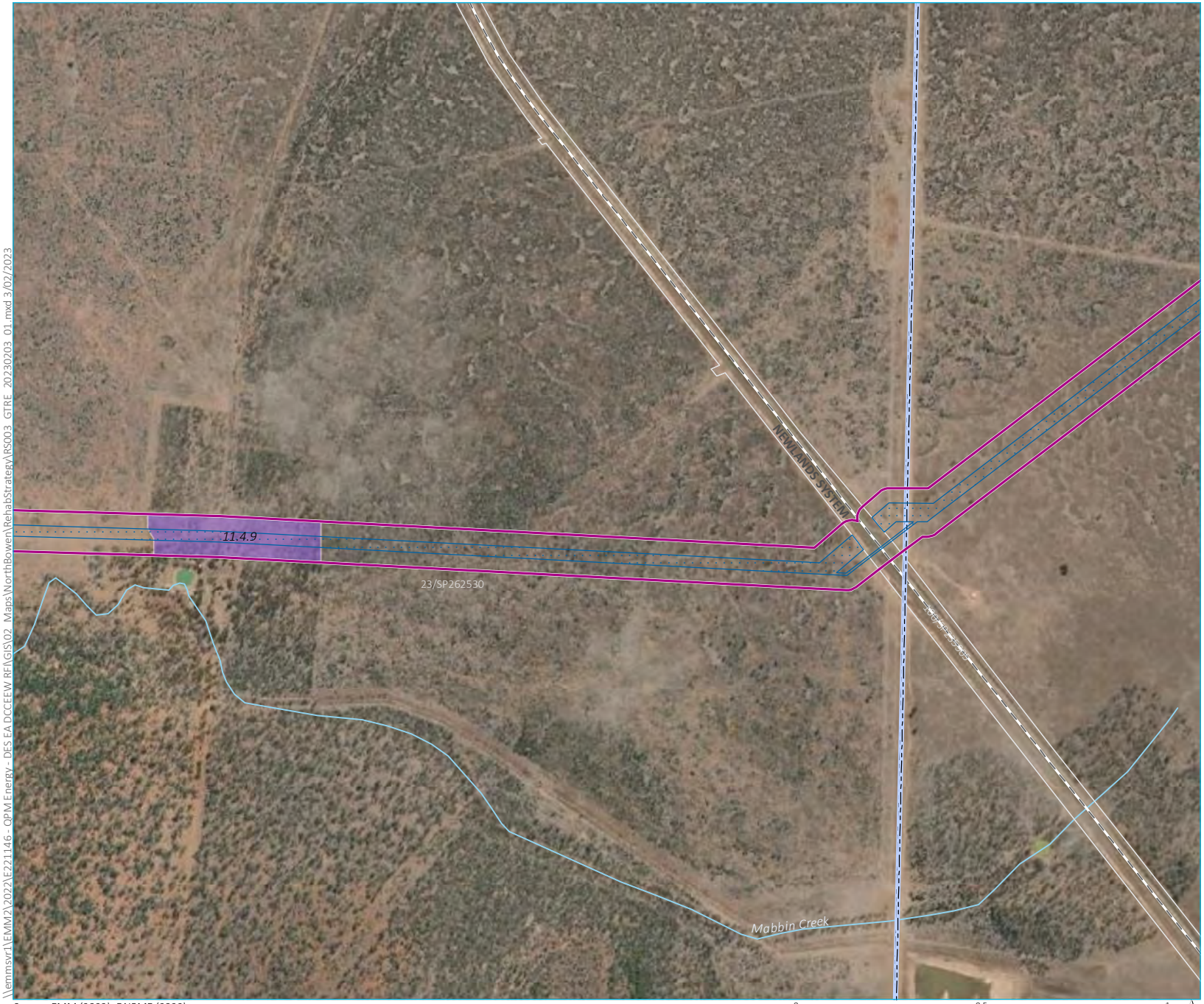

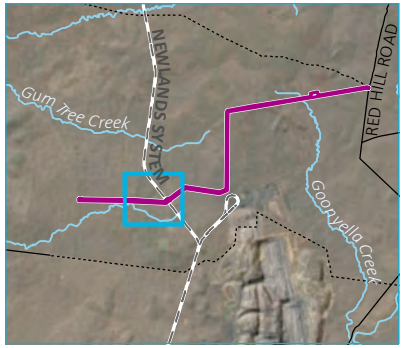

KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Ground-truthed regional ecosystems

- Remnant - endangered

Ground-truthed regional ecosystems
Map 2 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 3.1

Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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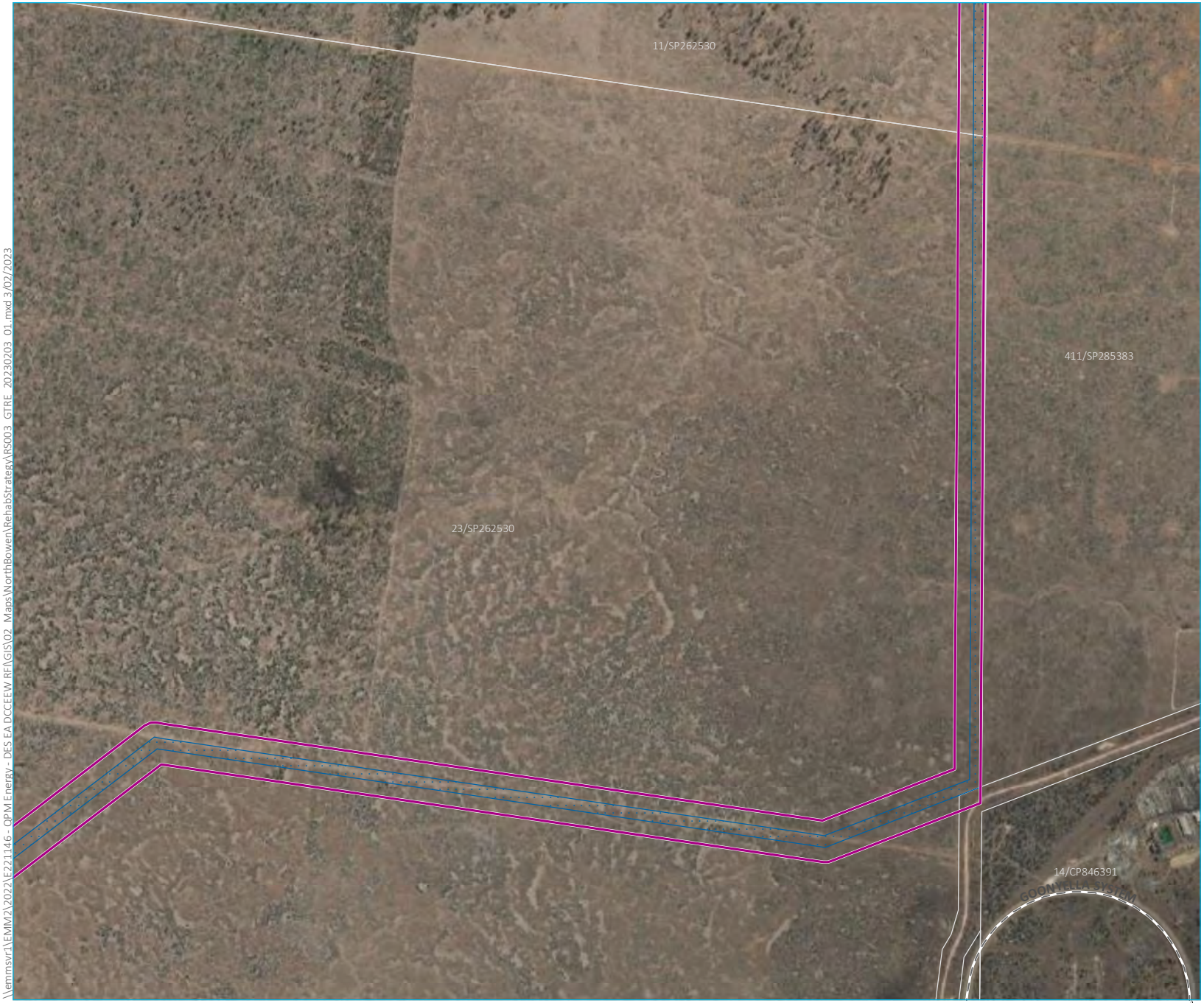

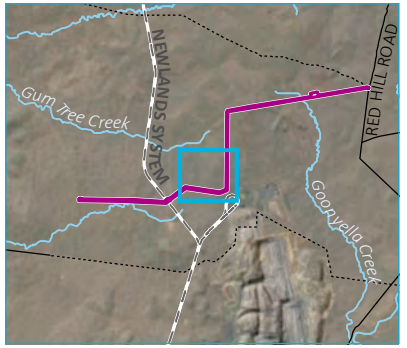

KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary

Ground-truthed regional ecosystems
Map 3 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 3.1

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Source: EMM (2023); DNRME (2022)

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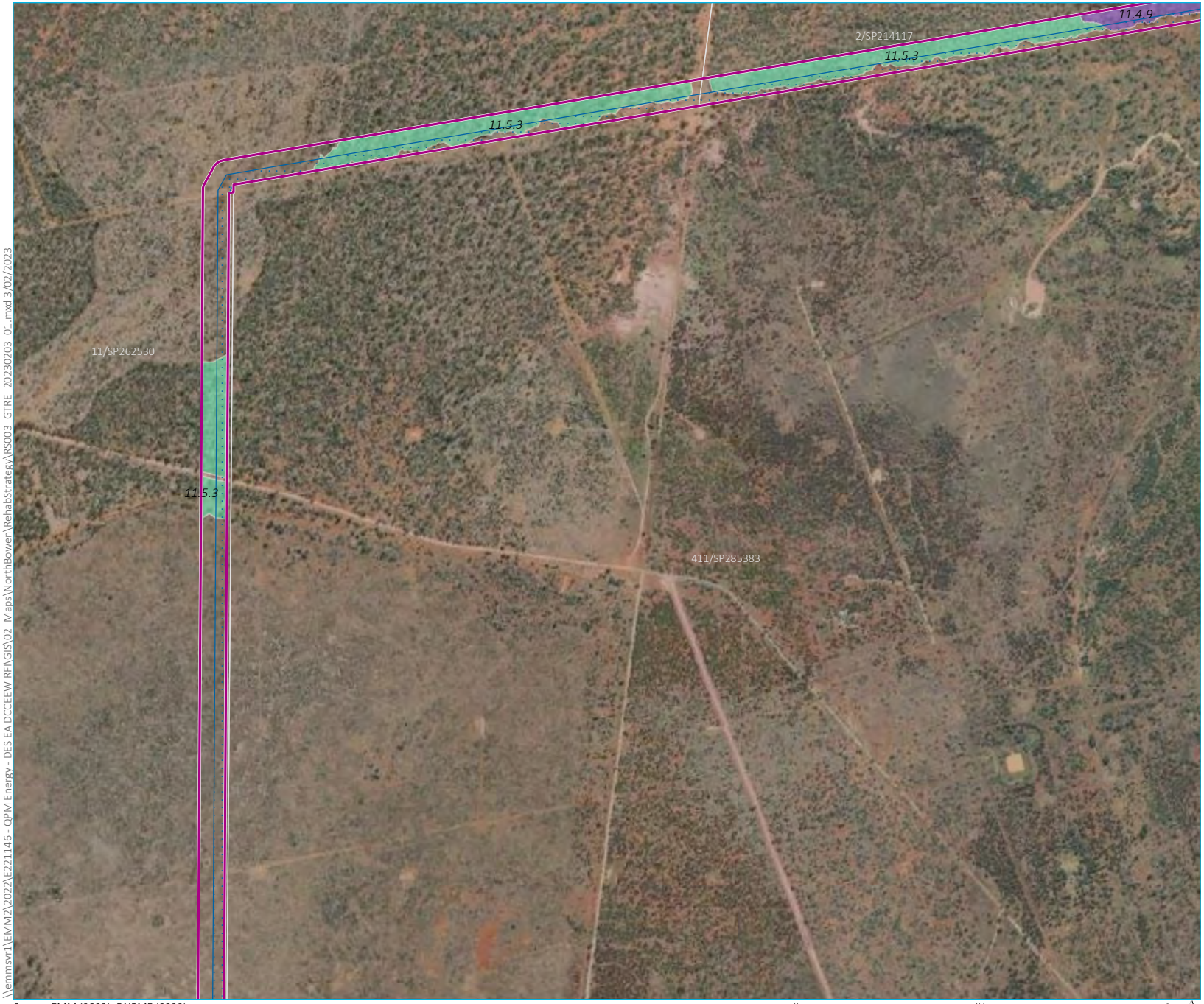
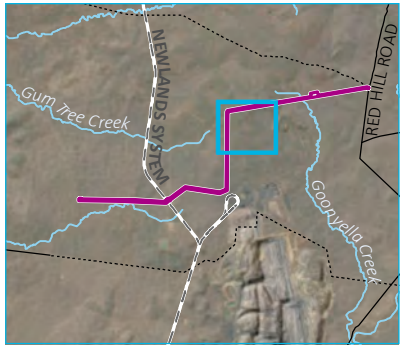
creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Cadastral boundary

Ground-truthed regional ecosystems

- Remnant - endangered
- Remnant - least concern

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Source: EMM (2023); DNRME (2022)

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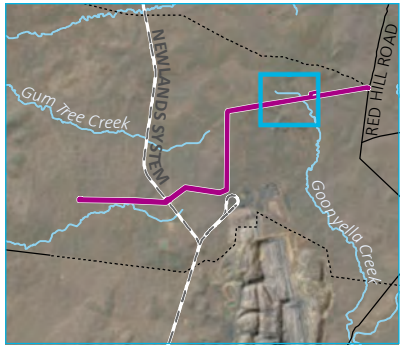
Ground-truthed regional ecosystems
Map 4 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 3.1

EMM
creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Ground-truthed regional ecosystems

- Remnant - endangered
- High value regrowth - endangered
- Remnant - least concern

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Source: EMM (2023); DNRME (2022)

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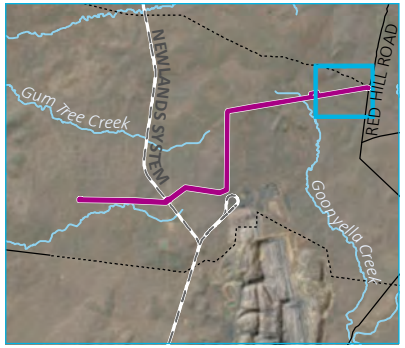
Ground-truthed regional ecosystems
Map 5 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 3.1

EMM
creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- Electrical transmission line
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Ground-truthed regional ecosystems

- Remnant - endangered
- High value regrowth - endangered

Ground-truthed regional ecosystems
Map 6 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 3.1

EMM creating opportunities

Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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4 Rehabilitation requirements

4.1 Rehabilitation objectives

The Project has been designed to meet the following broad objectives pertaining to rehabilitation:

- be rehabilitated to a safe and stable landform
- not cause environmental harm
- consult with involved landowners and key stakeholders regarding specific rehabilitation outcomes
- sustain post-operational land uses
- monitor the rehabilitation of disturbed areas to measure environmental outcomes.

Progressive rehabilitation and stockpiling of soils near the site of excavation will be conducted to minimise potential blending of topsoil with other material. Mulching of green waste will be completed throughout the construction phase of the project and stockpiled for use in rehabilitation and erosion and sediment control within the authorised construction area (although unlikely, mulch stockpiles are to be no greater than 10 m wide and higher than 2 m). Potential microhabitats features (e.g. rocks and fallen logs) will be relocated or stockpiled for use in rehabilitation.

The aim of the progressive rehabilitation and reinstatement is to ensure that the environment is safe, non-polluting and self-sustaining. The intention is to minimise additional management throughout the operational phase of the project. Ongoing inspection for the management and removal of key invasive weed species will be completed throughout all phases of the rehabilitation process. Rehabilitated areas are to be tracked via geographical information systems (GIS).

Where feasible to do so, the landscape will be rehabilitated to pre-existing contours with natural drainage lines restored and protected (if required). In certain cases, rehabilitation will be tailored to prior site-specific conditions in consultation with the landholder. To promote vegetation regrowth and promote and protect against the loss of topsoil, the pipeline 30 m wide construction corridor RoW surface will normally be lightly scarified prior to the respreading of topsoil.

4.2 Performance indicators and completion criteria

Nominally, the following rehabilitation objectives, performance indicators and completion criteria will be developed as summarised in Table 4.1.

Table 4.1 Performance indicators and completion criteria

Rehabilitation objectives	Performance indicators	Completion criteria
Safe and stable landforms	• No waste or hazardous material present. • Structurally sound. • Compatible with desired land use.	• Evidence waste or hazardous material removed. • Structural integrity assessed. • Evidence of use of rehabilitated areas by targeted fauna.
Non-polluting	• No waste or hazardous material present. • Surface water monitoring.	• Evidence waste or hazardous material removed. • Evidence through monitoring that criteria are met.
Vegetation cover established – ecosystem diversity compatible with desired land use	• Erosion monitoring. • Vegetation cover and type (native/exotic) comparable to selected reference sites.	• Soil loss comparable to selected reference sites. • Evidence through monitoring that criteria are met.

5 Rehabilitation measures and practices

The following measures will be implemented to facilitate rehabilitation within the Project area:

- Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated as soon as practicable following construction.
- Woody debris, logs and rocks will be retained for use in rehabilitation.
- Where seeding and/or revegetation is required select plant species that are found in similar adjacent habitat on site. Reuse of seed banks contained in topsoil that has been pushed aside for later use will have priority.

In order to undertake all aspects of rehabilitation, decommissioning of infrastructure is likely to be required. This includes the de-mobilisation and removal of buildings, plant and equipment and hard stand areas. The buried pipeline would remain in place. A final Rehabilitation and Decommissioning Management Plan required as part of the State approvals will be developed and submitted to the relevant authority 12 months prior to decommissioning occurring.

Clean-up, restoration, and rehabilitation will occur in a two staged approach for the project. Generally, clean-up and rehabilitation will involve removal of foreign material (construction material and waste), surface contouring and respreading topsoil. Existing seed stock within the topsoil is expected to naturally revegetate the disturbed easement. The removal of trees will be offset through the planting of tube stock shrubs or native grasses sourced from local nurseries where considered necessary.

5.1 General practices

5.1.1 Vegetation clearance procedures

The site layout has evolved to minimise vegetation clearing and impacts on MNES habitats. This has included:

- The location of the compressor facility is in an area of non-remnant vegetation, with shrubby regrowth and weedy understorey. This area is not suitable habitat for any of the target threatened species.
- The high-pressure pipeline alignment will follow existing clearings (e.g. fence lines, pulled and cleared pasture, firebreaks, access tracks) where practicable to minimise disturbance on the surrounding environment.
- The chosen access route was deemed as the most viable route due to minimised distance and impact to remnant vegetation.

5.1.2 Topsoil management

Existing seed stock within the topsoil is expected to naturally revegetate the disturbed easement. If required, this will be supplemented through the planting of tube stock shrubs or native grasses sourced from local nurseries where considered necessary (see Section 5.2).

Progressive rehabilitation and stockpiling of soils near the site of excavation will be conducted to minimise potential blending of topsoil with other material. Mulching of green waste will be completed throughout the construction phase of the project and stockpiled for use in rehabilitation and erosion and sediment control within the authorised construction area (although unlikely, mulch stockpiles are to be no greater than 10 m wide and higher than 2 m).

5.1.3 Erosion and sediment control plan

Erosion and sediment control management actions will be documented in an Erosion and Sediment Control Plan (ESCP) for the Project.

Actions will include maintaining a protective vegetated cover to reduce surface runoff, ripping surfaces to minimise erosion potential and development of drainage infrastructure.

5.1.4 Weed control

Weed management is a critical component of rehabilitation activities. Weed control is outlined in a Vegetation Management Plan (VMP) for the Project. This will be implemented during rehabilitation activities to minimise the spread of weeds off-site and seek to prevent the introduction of new weeds on to the site.

5.2 Rehabilitation process

Clean-up, restoration, and rehabilitation will occur in a two staged approach for the Project. Generally, clean-up and rehabilitation will involve removal of foreign material (construction material and waste), surface contouring and respreading topsoil. Existing seed stock within the topsoil is expected to naturally revegetate the disturbed easement. The removal of trees will be offset through the planting of tube stock shrubs or native grasses sourced from local nurseries where considered necessary.

5.2.1 Pipeline easement

i Progressive rehabilitation during construction

Rehabilitation will occur progressively and as soon as reasonably practicable be undertaken throughout the life of the proposed project. The target for successful rehabilitation is to ensure that reinstatement of vegetation is equal to or better that pre-construction status, except where permanent operational access is required.

Following completion of the pipeline construction, the pipeline easement will undergo initial stabilisation works. This will comprise reinstating topsoil, reprofiling contours, re-establishing any surface drainage lines and any soil amelioration if required.

Progressive rehabilitation and stockpiling of soils near the site of excavation will be conducted to minimise potential blending of topsoil with other material. Mulching of green waste will be completed throughout the construction phase of the project and stockpiled for use in rehabilitation and erosion and sediment control within the authorised construction area (although unlikely, mulch stockpiles are to be no greater than 10 m wide and higher than 2 m). All potential microhabitats features (e.g. rocks and fallen logs) will be relocated or stockpiled for use in rehabilitation.

The aim of the progressive rehabilitation and reinstatement is to ensure that the environment is safe, non-polluting and self-sustaining. The intention is to minimise additional management throughout the operational phase of the project. Ongoing inspection for the management and removal of invasive weed species will be completed throughout all phases of the rehabilitation process. Rehabilitated areas are to be tracked via GIS.

Where feasible to do so, the landscape will be rehabilitated to pre-existing contours with natural drainage lines restored and protected (if required). In certain cases, rehabilitation will be tailored to prior site-specific conditions in consultation with the landholder. To promote vegetation regrowth and promote and protect against the loss of topsoil, the pipeline 30 m wide construction corridor RoW surface will normally be lightly scarified prior to the respreading of topsoil.

ii Operational phase

The construction ROW will shrink to a 15 m wide operating easement, 3.2 km from the GCF. This width will typically include farm tracks and firebreaks alongside a fence line plus four metres to the other side of the pipeline to allow pipeline remediation and protection from deep-rooted trees. The operational easement will be kept clear of significant woody vegetation to maintain the integrity of the pipeline. This approach will maintain inspection traffic to an existing farm track which will enable the remaining area to become largely rehabilitated. This approach was developed with the assistance of the farm lessee to minimise long term impacts by using existing farm management practises and corridors.

Outside of the operational easement, but within the construction disturbance footprint, initial stabilisation will also take place but be followed by further rehabilitation to achieve final landform and land use. It is anticipated that the land will be returned to its pre-disturbance state. Given that the pipeline would be underground, land users would be able to resume previous land use activities on top of the pipeline provided they did not include excavation activities. Whilst deep rooted vegetation cannot be re-established within the operating easement, due to the potential for damage to the pipeline's coating, grasslands can be re-established, and no long-term impacts would be expected to sensitive ecosystems.

The majority of the alignment on Lot 23 and Lot 11 comprises land utilised for grazing, predominantly on landzone 4. Within these areas, rehabilitation works will focus on restoring the grazing potential of the land. Key objectives will include demonstrating percentage ground cover equal to or greater that in the surrounding area.

Within areas of the alignment currently mapped as being remnant or regrowth vegetation, rehabilitation works will seek to return the land to match the biodiversity values of the retained surrounding community. Natural regeneration will be the preferred method to reinstate native vegetation (as seedlings in the soil bank are likely to grow rapidly) however where natural regeneration is ineffective, assisted revegetation will be undertaken with species representative of the area using a combination of tubestock or seeding (with tubestock more suitable for canopy and shrub species).

On completion of the operational period of the pipeline, the operational easement will also be rehabilitated following the principles outlined above.

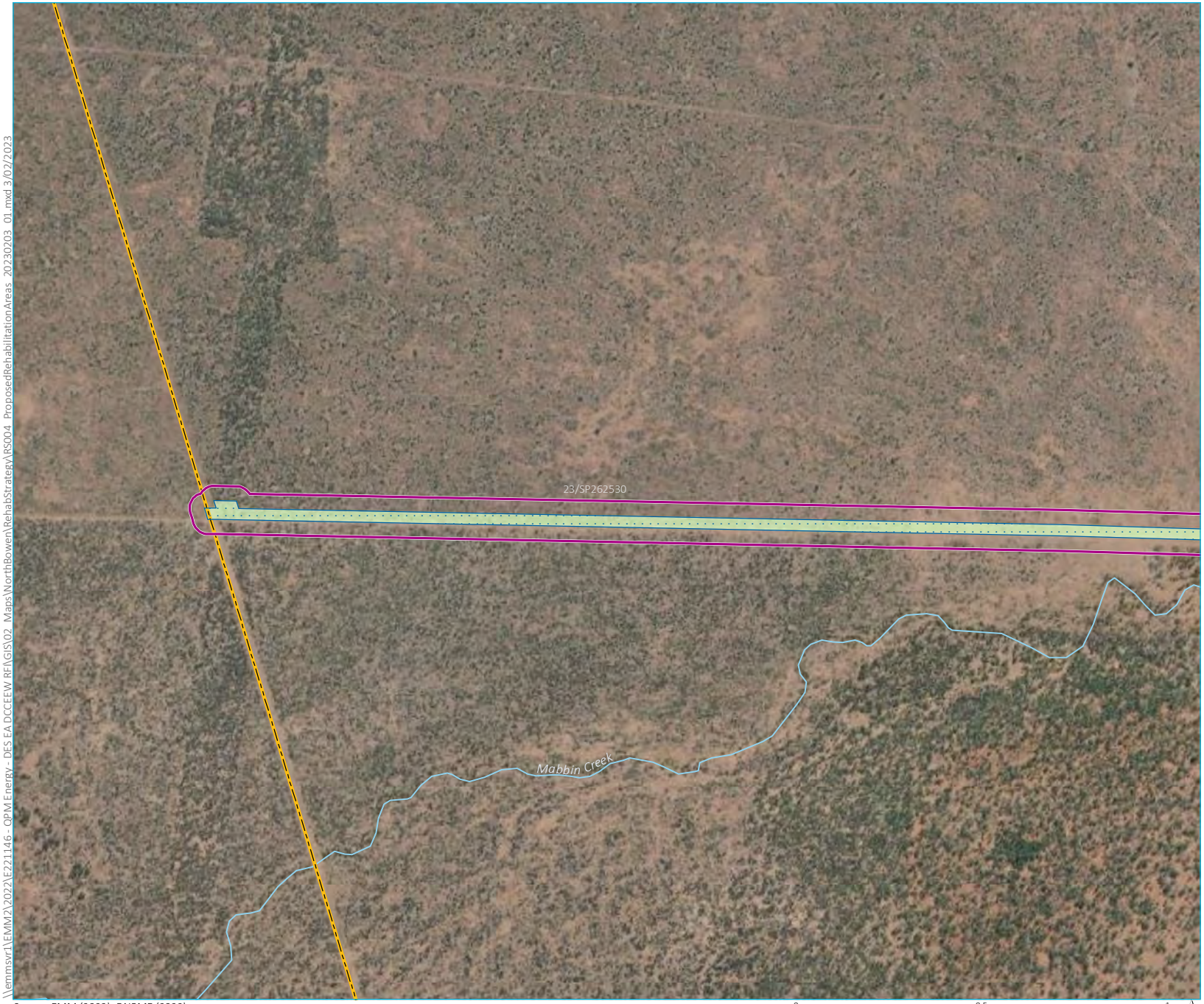
Livestock will be excluded from the areas being rehabilitated using temporary stock fencing to ensure rehabilitation is able to progress.

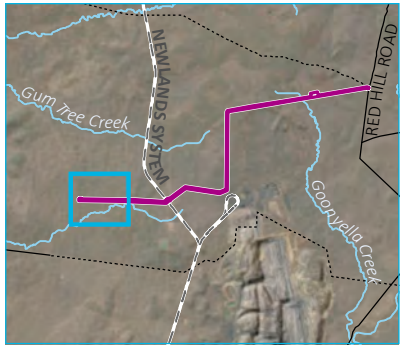
Rehabilitation will be undertaken in accordance with best practice and will ensure that:

- topsoil cover is re-established, and all land and waterways disturbed by project activities are returned to a stable condition as soon as practicable after construction
- land is returned as close as possible to its previous productivity
- stable landforms are re-established to original topographic contours
- natural drainage patterns are reinstated
- erosion control measures (e.g. contour banks, filter strips) are installed in erosion prone zones
- the pre-construction environment is reinstated and disturbed habitats recreated
- fences and gates are restored
- pipeline marker signs are installed.

5.2.2 Gas compression facility

The principles of rehabilitation will be as outlined in Section 5.2.1. Areas not required for operation will be rehabilitated following construction being completed.





KEY

- Project area
- Proposed disturbance footprint
- North Queensland Gas Pipeline
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Proposed rehabilitation areas

- Progressive rehabilitation following construction

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Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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Proposed rehabilitation areas
Map 1 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 5.1

EMM
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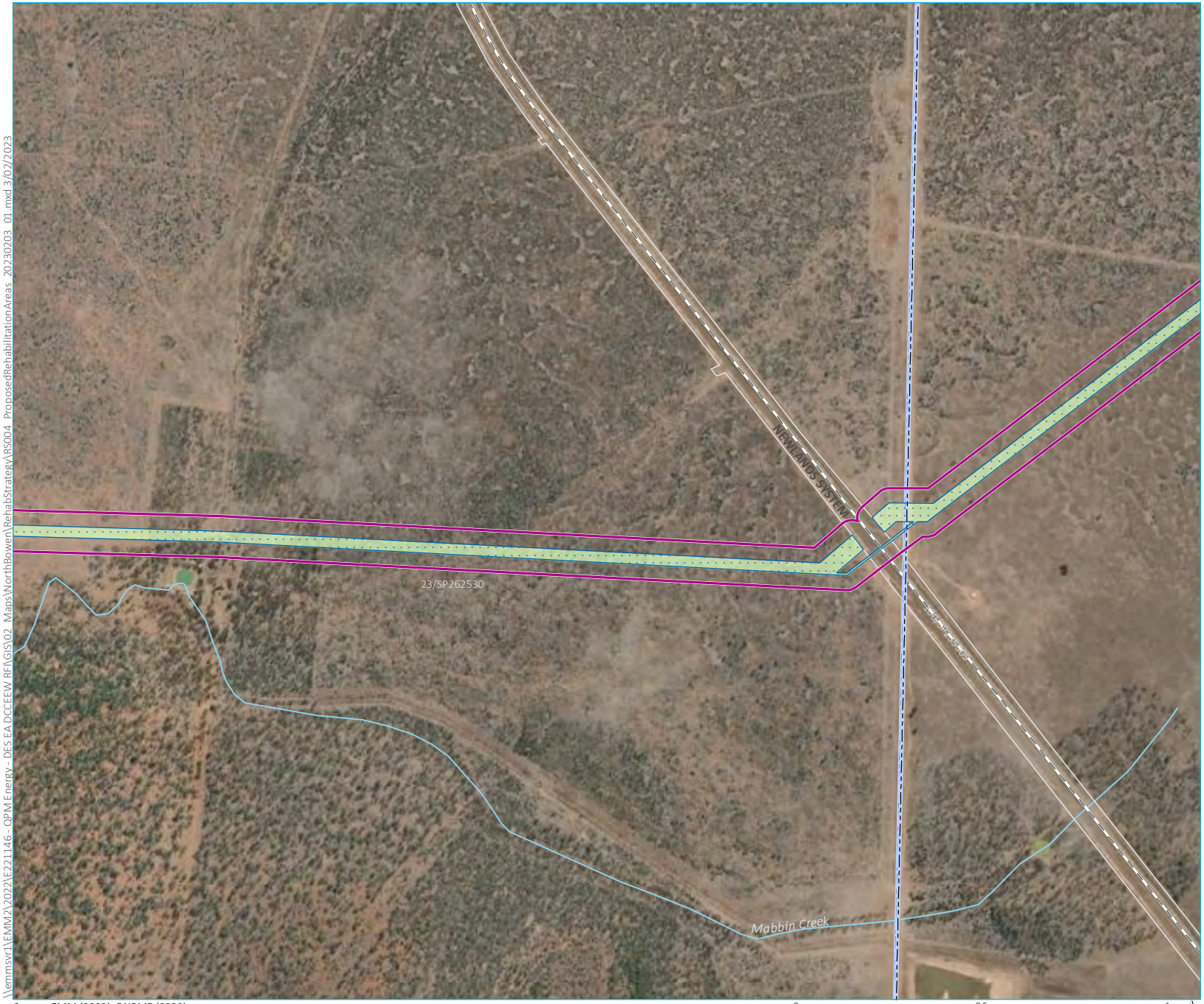

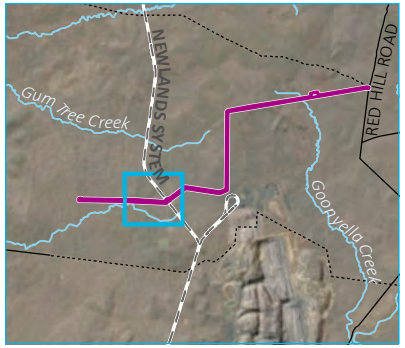

KEY

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- Cadastral boundary

Proposed rehabilitation areas

- Progressive rehabilitation following construction

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Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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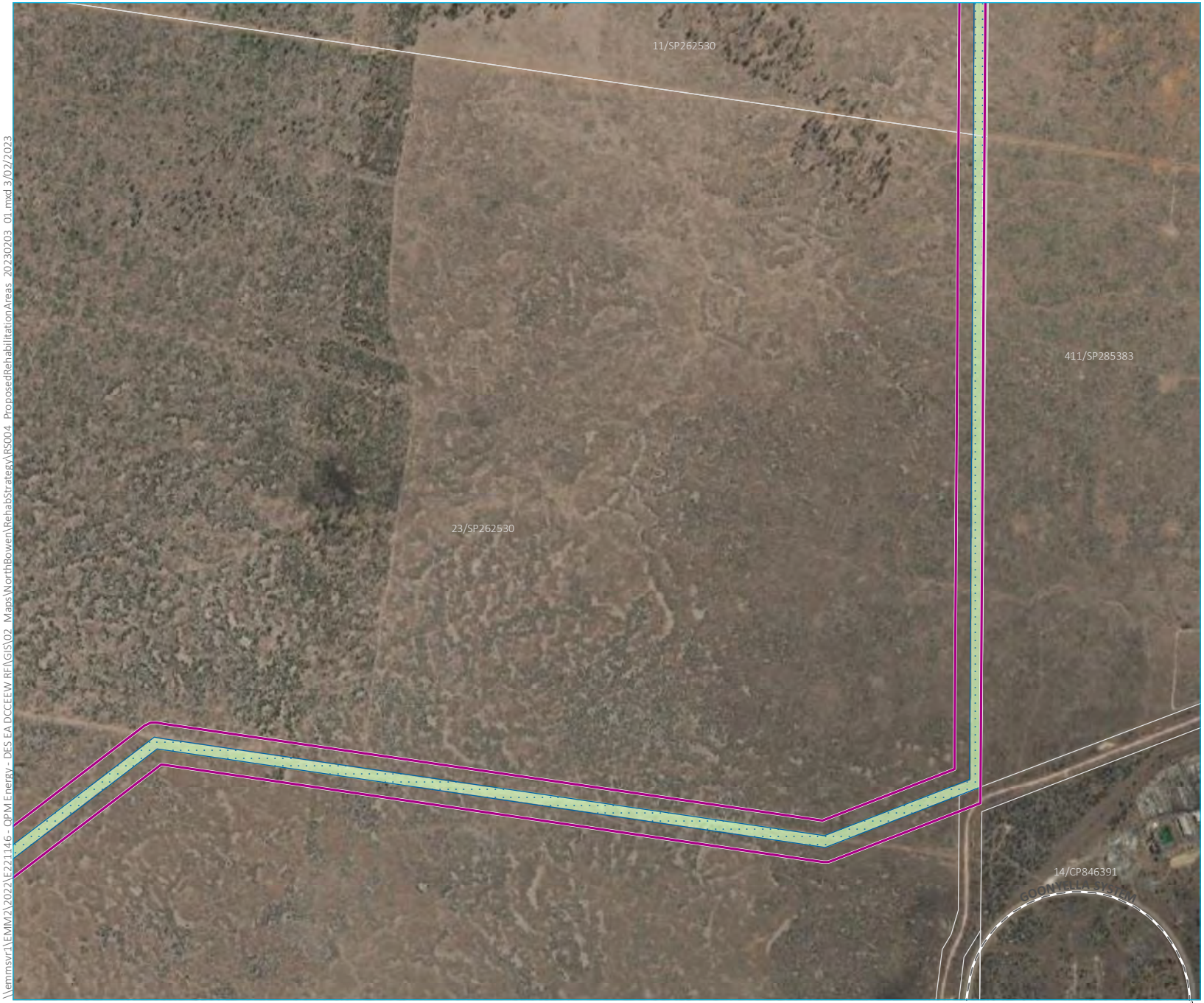
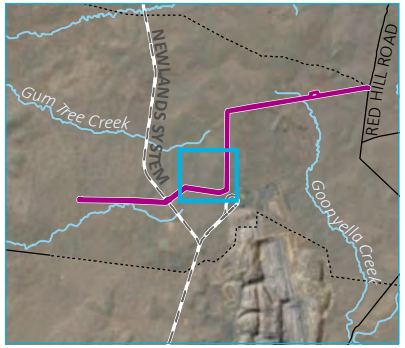
Proposed rehabilitation areas
Map 2 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 5.1

EMM
creating opportunities





KEY

- Project area
- Proposed disturbance footprint
- Rail line
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- Cadastral boundary

Proposed rehabilitation areas

- Progressive rehabilitation following construction

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Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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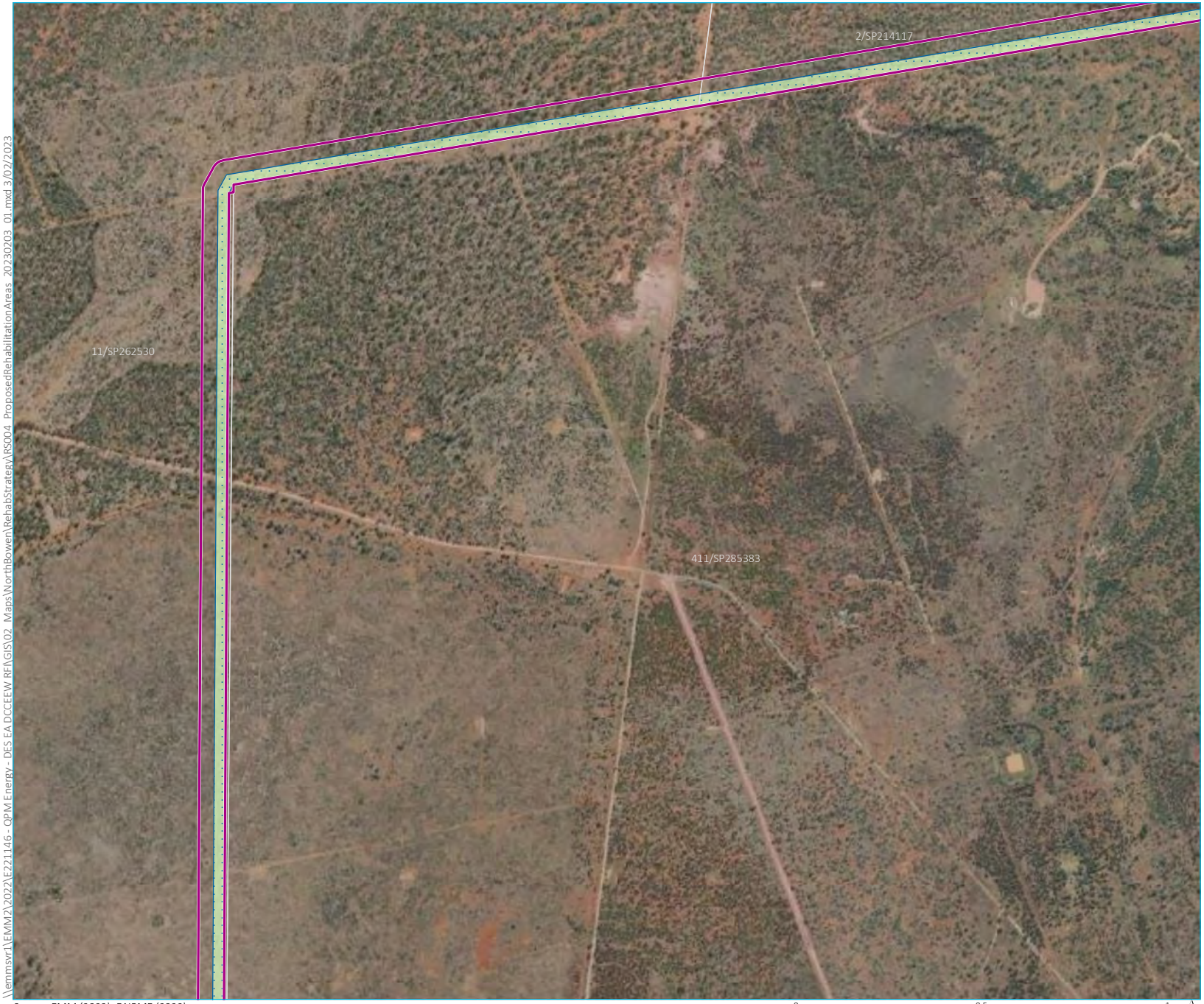
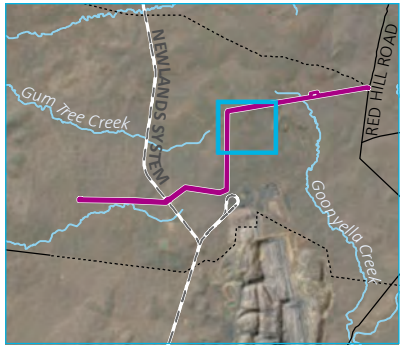
Proposed rehabilitation areas
Map 3 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 5.1

EMM
creating opportunities





KEY

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Proposed rehabilitation areas

- Progressive rehabilitation following construction

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Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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Proposed rehabilitation areas
Map 4 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 5.1

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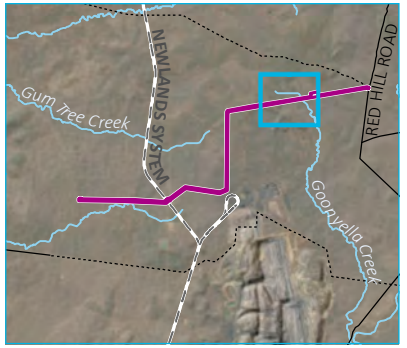

KEY

- Project area
- Proposed disturbance footprint
- Rail line
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Proposed rehabilitation areas

- Progressive rehabilitation following construction
- Long term rehabilitation following decommissioning

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Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

N

Proposed rehabilitation areas
Map 5 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 5.1

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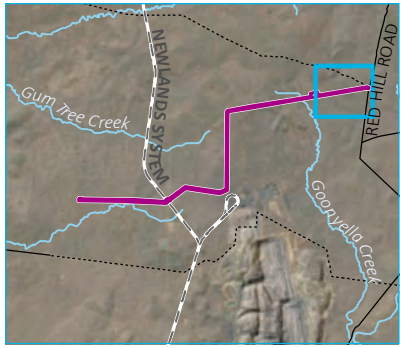

KEY

- Project area
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Proposed rehabilitation areas

- Long term rehabilitation following decommissioning

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\RehabStrategy\RS004 ProposedRehabilitationAreas 20230203 01.mxd 3/02/2023

Source: EMM (2023); DNRME (2022)

0 0.5 1 m

GDA 1994 MGA Zone 55

N

Proposed rehabilitation areas
Map 6 of 6

QPM Energy Project
Rehabilitation Strategy
Figure 5.1

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6 Rehabilitation monitoring

Monitoring of rehabilitated areas will be undertaken to establish whether the objectives of the Rehabilitation Strategy are being met, and whether a safe and stable landform has been achieved. Monitoring frequency, criteria and corrective actions will be confirmed in the detailed Rehabilitation Program, in accordance with EA conditions, legislation and standards, prior to commencing construction activities.

It is anticipated that monitoring of rehabilitated areas will be required for three years following rehabilitation works. If performance criteria are not being met, corrective actions/remedial works will be required. At the end of the monitoring period, if performance criteria are not met, the monitoring program and corrective actions/remedial works will be extended until the performance criteria are met.

Monitoring will include replicate monitoring sites within a range of rehabilitation areas. Key aspects that will be monitored include:

- soil erosion
- revegetation success and bare ground proportion
- proportion of weed cover
- vegetation health in areas being rehabilitated to preclearing vegetation communities. This may include vegetation surveys and photo monitoring
- integrity of any retained structures (e.g. erosion control structures or water diversion).

Potential remedial actions will include:

- weed management (either mechanical removal or herbicide treatment depending on species)
- supplementary planting or seeding
- additional erosion and sediment control measures
- reprofiling of land to improve stability or drainage.

7 Decommissioning

Decommissioning requirements for the Project are yet to be determined and will be finalised during operation and captured in a final Rehabilitation and Decommissioning Plan. Infrastructure would be assessed and the need to retain or remove determined based on desired final land use. A final Rehabilitation and Decommissioning Management Plan will be developed and submitted to the relevant authority 12 months prior to decommissioning occurring.

Currently, decommissioning procedures require the removal of all above ground infrastructure (including all scraper station plant and all pipeline valves and metering stations) and the restoration of associated disturbed areas.

7.1 Project components

7.1.1 Pipeline

At the time of decommissioning, a decision will be made regarding the opportunities for future use of the pipeline. The following two options will be considered:

- Mothballing – this would involve depressurising the pipeline, capping and filling with an inert gas (such as nitrogen) or water with corrosion inhibiting chemicals. The cathodic protection would be maintained to prevent the pipe corroding, or
- Abandonment – this could involve purging the pipe of natural gas, disconnecting it from the manifolds and NQGP, and removing all above ground facilities. The pipe would then be filled with water and left to corrode in-situ. Removing the pipe from the ground is unlikely to be an environmentally or commercially viable option. A detailed rehabilitation management plan (RMP) would be developed and implemented in consultation with landholders and the regulatory agencies at the time of abandonment. The location of pipelines that will remain in-situ will be recorded in an abandoned services register.

7.1.2 Access tracks

All building foundations and access tracks would be removed and rehabilitated (dependent on agreements made with relevant landholders).

7.1.3 Hardstand areas

Hardstand areas will be removed and the ground rehabilitated. Topsoil would be layered and compacted to match the density and consistency of the immediate surrounding area.

7.1.4 Excavated areas

Any excavated areas will be backfilled with clean material and covered with a layer of topsoil and contoured to match the surrounding area. These areas will then be seeded with native species consistent with the region and desired land use.

7.1.5 Buildings and structures

If buildings and structures are not required for final land use, then structures will be demolished and removed following standard practices. Areas will then be rehabilitated consistent with hardstand areas.

8 Compliance

8.1 Delegation of authority

QPM will be responsible for the construction of the Project and will manage the main construction contractor. QPM, the principal contractor and all site personnel will be responsible for implementation of measures in this draft Rehabilitation Strategy.

The personnel outlined in Table 8.1 will be accountable for implementation.

Table 8.1 Responsible personnel

Role	Responsibilities
Project manager	• Handover of design requirements to Construction Manager. • Ongoing accountability for Project delivery. • Managing construction work and managing Project personnel listed below.
Construction manager	• Managing construction work of the Project. • Approval of the final VMP. • Approval of design changes and obtaining any required planning approvals. • Reporting and responding to incidents on site. • Ensuring the environmental performance during the construction phase.
Environmental manager	• Reviewing the VMP and ensuring management and mitigation methods are carried out accordingly. • Delivering site inductions. • Conducting environmental audits. • Monitoring implementation of environmental controls. • Reporting and responding to incidents on site. • Ensuring all appropriate permits are in place (e.g. Critically Endangered, Endangered, Vulnerable and Near Threatened (CEEVNT) flora clearing permit).
Traditional owner	• Cultural Heritage Survey prior to and following clearing. • Identification, documentation and relocation of artefacts. • Identification, documentation and relocation of culturally significant flora.
Suitably qualified ecologist	• Co-ordinate and lead pre-clearance surveys to identify CEEVNT flora, animal breeding places and introduced flora.
Site personnel	• Reporting incidents, emergencies or other environmental incidents to the Environmental Manager and Construction Manager. • Understand environmental controls. • Conduct activities with environmental due diligence.

9 References

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EMM (2022b). QPM Energy Project. Matters of National Environmental Significance Report. Prepared for Queensland Pacific Metals, August 2022.

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Appendix L

Draft Construction Weed and Pest Management Plan

QUEENSLAND PACIFIC METALS

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Construction Weed and Pest Management Plan

QPM Energy Project

Prepared for Queensland Pacific Metals Pty Ltd

March 2023

Construction Weed and Pest Management Plan

QPM Energy Project

Queensland Pacific Metals Pty Ltd

E221165 RP1

March 2023

Version	Date	Prepared by	Approved by	Comments
1	21 February 2023	Anna McRae	Susan Lodge	
2	9 March 2023	Anna McRae	Susan Lodge	

Approved by

Susan Lodge
Environmental Consultant
9 March 2023

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Appendices

Tables

Figures

Abbreviations

The following abbreviations are used in this report:

Abbreviations used in this report

Abbreviation	Term
AHD	Australian Height Datum
BS Act	*Biosecurity Act 2014*
CEMP	Construction Environment Management Plan
CWPMP	Construction Weed and Pest Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
EMM	EMM Consulting Pty Ltd
EP Act	*Environmental Protection Act 1994*
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
EPC	Engineering, procurement and construction
EVNT	Endangered, vulnerable or near threatened
FMP	Fauna Management Plan
GCF	Gas Compression Facility
ha	Hectare
HVR	High value regrowth
km	Kilometres
LGA	Local government area
m	Metres
NC Act	*Nature Conservation Act 1992*
NQGP	North Queensland Gas Pipeline
QPM	Queensland Pacific Metal Pty Ltd
RE	Regional ecosystems
ROW	Right of way
SMP	Species Management Program
SEVT	Semi-evergreen vine thicket
TEC	Threatened ecological communities
TECH	Townsville Energy Chemicals Hub
VM Act	*Vegetation Management Act 1999*
VMP	Vegetation Management Plan

Abbreviations used in this report

Abbreviation	Term
WONS	Weeds of National Significance

1 Introduction

1.1 Background

Queensland Pacific Metals (QPM) Energy is the proponent of the QPM Energy Project (the Project). The Project involves the design, construction, and operation of a gas compression facility (GCF) and a high-pressure pipeline that links the proposed GCF to the nearby existing and operational North Queensland Gas Pipeline (NQGP).

The Project proposes to collect waste coal mine gas at the proposed GCF via waste gathering lines from existing adjacent mines. At the GCF, waste coal mine gas will be dehydrated and filtered, with the remaining clean gas then compressed and transported via high-pressure pipeline to the existing and operational NQGP. The NQGP will then transport the compressed gas north to Townsville, where it will be depressurised and distributed, by a third party, to industrial users, including QPM's Townsville Energy Chemicals Hub (TECH) Project.

EMM Consulting Pty Limited (EMM) has been commissioned to undertake ecological assessments for the Project including the identification of environmental matters prescribed at Commonwealth and State levels across the Project area and associated impact assessments. EMM has been working with QPM Energy and has contributed to the Project design including identification of appropriate mitigation measures to reduce environmental impacts and maximise beneficial environmental outcomes.

1.2 Purpose of this report

The purpose of the Construction Weed and Pest Management Plan (CWPMP) is to:

- detail how the management of activities associated with construction on site will prevent the spread of weeds and pests
- ensure that this site and activity specific management process is in place so control measures are monitored and that any issues are appropriately reported and addressed through a corrective action feedback system, and
- meet the requirements of the relevant Commonwealth, Queensland and Local Government regulations and approvals.

1.3 Project details

1.3.1 Subject site, premises, and Project area

The Project is proposed 43 km north of Moranbah, a coal mining town and locality within the Isaac Regional Council local government area (LGA).

The region is heavily disturbed with extensive mining (both open cut and underground) and grazing activities throughout.

The proposed high-pressure pipeline is situated over two properties, comprising the following lot/plans:

- Lot 23 on SP262530, herein named Lot 23 (Denham Park)
- Lot 11 on SP262530, herein named Lot 11 (Denham Park)
- Lot 2 on SP214117, herein named Lot 2 (Dabin Station).

The high-pressure pipeline also crosses (via underboring, with no surface impacts):

- Lot 100 on SP235905 (operational railway, Goonyella System)
- the Sunwater Moranbah and Eungella pipelines.

The Project area also includes a 40 m buffer from the proposed high-pressure pipeline corridor which is 30 m in width (total width surveyed along the alignment is 110 m). This buffer also intersects a small portion of Lot 14 on CP846391 (Burton Downs), herein named Lot 14, as well as Lots 23, 11 and 2.

The proposed GCF and access road are located on Lot 2, and is also buffered by 40 m, for the purpose of the ecological assessment.

Additionally, a 20 km buffer from the project area has been applied and is referred to as the study area.
The project area is shown on Figure 1.1.

For the purpose of this report, the following definitions are used:

- Project footprint – the location of the proposed pipeline, GCF and ancillary facilities and the area which will be directly disturbed by the project.
- Project area – is the project footprint within a 40 m buffer from the pipeline corridor, GCF and access track.
- Study area – 20 km buffer from the project footprint.

1.3.2 Project components

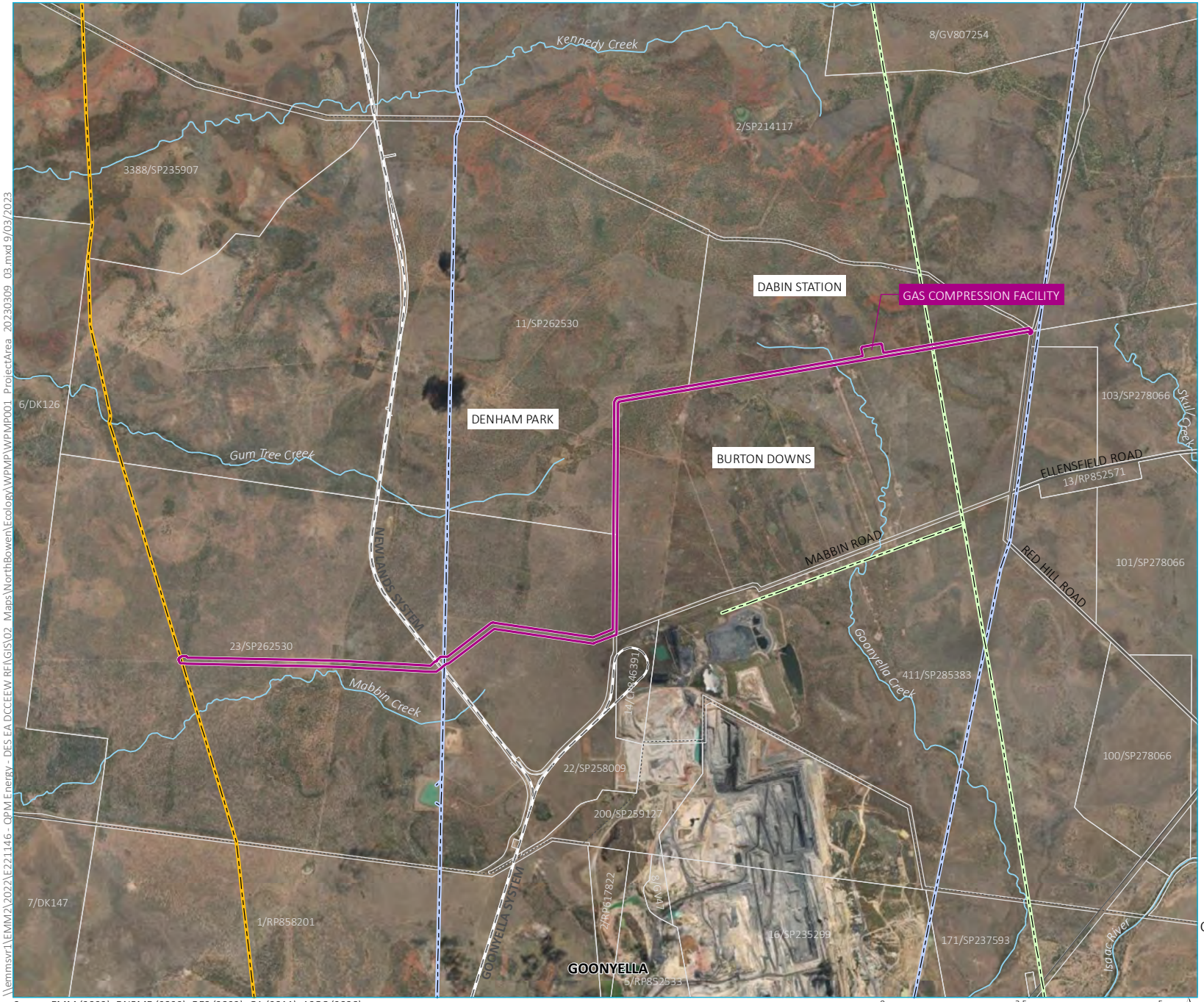
Table 1.1 describes the key components of the Project.

Table 1.1 Project components

Component	Description
Gas Compression Facility	• Captures and converts waste coal mine gas to clean gas. • Proposed to be located at Dabin Station on the southern boundary of Lot 2 SP214117 and 2.7 km west of the Red Hill Road reserve. • Sited on a 200 m by 300 m area. • 6 ha disturbance footprint.
High-pressure pipeline	• High-pressure pipeline to transport clean gas from the GCF to the NQGP. • 16.8 km in length, running along cleared areas, fence lines and fire breaks along property boundaries. • During construction, a 30 m wide construction right of way (disturbance area of 51 ha). • During operations, a 15 m wide operating easement (disturbance area of 25 ha) from 3.2 km from the GCF.
Access road	• Road to provide all-weather access to the GCF from Red Hill Road reserve. • 2.8 km long and 30 m wide. • 8 ha disturbance footprint

The Project is defined by limits which include:

- road connection to Red Hill Road
- GCF inlet flange/s at the facility from gas gathering systems on adjacent mining tenures
- connection to the NQGP (via hot tap)
- GCF clean water pipeline flange at the facility returning water to the relevant existing mine water management systems
- rainfall run-off from an on-site settling basin
- high-pressure pipeline easements (30 m wide Right of Way (ROW)) during construction and reduced to 15 m ROW during operations from 3.2 km from the GCF boundary).



KEY

- Project area
- Electrical transmission line
- North Queensland Gas Pipeline
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Named watercourse
- Cadastral boundary

INSET KEY

- Main road
- National park
- State forest

Project area

QPM Energy Project
Construction Weed and Pest Management Plan
Figure 1.1

\\emmsvr1\EMM2\2022\E221146 - QPM Energy - DES EA DCCEEW RFI\GIS\02 Maps\NorthBowen\Ecology\WPMP\WPMP001 ProjectArea 20230309 03.mxd 9/03/2023

Source: EMM (2023); DNRME (2022); DES (2022); GA (2011); ASGC (2006)

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GDA 1994 MGA Zone 55

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2 Legislation

Primary approvals for the Project are being sought under the EPBC Act and the *Environmental Protection Act 1994* (EP Act). These approval processes are being progressed concurrently.

A summary of the key legislation, policies and guidelines that have informed the design and implementation of field ecology surveys and impact assessments is provided in the following sections.

2.1 Commonwealth

2.1.1 *Environment Protection and Biodiversity Conservation Act* 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places — defined in the EPBC Act as matters of national environmental significance (MNES).

There are known MNES within the Project area. A referral to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (EPBC2022/09329) was lodged in October 2022. The Project was determined to be a controlled action and for assessment via the preliminary documentation pathway.

2.1.2 EPBC Act Environmental Offsets Policy

Environmental offsets are required to be delivered in accordance with the EPBC Act Environmental Offsets Policy (DoEE 2012). The Environmental Offsets Policy outlines the Australian Government's approach to the use of environmental offsets ('offsets') under the EPBC Act. Offsets are defined as measures that compensate for the residual adverse impacts of an action on the environment. Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act (DoEE 2012).

Avoidance and mitigation measures are the primary strategies for managing the potential significant impact of a proposed action. Offsets do not reduce the likely impacts of a proposed action, but instead compensate for any residual significant impact. Where significant impacts are found to occur to MNES, and environmental offsets are required, an offsets package should be provided. An offsets package is a suite of actions that a proponent undertakes in order to compensate for the residual significant impacts to the identified MNES. It can comprise a combination of direct offsets and other compensatory measures.

Offsets should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain (DoEE 2012). To support any offset assessments that may be required, it will be important to evaluate the specific MNES attributes that occur within the proposed disturbance area (e.g. whether foraging habitat or breeding habitat) and the habitat quality of mapped habitat areas. This information is required to inform offset calculations.

2.2 State

2.2.1 Nature Conservation Act 1992

The objective of the *Nature Conservation Act 1992* (NC Act) is the conservation of nature and the NC Act provides for the gazettal of protected areas including nature refuges, prescribes classes of wildlife and sets out restrictions on the taking or harm to native wildlife without a valid permit. As part of the MNES impact assessment (EMM 2021a), threatened flora and fauna species have been assessed in terms of those with potential to occur in the Project area, and habitat mapping prepared.

For a proposed activity that will have an unavoidable impact on breeding places of protected animals (which include all classes of native wildlife including least concern), a Species Management Program (SMP) is required to be prepared and approved by the Department of Environment and Science (DES).

The seasonal terrestrial ecology surveys have included habitat assessments and identification of animal breeding places. This information will be used at a later date to support the preparation of an SMP as required.

2.2.2 Biosecurity Act 2014

The *Biosecurity Act 2014* (BS Act) provides a legislative framework to manage pest flora and fauna, diseases and environmental contaminants, to address the impacts they have on the economy, environment, agriculture, tourism and society.

The Act prohibits or restricts the introduction and spread of declared plant and animal pests within Queensland.

Field ecology surveys identified the presence of pest plants and animals within the Project area.

The BS Act defines an invasive plant (or weed) as:

- a plant species that has, or is likely to have, an adverse impact on a biosecurity consideration because of the introduction, spread or increase in population size of the species in an area
- includes a plant species that is prohibited matter or restricted matter.

Prohibited weeds are a biosecurity matter that are not present in Queensland and would seriously threaten Queensland's agricultural industries, natural environment and human health. Restricted weeds are a biosecurity matter found in Queensland that has a significant impact on human health, social amenity, the economy or the environment. Restricted matter includes weed species. Specific actions are required to limit the spread and impact of this matter by reducing, controlling or containing it (DAF 2016).

This report uses the above definitions to identify weed species.

There are seven categories of restricted matter under the BS Act. The specific restriction requirements also apply to a person when dealing with restricted invasive plants unless they have a restricted matter permit (Business Queensland 2021). Categories 2 to 5 related to restricted weeds, and are defined as follows:

- Category 2 – the invasive plant must be reported within 24 hours to Biosecurity Queensland on 13 25 23.
- Category 3 – the invasive plant must not be distributed either by sale or gift, or released into the environment.
- Category 4 – the invasive plant must not be moved.
- Category 5 – the invasive plant must not be kept (Business Queensland 2021).

The *Australian Weeds Strategy* (Invasive Plants and Animals Committee 2017) outlines 32 introduced plants as Weeds of National Significance (WONS). WONS are identified as a priority current and future threat to Australia, and require strategic management to prevent, eradicate and/or minimise its impacts (Invasive Plants and Animals Committee 2017).

2.2.3 Vegetation Management Act 1999

The purpose of the *Vegetation Management Act 1999* (VM Act) is to regulate the clearing of native vegetation in a way that conserves remnant vegetation in declared areas, ensures clearing does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes.

Under the VM Act regional ecosystems (Res) are assigned one of three statuses which are:

- Endangered RE
- Of Concern RE
- Least Concern RE.

These statuses are taken from the RE description database, and respective definitions are provided in the Act. Within this report, the definition of an RE follows that described by Sattler and Williams (1999) i.e. “a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil”. Both VM Act status and biodiversity status of REs have been included.

3 Existing environment and ecological values

An initial walkover of the Project area was undertaken between 6–9 December 2021 by Sandra Walters and supported by Daniel Kelly. The walkover included general habitat assessments, incidental threatened flora, and fauna searches.

The second round of field surveying occurred between 7–12 March 2022, led by Sandra Walters and Andrew Jensen and supported by Daniel Kelly and Elliot Leach. The March survey represents a late wet season/autumn seasonal survey for the Brigalow Belt bioregion under the 'Terrestrial Vertebrate Fauna Survey Guidelines for Queensland' (Eyre et al. 2018). This coincides with an active period for fauna including dispersal and migration of many species. It is also more likely to be moist from summer rainfalls, than during the spring to early summer period, and overlaps with grass reproduction and propagation, which is important for granivores.

Further surveying was completed between 28 June – 1 July 2022, led by Sandra Walters and supported by Elliot Leach. These surveys focussed on verification of regional ecosystems present, potential for threatened ecological communities (TEC) and species habitat mapping.

A final field survey was completed by a team of two EMM ecologists, led by Elliot Leach and supported by Rachel Scott between 21–24 November 2022 on Lot 11 and Lot 2, to undertake spotlighting for MNES species potentially present, particularly Koala, Greater Glider and Ornamental Snake.

A summary of the flora survey methods and results are outlined in the MNES Preliminary Documentation (EMM 2023), and key findings are detailed below.

3.1 Project area values

The Project area is in the Brigalow Belt North Bioregion and Northern Bowen Basin sub-region. Surface elevations across the Project area range from approximately 290 m Australian Height Datum (AHD) at the high-pressure pipeline entry to the NQGP to approximately 330 m AHD at Red Hill Bluff, 2 km west of the GCF. Generally, the terrain is flat open grazing country.

The Project area is divided by the Burdekin Basin and Fitzroy Basin. The western part of the alignment is in the Burdekin Basin catchment and generally drains into the Suttor River and heads north. The eastern part of the alignment is in the Fitzroy Basin catchment and drains into the Isaac River.

The buried high-pressure pipeline alignment crosses Goonyella Creek which is a stream order 1 watercourse. Within the Project area, Goonyella Creek is an ephemeral drainage feature with no discernible banks.

Habitats with ground cover, a shrub layer which occasionally cleared and pockets of large trees provide a more complex structure. These habitats offer denning or shelter sites in leaf litter, foliage, under exfoliating bark or in tree hollows. Additional habitat complexity is provided by the presence of ground dwelling plants, open bare areas, fallen logs and branches that provide sheltering opportunity for terrestrial species.

The community assemblage is also driven by the availability and variety of resources (such as food, water and breeding opportunities). Habitats with abundant and variable resources tend to support a greater species diversity. Additionally, certain species are driven by the presence or absence of preferred dietary items (e.g. Painted Honeyeater and mistletoe). Habitat usage can be extremely variable and driven by seasonal conditions or in response to a specific event such as recent rainfall or mass flowering events.

Generally, the site is heavily disturbed by current and historical land uses including livestock grazing and mining. The site is predominantly non-remnant with minor areas of remnant vegetation. Pre-clear vegetation consisted primarily of brigalow woodland, which has been broadscale cleared and seeded with the exotic pasture species, Buffel Grass.

Despite disturbance, the high-pressure pipeline alignment on Lot 23 contains an abundance of Gilgai habitat which transforms rapidly to freshwater wetlands after heavy, typically seasonal rain. These short-lived wetlands provide suitable habitat for a range of species that are difficult to detect when conditions are dry (e.g. burrowing frogs and ornamental snake).

General habitat assessments were completed across the Project area. Specific habitat attributes were analysed at each site to confirm suitable habitat features for particular endangered, vulnerable or near threatened (EVNT) species and provide justification for the potential presence or absence of a species due to the presence or absence of suitable microhabitats.

Most habitat observed across the survey area is considered of relative low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and proximity of mining operations. Remaining vegetation in the survey area is largely fragmented with useful habitat limited in extent.

The majority of the Project area on Lot 23 is characterised by Brigalow regrowth with Buffel Grass understorey, with the exception of one region of remnant Brigalow. On Lot 11, vegetation is correctly mapped as predominantly non-remnant, with one area of remnant RE 11.5.3. Significant RE mapping errors are present on Lot 2. The majority of vegetation is mapped as remnant or High Value Regrowth SEVT REs 11.5.15 or 11.8.13, which are not present. The actual vegetation present is predominantly Brigalow regrowth which has retained remnant status, but is heavily degraded with Buffel Grass in the understorey, and dense areas of Parthenium weed at the eastern end.

Due to the highly disturbed nature of the Project area a number of weed species were recorded. Open (non-remnant) areas were dominated by groundcover weeds, primarily Parthenium (*Parthenium hysterophorus*) and Buffel Grass (*Cenchrus ciliaris*). Additionally, Harrisia Cactus (*Harrisia martini/Harrisia toruosa*) and Prickly Pear (*Opuntia sp*) were recorded at a number of locations in the Project area.

Parthenium is a category 3 restricted invasive plant under the *Biosecurity Act 2014*, and was recorded on all subject Lots within the Project area. It is particularly dense in the black soil sections of Lot 23 (Denham Park Station) and Lot 2 (Dabin Station). It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). Parthenium is also a WoNS at Commonwealth level.

Harrisia Cactus and Prickly Pear are also category 3 restricted invasive plants under the *Biosecurity Act 2014*, and was recorded at widespread locations throughout the Project area albeit not in high densities. Prickly Pear is also a WoNS at Commonwealth level.

Additionally, although not recorded in the Project area, Rat's tail grasses (particularly Giant Rat's Tail Grass – *Sporobolus pyramidalis/S. natalensis* are identified as a high risk species for invasion of the Project area which can reduce pasture productivity and cause significant degradation of natural areas. Other high risk species for establishment include Fireweed (*Senecio madagascarensis*).

A full list of exotic or naturalised flora species recorded during the quaternary assessments completed for the Project is provided in Table 3.1.

Table 3.1 Weed species recorded

Species	WONS	Biosecurity Act category
Apophyllum_anomalum		
Bothriochloa_pertusa		
Bothriochloa_pertusa		
Cenchrus_ciliaris		
Chloris_gayana		
Chloris_inflata		
Chloris_virgata		
Conyza_bonariensis		
Harrisia_martinii		3
Harrisia_tortuosa		3
Leptochloa_divaricatissima		
Macroptilium_atropurpureum		
Malvastrum_americanum		
Maytenus_cunninghamii		
Megathyrsus maximus		
Melinis_minutiflora		
Melinis_repens		
Mimosa_pudica		
Opuntia_tomentosa	X	3
Parthenium_hysterophorus	X	3
Plantago sp		
Salsola_kali		
Stylosanthes scabra		
Urochloa_mosambicensis		

Care should be taken to ensure vehicle and machinery hygiene protocols are adopted, to prevent the spread of Parthenium and Rat's-tail grasses (*Sporobolus* sp) off-property and into areas that are clean of the species.

Four terrestrial vertebrate pest species were recorded within the Project area – the Cane Toad (*Rhinella marina*). Rabbit (*Oryctolagus cuniculus*), Common Myna (*Acridotheres tristis*) and Brown Hare (*Lepus europaeus*). Wild Dog (*Canis lupus familiaris*) and Feral Cat (*Felis catus*) are both likely to occur along with a number of introduced bird species. Three of these species (Feral Cat, Rabbit and Wild Dog) are listed as 'restricted matters' under the *Biosecurity Act 2014*.

4 Potential Impacts

4.1 Construction

The Construction Environment Management Plan (CEMP) outlines the general construction activities that will be completed to execute this Project. Higher risk activities have been identified below and have been used to determine the potential impacts and control measures to mitigate the risk of weed and pest introduction and spread.

- site clearing and vegetation removal
- mobilisation to site
- materials delivery
- vehicle movements
- bulk earthworks and soil movement
- waste generation, storage and removal
- pipeline infrastructure works.

The following potential direct and indirect impacts have been identified as a result from the above 'higher risk' construction activities:

- Site clearing and vegetation removal may create new access points into areas of intact vegetation may create pathways for feral fauna species to disperse.
- Materials brought onto the site may contain foreign seeds and plant material, which could introduce new weed species to the area.
- Soil movement and bulk earthworks have the potential to cause both introduction and spread of new weed species during construction works.
- Increase of weed species density due to traffic movement to and from site.
- Existing habitat degradation from invasive species and inappropriate fire regimes.
- Increased vehicle movements and opening up areas of remnant vegetation from clearing for infrastructure may increase in numbers of pest animals and weeds.
- Uncontrolled spread of pest flora abundance may have adverse impacts on native vegetation and biodiversity, as well as potential negative economic effects on local land uses such as grazing activities.
- Inappropriate storage or irregular removal of wastes generated on site from construction activities may attract feral fauna, such as Wild Dogs.
- Creation of artificial water sources during construction works may increase the capacity of the area to support feral species such as Cane Toads.

4.2 Weed and pests

Project activities have the potential to increase the abundance of pest flora in the Project area and facilitate dispersal of species to previously unimpacted areas. For linear projects such as pipelines across multiple properties, varying level of weed infestation can be a significant issue.

Uncontrolled movement of vehicles, equipment and personnel throughout the Project area is the key vector of transmission, in particular vehicles and equipment sourced from regions beyond the Project area which may introduce new species. Many weed species thrive on ground disturbance and will rapidly colonise disturbed areas in advance of native species recolonisation.

Pest and weeds may pose a significant threat to flora and fauna values adjacent to the Project area and the productive capacity of adjacent agricultural and grazing lands. Much of the grazing lands already contains a proportion of introduced grass species designed to improve the grazing capacity of the land. Species such as Buffel Grass are a significant component. Weeds such as Prickly Pear (occasional plants) and Parthenium were encountered during the surveys.

Increased pest flora abundance has adverse impacts on native vegetation and biodiversity, as well as potential negative economic effects on local land uses such as grazing activities.

Project related activities may also increase pest fauna abundance in the Project area. This can lead to increased competition with, and predation of native fauna. In addition, habitat degradation may occur through vegetation trampling. Creation of new access points into areas of intact vegetation may create pathways for feral fauna species to disperse. In addition, the creation of artificial water sources may increase the capacity of the area to support feral species such as Cane Toads. Uncontained waste sources may also attract feral fauna such as Wild Dog.

5 Impact avoidance and minimisation

5.1 Avoidance and minimisation

During early stages of Project design, and following ecological surveys of the Project area, QPM has sought to avoid and minimise ecological constraints wherever practicable. As previously alluded to in Section 3.1, the Project area is heavily disturbed by current and past land use with vegetation being predominantly non remnant with minor areas of remnant vegetation.

- Vegetation clearing will be limited to those areas required for earthworks and construction of the Project. Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated as part of the construction process. Rehabilitation will be detailed in a final Vegetation Management Plan (VMP) to be prepared prior to commissioning of the Project.

- The approved disturbance area will be clearly demarcated prior to clearing to avoid unnecessary clearing of vegetation and to ensure personnel and vehicles stay within the approved footprint. Measures to ensure clearing limits are adhered to will be documented in the CEMP and addressed in site inductions.

- Clearing limits will be clearly demarcated on site, including through use of temporary fencing (e.g. flagging tape to mark out areas or plastic mesh fencing installed with star pickets) to avoid unintentional access to retained sensitive environmental areas.

- Access points have been identified and are limited to approved access roads and tracks.

5.2 Fragmentation

- Implement weed and pest control across the Project area to reduce degradation of habitats and edge effects as a result of the Project.

- Retained vegetation will be maintained following a site VMP to reduce hazards from fire, pest species, degradation and other potential impacts. This will assist in maintaining the integrity of the vegetation as habitat and reduce disturbance to surrounding habitat. The Project VMP will be developed prior to construction and include the following components.

5.2.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- All areas of fencing during construction will be inspected as part of regular worksite inspections. Areas of higher risk exclusion fencing will be inspected at least weekly. Corrective actions include:

    - repair of any fencing found to be in poor condition or broken.

5.3 Weeds and pests

The following measures will be implemented to mitigate and manage impacts from weeds and pest animals as much as practicable during the construction phase:

- A final Weed and Pest Management Plan will be developed for the Project with specific advice for key identified species. The plan will include management of weed spread, management of pest infestations, and monitoring effectiveness of control measures. The Project area is currently subject to high-levels of weed infestation and, as such, focus is to avoid further impacting the quality of retained areas of habitat along the riparian corridors. This plan forms a draft plan, but specific measures will be provided after detailed design and based upon engineering, procurement and construction (EPC) contractor's work method statements. Control methods will be consistent with the guidance provided in Appendix A.

- All vehicles and machinery are to be washed down prior to entering the site and when working within a known contaminated area within the site, prior to exiting the contaminated area. Clean and dirty zones should be established to facilitate this aim. No-go zones should be marked with temporary fencing and reviewed weekly.

- Vehicle access will be restricted to existing roads and tracks where practicable to minimise spread of weeds and damage to native vegetation. Where vehicles are to cross vegetated ground, they should seek to avoid priority weed species. Priority weed locations will be shown on Project maps and used during clearing works.

- Parthenium weed (*Parthenium hysterophorus*) is abundant along the pipeline alignment, especially at the eastern end near Red Hill Road. This is a declared pest under the Biosecurity Act (QLD) so weed spray out programs and hygiene protocols will need to ensure it is not spread. It is also common on Denham Park.

- Hygiene protocols will be implemented to reduce the potential for introduction or spread of weeds. Measures will include:

    - Hygiene checks will focus on ensuring no weed plant material/seed/mud/soil material enters the site (or leaves known infestation areas within the site), with all machinery, vehicles and equipment requiring cleanliness certification. Footwear will be cleaned prior to entering the site, and when working within a known contaminated area within the site, prior to exiting the contaminated area.

    - Onsite waste disposal (especially food waste) to discourage presence of pest fauna. Waste will be stored in covered bins/skips to prevent fauna access.

    - Weeds will be identified during pre-clearing surveys, in particular, any large infestations within proposed disturbance areas. Spray-out programs will be undertaken on a regular planned basis. Clean and dirty zones should be demarcated on site to facilitate weed management.

    - Any materials brought into site (such as gravel) will be certified as weed and disease free.

    - Any herbicides used on site must be dispensed by an appropriately trained and qualified weed sprayer.

    - Access into retained areas of habitat during construction will be limited and monitoring of weeds in these areas in place.

5.3.1 Proposed monitoring and corrective actions

The following monitoring will be undertaken to verify the implementation of the above management and mitigation actions:

- Record weed species during pre-clearance surveys, and confirm any large infestations required for treatment prior to clearing. Corrective actions include:
  - Weed control via a weed spray-out program to be coordinated with the Station lessee.
  - Weed control methods to be adjusted if current techniques are not proving effective.
  - Check that vehicle are clean and in accordance with certification documents on site entry. Reject uncertified and unclean vehicles entering the site.
  - Increase hygiene protocol requirements if vehicles or equipment are found to introduce new weeds.
- Check material being brought into site such as gravel is weed and disease free:
  - Increase hygiene protocol requirements if vehicles or equipment are found to introduce new weeds.

The following performance criteria shall be met:

- New weed outbreaks are prevented or potential outbreaks are identified and managed at an early stage.
- Weeds will not be spread to areas which are 'weed free'.
- No introduction of new weed species to the site and neighbouring areas.
- The weed load along existing problematic project areas such as the Access Road to the GCF will be treated to reduce the weed population to negligible level.

5.4 Rehabilitation

The following measures will be implemented to facilitate rehabilitation within the Project area:

- Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated to as soon as practicable following construction.
- Restoration and revegetation will be detailed in a VMP to be prepared prior to commissioning of the Project. Methods for habitat restoration, will also be described which may include soil stabilisation, direct seeding, managing natural regeneration and weed management.
- Woody debris, logs and rocks will be retained for use in rehabilitation.
- Where seeding and/or revegetation is required select plant species that are found in similar adjacent habitat on site. This may include use of an inert initial colonisation species to assist in groundcover and stabilisation.
- The rehabilitation and closure strategy will be detailed in detailed design. The purpose of the strategy is to:
  - identify potential rehabilitation risks associated with the Project
  - set rehabilitation objectives, indicators and performance criteria for rehabilitation activities

- provide a methodology for achieving rehabilitation objectives, with a focus on safety, non-polluting, not causing environmental harm and land stability

- ensure that environmental impacts are managed and rehabilitated appropriately.

In order to undertake all aspects of rehabilitation, decommissioning of infrastructure is likely to be required. This includes the de-mobilisation and removal of buildings, plant and equipment and hard stand areas. The buried pipeline would remain in place. A Rehabilitation and Decommissioning Management Plan will be developed and submitted to the relevant authority 12 months prior to decommissioning occurring.

6 Monitoring and reporting

Visual monitoring is used to validate the implementation and effectiveness of control measures. Weed monitoring records will be incorporated into a general Environmental Inspection Checklist, and include:

- Certificate of cleanliness for each vehicle entering site from Red Hill Road.
- Cleaning logs for vehicles/plant/equipment.
- Records of any weed control activities including date applied, herbicide used, application concentration, application rate, application method and contractor.
- Incoming material compliance certificates.

For each of the above records, the date, time, observation/s, location/s, action taken and who completed the record must be documented.

Any complaints, non-conformances and incidents relating to weed management will be recorded through the reporting system and associated documents set out in the CEMP.

Where a non-conformance with the Weed and Pest Management Plan has the potential to cause an unacceptable impact to the flora, fauna and/or habitat on the site and/or the area immediately surrounding it, this must be reported to the Project Manager as soon as reasonably practicable, or within 12 hours of occurrence so that corrective actions can be determined and the issue addressed immediately.

Corrective Action Triggers for corrective actions specific to the Weed and Pest Management Plan include:

- Vehicles do not submit a certificate of cleanliness.
- Vehicles are not appropriately cleaned.
- Cleaning logs are not completed.
- Materials, plant and/or equipment entering the site have not been certified or checked.
- Unauthorised entry into no-go zones.
- No-go zones are not appropriately fenced and/or signed.
- Increased weed load at seasonal monitoring locations.
- Weed spread is not identified and controlled.

The CEMP details the hierarchy of corrective actions which should be followed where non-conformances with controls in the Weed and Pest Management Plan are identified.

7 Compliance

7.1 Delegation of authority

QPM will be responsible for the construction of the Project and will manage the main construction contractor. QPM, the principal contractor and all site personnel will be responsible for implementation of measures in the CEMP and this management plan.

The personnel outlined in Table 7.1 will be accountable for implementation.

Table 7.1 Responsible personnel

Role	Responsibilities
Project Manager	• Handover of design requirements to Construction Manager. • Ongoing accountability of the Project delivery. • Managing construction work and managing Project personnel listed below.
Construction Manager	• Managing construction work of the Project. • Approval of the final Weed and Pest Management Plan. • Approval of design changes and obtaining any required planning approvals. • Reporting and responding to incidents on site. • Ensuring the environmental performance during the construction phase.
Environmental Manager	• Reviewing the Weed and Pest Management Plan and ensuring management and mitigation methods are carried out accordingly. • Delivering site inductions. • Conducting environmental audits. • Monitoring implementation of environmental controls. • Reporting and responding to incidents on site. • Ensuring all appropriate permits are in place including cleanliness certificates.
Suitably qualified ecologist	• Coordinate and lead pre-clearance surveys to identify EVNT flora and fauna, animal breeding places and introduced flora and fauna.
Site personnel	• Reporting incidents, emergencies or other environmental incidents to the Environmental Manager and Construction Manager. • Understand environmental controls. • Conduct activities with environmental due diligence.

7.2 Inductions and training

It is essential that all site personnel, including Managers, are aware of the ecological values within the Project area, the potential for environmental impacts to occur, and the management and mitigation measures that are to be followed to avoid, minimise, and mitigate impacts. The following training methods will be undertaken to ensure personnel are well trained and environmentally aware.

7.2.1 Environmental awareness induction

All site personnel will be required to attend an environmental awareness induction prior to arriving to site. The induction will cover the following aspects:

- Objectives of the CWPMP and associated environmental controls (including hygiene protocols).

- Briefing on weeds and pests and associated habitats within the Project area.
- Individual's and organisation's environmental obligations.
- Restricted and 'no-go' areas.
- Procedures for responding to environmental incidents and emergencies.
- Responsibilities for environmental monitoring and reporting.

7.2.2 Pre-start meetings

All site personnel will be briefed on environmental requirements, focusing on practical measures, during daily pre-start meetings. Pre-start meetings will cover the following aspects:

- Changed environmental conditions.
- Vegetation clearing demarcations.
- Any weed or pest species or sensitive habitats in proximity to the work area.
- Vehicle speed limits.

7.3 Incident management

An incident investigation procedure and reporting form will be developed by the construction contractor as part of the Project CEMP or CWPMP.

7.4 Emergency response

An Emergency Response Plan will be developed as part of the Project CEMP and will include measures around emergencies directly related to vegetation.

Appendix A
Weed and pest fact sheets

EMM
creating opportunities

Restricted invasive animal

European fox

Vulpes vulpes

The European fox was deliberately introduced into Australia for hunting purposes. Foxes quickly became established following releases in the 1870's in southern Victoria. Foxes colonised rapidly; by 1893, foxes were a nuisance in north-eastern Victoria and by 1930 they occupied most of southern Australia. Foxes are a major invasive species in Australia that threaten agricultural and native species alike.

The most common and widespread of the world's many fox species is the European fox. Foxes are a major invasive species in Australia that threaten agricultural and native species alike. Foxes have pointed muzzles, flattened slender skulls, large ears and long bushy tails. Adult male foxes weigh around 6 kg, while females weigh about 5 kg.

Queensland Government

Legal requirements

The European fox is a category 3, 4, 5 and 6 restricted invasive animal under the *Biosecurity Act 2014*. It must not be moved, kept, fed, given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive animals under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

The most common and widespread of the world's many fox species is the European fox.

Foxes are small, active canids with a reddish-brown coat above, with white underparts except for a black tipped nose and lower legs. It also has a large, very noticeable, bushy tail that is white tipped.

Depending on geographic location they can vary in size, as body length can range from 45 to 90cm, tail length from 30 to 55cm and body mass from 3 to 14kg. Usually adult male foxes weigh around 6 kg, while females weigh about 5 kg.

Diet

Foxes in Queensland are primarily carnivorous (meat-eating) scavengers and predators. However, foxes are opportunistic feeders and can consume an enormous variety of animal and plant material, such as rabbits, rodents, frogs, birds, insects and even fruit, vegetables and grain. This ability is key to the success of foxes to utilize a variety of habitats and climates in Australia. It also means that foxes can impact on a range of wildlife and agricultural species.

Fox predation is considered the greatest threat to the long-term survival of many small marsupial species in Australia. Long-term studies have shown that rock wallaby and malleefowl populations are probably regulated by fox predation.

Life cycle

Foxes breed once a year in winter with cubs born in spring. The fox's gestation period is 51–53 days. Cubs are generally born in burrows (dens) but litters have been found in hollow trees, rock crevices, under houses or in log piles. Litter size ranges from 4–10.

Foxes have generally been considered monogamous, communal denning as well as the presence of 'helpers' at the den has been recorded.

Australian studies suggest there are very few non-breeding females in fox populatons.

As a result, fox populations can withstand high yearly mortality rates (~65%) and recover to pre-control population levels. Recovery rates are dependent on immigration rates and breeding success.

Mortality of young foxes is generally high, with up to 80% dying in the first year. Poisoning, hunting, roadkills, disease, predation, food shortage and social factors contribute to mortality. Foxes in Australia have few natural predators, birds of prey and dogs in particular can kill foxes, particularly cubs.

Most foxes live less than four years, although eight-yearold foxes in the wild have been reported. Mange and distemper are thought to be important causes of mortality in wild fox populations; however, little is known about their role in regulating Australian fox populations.

Social behaviour

Foxes communicate by sound as well as by scent marking and body language. Young foxes use aggressive yapping and a resonant howl during the winter mating season. Vixens and pups will bark and whimper softly. Adult foxes also make vocalisations that can sound like screaming.

Habitat and distribution

Next to wild dogs, the fox is the largest land-dwelling carnivorous mammal in Australia. Foxes are well-adapted to a variety of different habitats, ranging from deserts to urban environments. However, foxes are not found in tropical Australia. Climatic preferences and food supply most likely determine their northern distribution.

Foxes generally disperse from where they were born in autumn at 6–9 months of age. Dispersal behaviour varies between males and females and between individuals of the same litter. Males typically disperse further than females and distances of 300 km have been recorded.

Faeces and urine are used to define territories by scent marking conspicuous landmarks like tussocks of grass and rabbit warrens. These scent marks are distributed throughout the fox's range, especially in places that are visited often.

Foxes are solitary hunters, but evidence suggests that fox family groups occupy well-defined home ranges. Family groups usually consist of a male and female fox with cubs, but non-breeding, subordinate females may also be present. Rural home ranges in Australia are about 500 ha; however, this can vary widely and depends on resource availability.

Foxes are most active from dusk till dawn and usually rest during the day in an earth den (often an enlarged rabbit burrow), thicket, hollow log or log pile. Foxes may also hunt and scavenge during the day.

Impacts

Predation on livestock

In some circumstances foxes may kill lambs and goat kids. Fox predation on healthy, viable lambs is generally less than 5%; however, this varies between properties. Individual 'rogue' foxes can cause high stock losses. Foxes

are noted for 'surplus killing' and can kill multiple easy prey animals despite an abundance of available food.

Foxes usually attack the throat of lambs and kids, although some are killed by multiple bites to the neck and back. Foxes do not have the size and strength to hold and immobilise large prey like adult sheep or goats, or to crush large bones; therefore, repeated bites may be required to subdue prey.

Foxes generally prefer large internal organs and begin feeding through an entry behind the ribs. However, some individuals develop certain preferences and can target the nose and tongue and may consume the head of small prey. Foxes are noted for carrying small carcases back to their dens to feed their young, which may account for some poultry, lambs and kids that disappear and are never found. Some food can also be cached, or buried or hidden elsewhere, for later consumption.

One way to distinguish fox attacks from wild dog attacks is that foxes rarely cause severe bone damage to stock. Poultry or other small prey can, however, be badly damaged through fox attacks.

Urban foxes

Both in Australia and overseas, foxes readily survive and prosper in urban environments. Fox densities in Melbourne are reported to be as high as 16 per km^2 compared to densities generally less than 2 per km^2 in most semi-arid grazing areas.

The distribution of urban foxes depends on the availability and distribution of suitable shelter and food. While foxes in urban areas are generally found in remnant bushland or parks, foxes can find refuge under railway platforms, houses or sheds, or in quiet gardens. Bushland areas in and around cities provide ideal shelter.

In urban areas, foxes eat a diversity of food types including small birds, worms, insects, fruit and pet or other food put out by residents.

Urban foxes will rarely attack people. However, any urban fox is a wild animal and should be treated as such.

Urban foxes can be a nuisance by:

- attacking poultry and livestock in people's yards
- raiding garbage bins scavenging for food
- digging holes in lawns while scavenging for food
- causing domestic dogs to bark
- defecating on lawns.

Disease threat

Foxes, along with other feral animals, have the potential to spread diseases such as rabies, should such diseases ever be introduced into Australia. They would also provide a reservoir of infection, making rabies almost impossible to eliminate.

Rabies is a contagious disease of virtually all mammals, including humans. Once symptoms of rabies appear, the virus is almost always fatal to both humans and animals.

This deadly virus is not established in Australia but is present in Asia.

We should not be complacent about the rabies issue. Foxes are capable of contracting and spreading rabies. In the Northern Hemisphere foxes are the principal vectors and victims of the disease. Overseas, millions of foxes have been culled or vaccinated in attempts to control the disease.

Control

Managing European foxes

The GBO requires a person to take reasonable and practical measures to minimise the biosecurity risks posed by foxes. This fact sheet provides information and some options for controlling foxes.

Current options available for control of foxes in Queensland include poisoning, trapping, shooting, guard animals and exclusion fencing. The choice of control method should suit the individual circumstances.

Exclusion fencing

Exclusion fencing for foxes is expensive. Fences must be well constructed and maintained due to the climbing agility of foxes and their ability to squeeze through small holes. As a result, fencing is most often used to protect high value stock, poultry or wildlife from fox predation in areas where other control methods cannot be used (i.e. in closely settled areas). Secure poultry runs and yards for small livestock should be considered in areas where foxes are a problem. Foxes can dig and climb so runs and yards need to be constructed with this in mind.

Trapping

Trapping is time consuming, labour intensive and generally ineffective for the broadscale reduction of fox populations. The success of trapping (using soft-catch traps and snares, not the illegal unmodified serrated steel-jawed traps) depends on the skill of the operator. Trapping is predominantly used in urban areas where poisoning and shooting are restricted, where there is high risk to native species, or for live-capture research purposes.

Shooting

Shooting of foxes is a highly selective and used in rural Australia. Fox shoots are normally carried out at night from a vehicle using a centrefire rifle (e.g. .223 calibre) with the aid a spotlight. Although the success of this method varies, depending on the shooter's marksmanship and the wariness of the foxes, the technique is still considered ineffective for broadscale or long-term reductions of fox populations. Furthermore, the practice is biased towards young unwary juveniles and may do little to reduce the impact of foxes on lambs or wildlife. Shooting is best done in addition to other control techniques.

Guard animals

Guard animals, primarily maremma dogs, and alpacas are used to protect sheep and goats from fox predation in numerous countries, including Australia. The effectiveness of guard animals in reducing fox predation on lambs and goat kids is primarily unknown. Consequently, guard animals should supplement rather than replace other control techniques until proven successful.

Although dogs have traditionally been used for guarding, alpacas have the added advantage of being herbivores and therefore do not require additional feeding. They are also less likely to wander and become problem animals themselves. This control technique is most suited to small properties on the urban fringe.

Poisoning

Presently there are three poisons legally available for fox control in Queensland—sodium fluoroacetate (1080) strychnine and para amino propiophenone (PAPP).

1080 and PAPP poison baits are economical and effective method of controlling foxes. Only authorised persons can supply 1080 or PAPP baits to landholders. PAPP is only supplied as a manufactured bait. 1080 comes in manufactured or fresh meat baits.

1080 baits are best be placed along track and fence lines 200–500 m apart, 8–10 cm underground and covered with loose soil. Burying baits has the advantages of reducing non-target bait take (more baits for foxes) and protecting baits from insect consumption (e.g. ants). All property neighbours should be notified at least 72 hours prior to baiting, and baiting signage should be erected at every property entrance and left for at least one month after baiting. Based on fox biology, the optimum time to bait is in Spring followed by June/July when food demand is highest (this coincides with lambing on many properties). Foxes are also often killed by 1080 baiting programs that are designed primarily to control wild dogs or feral pigs.

Ejectors are a new tool in the delivery of 1080. They require a fox or wild dog to pull the ejector head to be activated. This is done by attaching a lure reward to the ejector head. A capsule of lethal dose 1080 is burst into the foxes or the dog's mouth. Ejectors are fixed in one stop and are only able to be activated by foxes and dogs.

PAPP is a new poison and for advice on most effective way to use it consult your local government officer. Manufactured or meat baits can only be obtained through a person approved under the Health (Drugs & Poisons) Regulation 1996.

A Queensland Health permit is necessary to purchase strychnine. Baits can be selectively positioned or tethered to avoid access by native non-target species. This is particularly important in areas containing native carnivores such as quolls. A fox's keen sense of smell enables it to find baits intentionally buried or otherwise hidden.

To effectively reduce the short- and long-term impact of foxes, it is highly recommended that baiting activities be coordinated among adjoining properties. Baiting of individual properties will only provide short-term success due to the high mobility of foxes resulting in rapid re-invasion.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

This fact sheet is developed with funding support from the Land Protection Fund.

Restricted invasive animal

Feral cat

Felis catus

A descendant of the African wild cat (*Felis silvestris lybica*), the common 'house' cat (*Felis catus*) has now been domesticated for about 4000 years. Although the domestic cat has a long history of association with humans, it retains a strong hunting instinct and can easily revert to a wild (feral) state when abandoned or having strayed from a domestic situation.

Feral cats live around dump sites, alleys or abandoned buildings, relying on humans by scavenging rubbish scraps and sheltering in abandoned structures. The true feral cat does not rely on humans at all, obtaining its food and shelter from the natural environment.

Legal requirements

The feral cat is a category 3, 4 and 6 restricted invasive animal under the *Biosecurity Act 2014*. This is a cat that is not owned. The feral cat must not be moved, fed, given away, sold, or released into the environment.

The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive animals under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

Queensland Government

At a local level, each local government must have a biosecurity plan that covers invasive animals in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

The feral cat differs little in appearance from its domestic counterpart; however, when in good condition, the feral cat displays increased overall muscle development, especially noticeable around the head, neck and shoulders, which gives the animal a more robust appearance. The average body weight of male feral cats is 3–6 kg, while females weigh 2–4 kg. Body weights vary with condition, with some extremely large specimens documented.

Australian feral cats are predominantly short-haired, with coat colours that range between ginger, tabby, tortoiseshell, grey and black. White markings may be present on the feet, belly, chest and throat; completely white feral cats are extremely rare. In established populations, coat colours are the result of a natural, genetically selective process. Terrain, predators and the ability to capture prey limit coat colours to those that provide the most suitable camouflage and cause a predominance of these colours in subsequent offspring. Ginger cats are more likely to be found in the semi-arid and desert areas, while grey and black specimens generally predominate in scrub and more heavily timbered habitats.

The feral cat is most active at night, with peak hunting activity occurring soon after sunset and in the early hours before sunrise. At night the cat displays a distinctive green eyeshine under spotlight, making it easily distinguishable from other animals. During the day it will rest in any number of den sites, which may include hollow logs, dense clumps of grass, piles of debris, rabbit burrows, and even the hollow limbs of standing trees.

The most obvious and characteristic field signs of feral cats are their scats (droppings). Unlike the domestic cat, the feral cat does not bury its scats, but leaves them exposed at prominent sites to warn other cats of its territorial boundary.

Life cycle

Male cats attain sexual maturity at about 12 months, whereas females are capable of reproduction at approximately seven months. Annually, and under ideal conditions, an adult female can produce up to three litters—each of usually four kittens, but varying from two to seven.

As the breeding instinct is triggered by the increasing length of daylight, litters are less frequent in winter. Most reproduction occurs during the spring and summer months, and is generally limited to two litters per year. Birth follows a gestation period of 65 days, and kittens may be reared in a single den site or may be frequently shifted to other sites within the female's home range. Family and litter bonding begin to break down when the kittens are approximately seven months old. The female's ability to bear litters does not decrease with age, so reproduction continues for the course of her life.

Habitat and distribution

There is some evidence to suggest that the cat was present in Australia long before European settlement. This may have occurred as a result of Dutch shipwrecks and regular visits to northern Australia by early South-East Asian vessels as long as 500 years ago.

Post-settlement dispersal resulted from cats straying from areas of early colonisation. In the late 19th and early 20th centuries, large numbers of cats were purposely released in many rural areas to combat plague numbers of rabbits. Unwanted cats continue to be released into urban and rural areas by irresponsible pet owners.

The feral cat is now present Australia-wide, thriving under all climatic extremes and in vastly different types of terrain.

Feral cats maintain stable home ranges, the sizes of which depend upon the relative abundance of food and the availability of suitable den sites. Dominant male cats may have territories of up to 8 km^2, while the territories of females are smaller and may even be halved while kittens are being reared.

Scent glands are present on the chin, at the corners of the mouth, and in the anal region. Territorial boundaries are maintained by scent marking with the cheek glands, pole-clawing, urinating and leaving exposed faecal deposits.Although feral cats are often thought of as being solitary animals, studies show this behaviour is generally limited to hunting activities. At other times feral cats display a degree of social interaction that peaks during the breeding season. Group behaviour has been observed in wild populations, and it has been suggested that such behaviour is exhibited also in feral populations.

Groups usually comprise several related adult females, their young of both sexes, and an adult male—whose range may include other groups of females. Young females usually remain in a group, while young males either leave or are driven from the group as they reach sexual maturity.

Impacts

Effects on wildlife

The energy expended by an adult male cat requires it to consume 5–8% of its body weight in prey per day, while females raising kittens require 20%. Based on these figures, one study concluded that 375 feral cats on Macquarie Island would consume 56 000 rabbits and 58 000 sea birds per year. Where present on the mainland, rabbits may comprise up to 40% of a feral cat's diet. Cats are successful as a control mechanism only when rabbit densities are low. At other times cat predation does little to halt the build-up or spread of rabbit populations; rabbits merely help to support a larger number of cats. When seasonal shortages of rabbits occur there is a corresponding rise in the number of native animals taken by cats.

The feral cat is an opportunistic predator, and dietary studies have shown that small mammals, birds, reptiles, amphibians, insects and even fish can be taken as prey. Cat predation is particularly harmful in island situations, and a number of species have become extinct due to the introduction of cats by early sealers and lighthouse keepers. On the mainland, native animals—which already suffer due to the destruction of their habitats by man and other introduced animals—may be endangered further by cat predation. Actual competition for prey can cause a decline in the numbers of native predatory species such as quolls, eagles, hawks and reptiles. Not only do native animals bear the brunt of predation, but they also suffer the effects of a parasite that reproduces only in the intestine of the cat. This disease (toxoplasmosis) is particularly harmful to marsupials, which may develop blindness, respiratory disorders, paralysis, and suffer the loss of offspring through abortion and stillbirths.

Exotic disease—rabies

Due to their widespread distribution, feral cats may prove to be a major vector for this fatal viral disease if it ever enters Australia. Overseas studies have revealed that wounds inflicted by rabid cats are more dangerous than those caused by rabid dogs. While the bites of rabid dog are generally inflicted on the arms and legs, the cat attacks the head of its victim, biting and clawing viciously. These head and facial bites reduce the time taken for the virus to enter the central nervous system, lessening the chance of success from subsequent remedial treatment.

Control

Managing feral cats

The GBO requires a person to take reasonable and practical measures to minimise the biosecurity risks posed by feral cats. This fact sheet provides information and some options for controlling feral cats.

Exclusion fencing

Fencing is the only feasible method of control when special areas need protection from cats. Feral cats have been successfully prevented from climbing over netted fences that use an electrified wire mounted 15 cm from the top and 10 cm outward from the fence. Non-electrified fencing should incorporate a netted ceiling, or a curved overhang, which prevents the cat from climbing straight up and over the fence.

Trapping

Rubber-jawed, leg-hold traps (see below) can be laid in the same manner as they are laid for dingoes and foxes. Leg-hold traps can work well with true feral cats, which would normally avoid the live-capture box traps.

Ideal sites are those where territorial markers, such as faecal deposits and pole-clawing, are noticed. Tuna fish oil has shown some success as an attractant; however, feral cats seem more readily attracted to a site by some visual stimulus such as a bunch of bird feathers hung from a bush or stick.

Feral cats are easily trapped in wire ‘treadle-type’ box traps (see diagram at right). Attractants/lures may be of meat or fish and should be placed so that they cannot be reached through the wire and be retrieved by clawing.

A number of local governments hire cat traps for the purpose of removing stray and feral cats in urban situations.

Lures

Audible recorded lures for feral cats and other predators are available through a number of sources. These recordings mimic the distress call of a small animal and can be used to draw a predator to a bait or trap site.

Shooting

Night shooting is assisted by the cat’s distinctive, green eyeshine. Cats have been successfully attracted by the use of a fox whistle.

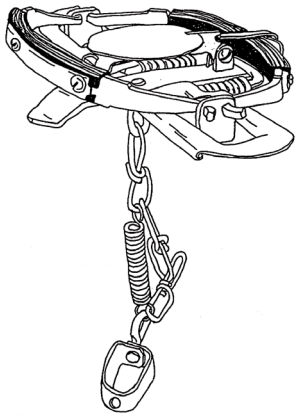
Poisoning

Fresh meat baits containing 1080 may be used for controlling feral cats under APVMA PERMIT14015. To obtain a copy of this permit visit apvma.gov.au.

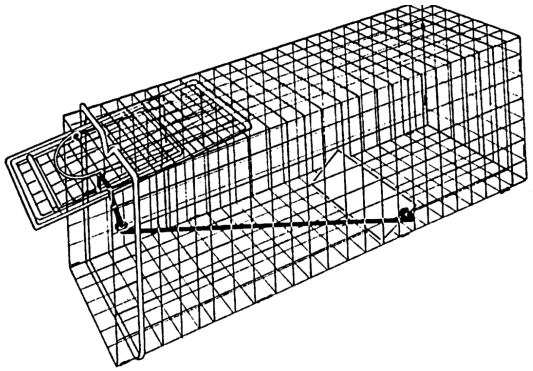
Only authorised persons can supply 1080 baits to landholders.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.



Rubber-jawed leg-hold trap



Treadle box trap