Australia Pacific LNG
Remediation, Rehabilitation, Recovery and Monitoring Plan

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A	01.06.11	Issued to DSEWPaC	KJ	AC	RU
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1. Introduction

1.1 Project Description

Australia Pacific LNG is the leading producer of coal seam gas (CSG) in Australia and holds the country's largest CSG reserves position. Australia Pacific LNG is proposing to develop a multi-billion dollar, world-class CSG to LNG export project in Queensland. Origin and ConocoPhillips are 50:50 joint venture partners in Australia Pacific LNG. Sinopec has agreed to subscribe for a 15% equity interest in Australia Pacific LNG. On completion of the transaction, Origin and ConocoPhillips' ownership interest will be reduced to 42.5% respectively. The 30 year Project has the following objectives:

- development of the Walloons Gas Fields (the Gas Fields) in the Surat Basin in southern central Queensland with up to 10,000 CSG wells
- construction and operation of an approximately 530km main gas transmission pipeline ('the gas pipeline') to connect the Walloons Gas Fields with the LNG facility near Laird Point, and
- construction and operation of a LNG facility near Laird Point on Curtis Island near Gladstone for production and export of approximately 18Mtpa of LNG.

Development of the Gas Field component of the Project will comprise:

- a maximum of 10,000 production wells over a 30-year timeframe
- drilling of wells and installation of associated well pad surface equipment, such as wellhead separators, wellhead pumps, wellhead flares, telemetry devices, and metering stations
- gas gathering lines (high density polyethylene (HDPE) pipe and steel pipes)
- gas processing facilities, which include flares, substations, and power lines
- high pressure gas pipelines connecting to lateral pipelines and ultimately the main gas pipeline to Gladstone
- field infrastructure such as access tracks, borrow pits, warehouses, camps (both construction and operations), offices, and telecommunications
- water gathering and water management infrastructure, such as water gathering lines, ponds, water treatment facilities, and saline effluent ponds, and
- use of treated associated water.

1.2 Purpose or Scope

This Remediation, Rehabilitation, Recovery, and Monitoring Plan (RRRMP) has been prepared to address State and Federal government approval conditions for the Australia Pacific LNG Project (APLNG) relating to rehabilitation activities within the Gas Fields.

The RRRMP specifically addresses conditions 15 to 19 of EPBC approval 2009/4974 issued by the Department of Sustainability, Environment, Water, Population, and Communities (DSEWPaC) on 21 February 2011. Detailed lists of all State and Federal government approval conditions that this RRRMP addresses are provided in Appendices B-E.

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Re-instatement and rehabilitation of disturbed areas is a regulatory requirement at the Federal and State level as part of environmental impact mitigation measures for the APLNG Project. Due to the different types of activities, disturbances and land uses across the Gas Fields there is a need for a diversified approach to rehabilitation. Each site and each location will require specific rehabilitation measures to ensure the land is returned to the pre-disturbance condition at the completion of the Project.

2. Definitions

In this document, the following definitions and abbreviations apply:

Term/Abbreviation	Meaning
CSG	Coal seam gas
Decommissioning	To withdraw something from active service. This typically involves the removal of project infrastructure on the completion of a project
DERM	Department of Environment and Resource Management (Queensland)
DEEDI	Department of Employment, Economic Development and Innovation
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
EA	Environmental Authority
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
Environment Group	Suitably qualified personnel within APLNG which advise on environmental operational issues and assurance measures
ESA(s)	Category A, B and C Environmentally Sensitive Areas as mapped by DERM and defined in the Draft Condabri Environmental Authority
EVNT	A species listed as endangered, vulnerable or near threatened under the NC Act or the EPBC Act
EP Act	*Environmental Protection Act 1994* (Queensland)
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GCL	Geosynthetic clay liner
GIS	Global Information System
GPF	Gas Processing Facility
GPS	Global Positioning System
GQAL	Good Quality Agricultural Land as defined by *Planning Guidelines: the Identification of Good Quality Agricultural Land.* (Queensland)
HDD	Horizontal Directional Drilling
HDPE	High density polyethylene
LP Act	*Land Protection (Land and Stock Route Management) Act 2002* (Queensland)
MNES	Matters of National Environmental Significance listed under the EPBC Act
NC Act	*Nature Conservation Act 1992* (Queensland)
Progressive Rehabilitation	The process by which disturbed areas are rehabilitated to their pre-disturbance land use with the same species and density of cover to that of surrounding undisturbed areas, as soon as practicable following the completion of any construction or operational works (*Based on DERM EA conditions*)
Protocol	Constraints Planning and Field Development Protocol
QGEOP	Queensland Government Environmental Offsets Policy
RE	Regional Ecosystem
Recovery	The process of protecting, conserving and managing a listed threatened species or a listed threatened ecological community (*EPBC Act definition*)
Regeneration	Vegetation that regenerates naturally (i.e. without the assistance of human intervention) from existing seed banks, suckering or coppice growth

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Rehabilitation	Means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with acceptance criteria set out in relevant environmental approvals and, where relevant, includes remediation of contaminated land (*DERM EA definition)*
Reinstatement	The process of bringing the construction earthen landscape back to the original profile of the surrounding environment, including the stabilisation of the site. This can include seeding with grasses to stabilise the site
Remediation	To take action to repair or mitigate damage that may or will be, or that has been, caused to a MNES or an EVNT listed species (*EPBC Act definition*) Remediation in reference to contaminated land, means: (a) rehabilitate the land; or (b) restore the land; or (c) take other action to prevent or minimise serious environmental harm being caused by the hazardous contaminant contaminating the land *(EP Act definition (Qld))*
Revegetation	The use of direct seeding or tubestock to support an area achieving the pre-clearance native vegetation or regional ecosystem
ROW(s)	Right of Way(s)
SEVT	Semi-evergreen vine thicket ecological communities, which are listed under the EPBC Act as the semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC
Supernatant	The liquid remaining after solids suspended in the liquid have been sedimented by gravity or by centrifugation
TEC	Threatened Ecological Community listed under the EPBC Act
TECMP	Threatened Ecological Community Management Plans
VM Act	*Vegetation Management Act (1999)* (Queensland)
WTF	Water Treatment Facility
WTS	Water Transfer Station

3. Scope

3.1 Geographical Extent

The Gas Fields component of the APLNG Project covers approximately 570,700ha within the Walloons Gas Fields of the Surat Basin. The Gas Fields are located in the three regional council areas of Maranoa, Toowoomba and Western Downs. The nearest townships are Roma, Wallumbilla, Wandoan, Miles, Condamine, Chinchilla, Kogan, and Millmerran (**Appendix A**).

3.2 Land Types and Uses

Grazing is the dominant land use throughout the Gas Fields area; however, in areas where more fertile soil is present and the use of machinery is not constrained, various forms of cropping are found. Forestry, nature conservation, resource extraction and urban activities are other land uses within the area.

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4. Commitments and Environmental Approval Conditions

4.1 Environmental Impact Statement Commitments

EIS commitments for the Gas Fields are set out in Chapter 6, Volume 1 of the APLNG EIS. EIS commitments relevant to rehabilitation are summarised in Appendix B.

4.2 Commonwealth Approval Conditions

The approval conditions issued under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) for the APLNG Gas Fields were issued by DSEWPaC on 21 February 2011 (EPBC 2009/4974). Conditions 15 to 19 of the approval set out the requirements for the proponent (Australia Pacific LNG) to develop a Remediation, Rehabilitation, Recovery and Monitoring Plan. These conditions are reproduced in Appendix C. Details of where the required contents of the RRRMP as per EPBC 2009/4974 are addressed are provided in Table 1.

The approvals under the EPBC Act relate to the pipelines according to the original EPBC referral. As such there are conditions that must be considered in regard to the portion of the main pipelines covered by the Gas Field's approval (EPBC 2009/4974), which are:

- Condabri Lateral excluding CKP23 to the Hub
- Woleebee Lateral excluding WKP46.5 to the Hub, and
- any additional pipelines constructed within the Gas Field area.

It is a DSEWPaC approval requirement (EPBC 2009/4974 Condition 83) that within five years of the commencement of gas field development; the proponent will develop a Decommissioning Plan. Decommissioning of infrastructure will be dealt with in the Decommissioning Plan and will only be addressed where relevant to the RRRMP.

Table 1 Details of where DSEWPaC Approval Conditions EPBC 2009/4974 are addressed

EPBC 2009/4974 Condition	Section of RRRMP where addressed
15a. Include site remediation measures including timeframes and standards for preventing erosion and stabilising disturbed soil in impact areas.	Erosion and sediment control addressed in Section 5.5 page 24 Stabilisation addressed in Section 5.4.6 page 22 and Section 5.6 page 26
15b. Include measures to support recovery of listed species' habitat and recovery of listed ecological communities affected by Gas Field development.	Listed ecological communities addressed in Section 8.1 page 63 Flora species addressed in Section 8.2 page 67 Fauna species addressed in Section 8.3 page 68
15c. Include responses to threats to MNES from the proponent's operational activities and land management activities including the disposal and use of associated water, damage by livestock, and impacts from feral animals and weeds.	Disposal and use of associated water addressed in Section 6.8 page 48 and Section 7.4.1 page 49 Damage by livestock addressed in Section 5.6.3 page 27 and Section 8.2.2 page 67 Feral animal control addressed in Section 5.10

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EPBC 2009/4974 Condition	Section of RRRMP where addressed
	page 31 Weeds addressed in Section 5.9 page 29
15d. Provide for fire prevention and management regimes during construction, operation and decommission of protected MNES.	Fire prevention and management regimes addressed in Section 5.11 page 32
15e. Include performance measures and related monitoring to assess site remediation, rehabilitation and recovery.	Success criteria provided in Section 9 page 73 Monitoring addressed in Section 10 page 84
15f. Provide for reporting on the implementation of the Remediation, Rehabilitation, Recovery and Monitoring Plan including monitoring and performance standard which can be independently audited.	Reporting requirements addressed in Section 10.3 page 95
15g. Reference relevant conservation advice, recovery plans, species management plans, or policies, practices, standards or guidelines endorsed or approved from time to time by the Department.	Referenced in Section 8.1 - 8.3 page 63-68
17. The proponent must establish a program to routinely review the Remediation, Recovery and Monitoring Plan by an independent qualified ecologist, or other experts, approved by the Department to take into account any new information available to the proponent, including any information or advice provided by the Commonwealth or Queensland Government agencies or available from other CSG proponents.	Routine review addressed in Section 11 page 97

4.3 Coordinator General's Conditions

The Co-ordinator General's conditions for the APLNG Gas Fields were provided in November 2010 within the Coordinator General's Report on the EIS (The Coordinator General 2010) and are reproduced in Appendix D. Table 2 shows where these conditions are addressed within the RRRMP.

Table 2 Details of where the Co-ordinator General's Conditions are addressed

Requirement Source	Requirement	Section of RRRMP where addressed
Appendix 1, Conditions that apply to the whole project – gas fields, gas transmission pipelines and LNG facility Part 1 General	Condition 6, Stock routes The parts of the stock route network disturbed or affected by the works must be rehabilitated upon completion of the	Section 8.7.2 page 73

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Requirement Source	Requirement	Section of RRRMP where addressed
	project to a state that is safe for travelling stock and drovers, and the travelling public, and is consistent with the area's pre-disturbance state unless otherwise agreed by DERM and the local government.	
Appendix 2, Conditions that apply to the Gas Fields Part 2 Environmental	Condition 15 Borrow Pits Prior to the construction of borrow pits the proponent must undertake an assessment of the environmental values, potential impacts, mitigation measures for the siting, construction, operation, decommissioning and rehabilitation of borrow pits required for petroleum activities and will provide this assessment to the administering authority.	Section 6.13 page 56
Appendix 2, Conditions that apply to the Gas Fields Part 2 Environmental	Condition 18 Dam decommissioning Decommissioned dams are to be rehabilitated and the landform must be reinstated such that it will not function as a dam and will be stable and sustainable for the foreseeable future (unless otherwise negotiated with landholders). A minimum depth of 0.25m topsoil must be placed over decommissioned storage dams to ensure an adequate vegetal cover can be established.	Section 6.8 page 48 and Section 7.4.1 page 61
Appendix 3, Conditions that apply to the Gas Transmission Line Part 2, General Conditions	Condition 9, GQAL The proponent must include provisions in the EM Plan for the gas pipeline, ensuring that, on land identified as being good quality agricultural land (GQAL), The pipeline contractor must: a. on completion of construction, remove temporary access tracks b. on completion of construction, lightly rip disturbed areas, replace topsoil and return the surface to a land use condition that serves the preconstruction use c. on completion of construction, implement land management and erosion control measures d. on land with GQAL class A, B or C1, bury the pipeline to at least 0.9m below finished land surface, or greater if deep ripping is a normal practice.	a. Section 6.11.3 page 55 b. Section 5.4.7 page 23 and 5.4.8 page 24 c. Section 5.5 page 24 d. Section 8.5 page 70

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4.4 Document Flow Chart

This Remediation, Rehabilitation, Recovery Monitoring Plan is one of a suite of documents developed to satisfy APLNG project and approval requirements to ensure and demonstrate compliance. Figure 1 below shows interrelationships between key project documents and sets out how APLNG management plans have been developed and structured to satisfy key project approval requirements. Note however that this is not a comprehensive listing of all management measures but instead is indicative of the key elements of the system of management plans which the project must comply with.

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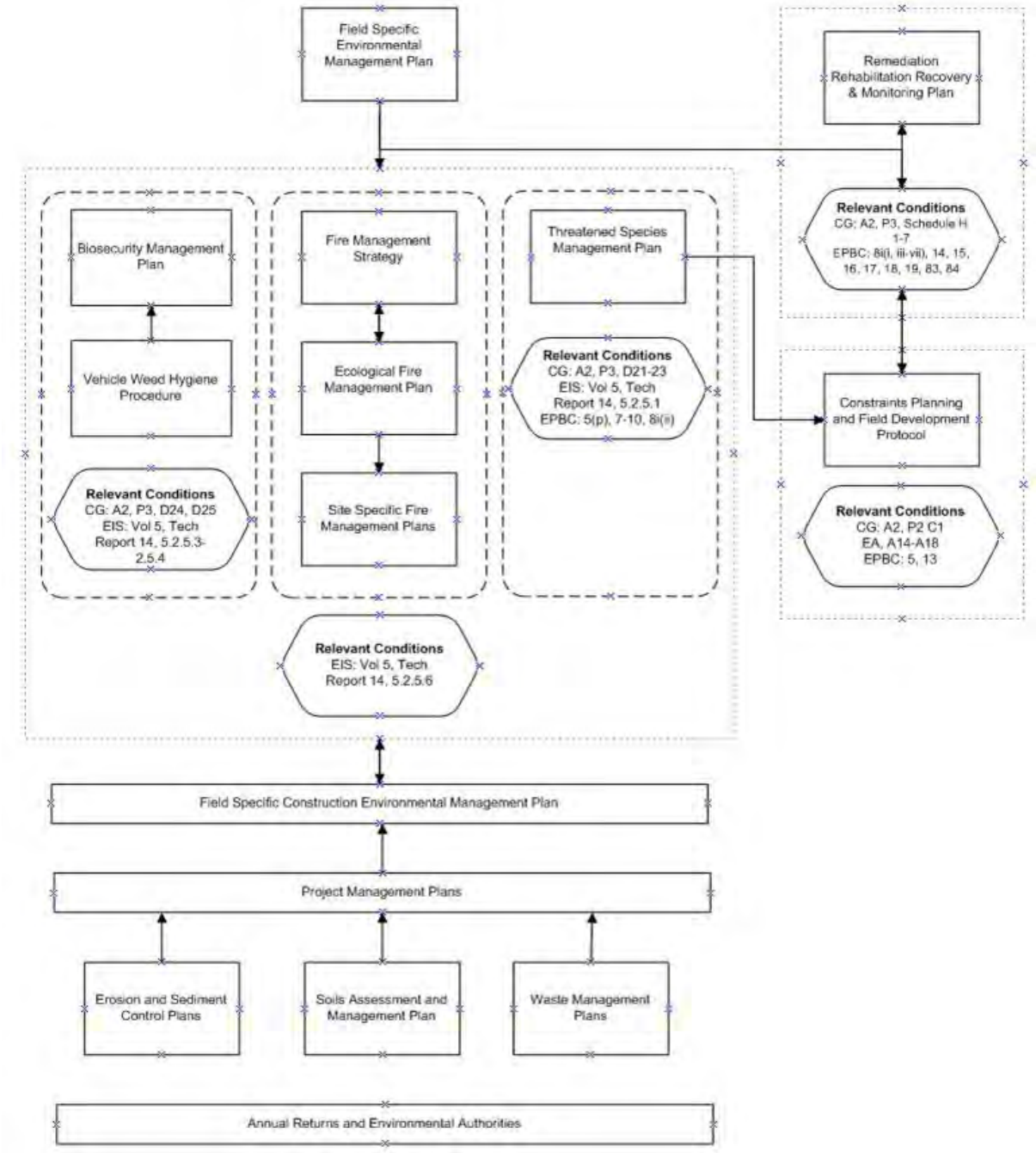
Figure 1 Flow Chart: Document Relationships with other APLNG Management Plans



4.5 Environmental Authority Conditions

The Coordinator General's Report contains draft conditions that may be used by DERM in Environmental Authorities. While the Environmental Authorities for the Gas Fields are yet to be finalised, the Condabri Development Area EA (PEN101674310) has been approved on 10 June 2011, these conditions have been applied across the entire Gas Fields area within this RRRMP Conditions specifically pertaining to rehabilitation are provided in Schedule H, Rehabilitation (pp. 44) and are reproduced in Appendix E.

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Note that since the sections of the main pipeline covered by EPBC 2009/4974, are not covered by Condabri Development Area EA (PEN101674310), model conditions within the Co-ordinator Generals Report have been used in regard to the main pipelines.

5. Rehabilitation Methods

This section outlines a general rehabilitation method irrespective of the infrastructure type. The infrastructure types to which particular techniques apply are outlined at the start of Section 6, which outlines the infrastructure types. Note that for many infrastructure types, certain areas will be required to remain treeless during Project operations. These areas will be reinstated after construction. Reinstatement will involve the reinstatement of soil and re-seeding with pasture grasses or native grasses and ground cover species. In some situations final re-profiling of the land-form may not take place during reinstatement, and will take place on the completion of operations. An example of this is a well pad where a cutting is required to create a level surface, and the well pad is required to remain open during operations. Final rehabilitation, including return of woody native vegetation, where required, will take place once infrastructure is no longer required.

The typical steps in the rehabilitation process are outlined in Figures 2, 3 and 4. However, there will be variations in the process depending on the type of infrastructure.

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Figure 2 Flow Chart: General Rehabilitation Process

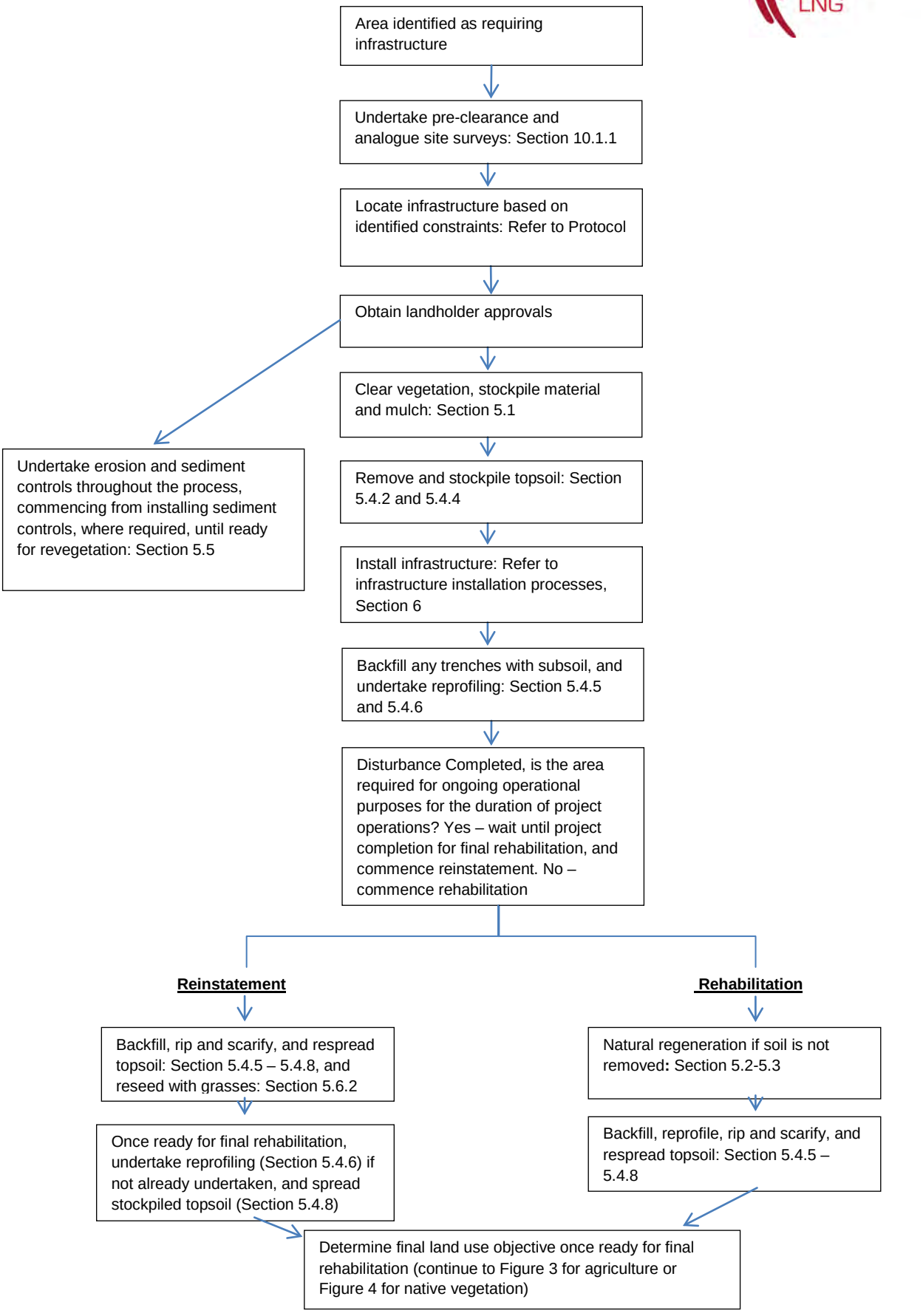

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Figure 3 Flow Chart: Revegetation Process for Agricultural Land

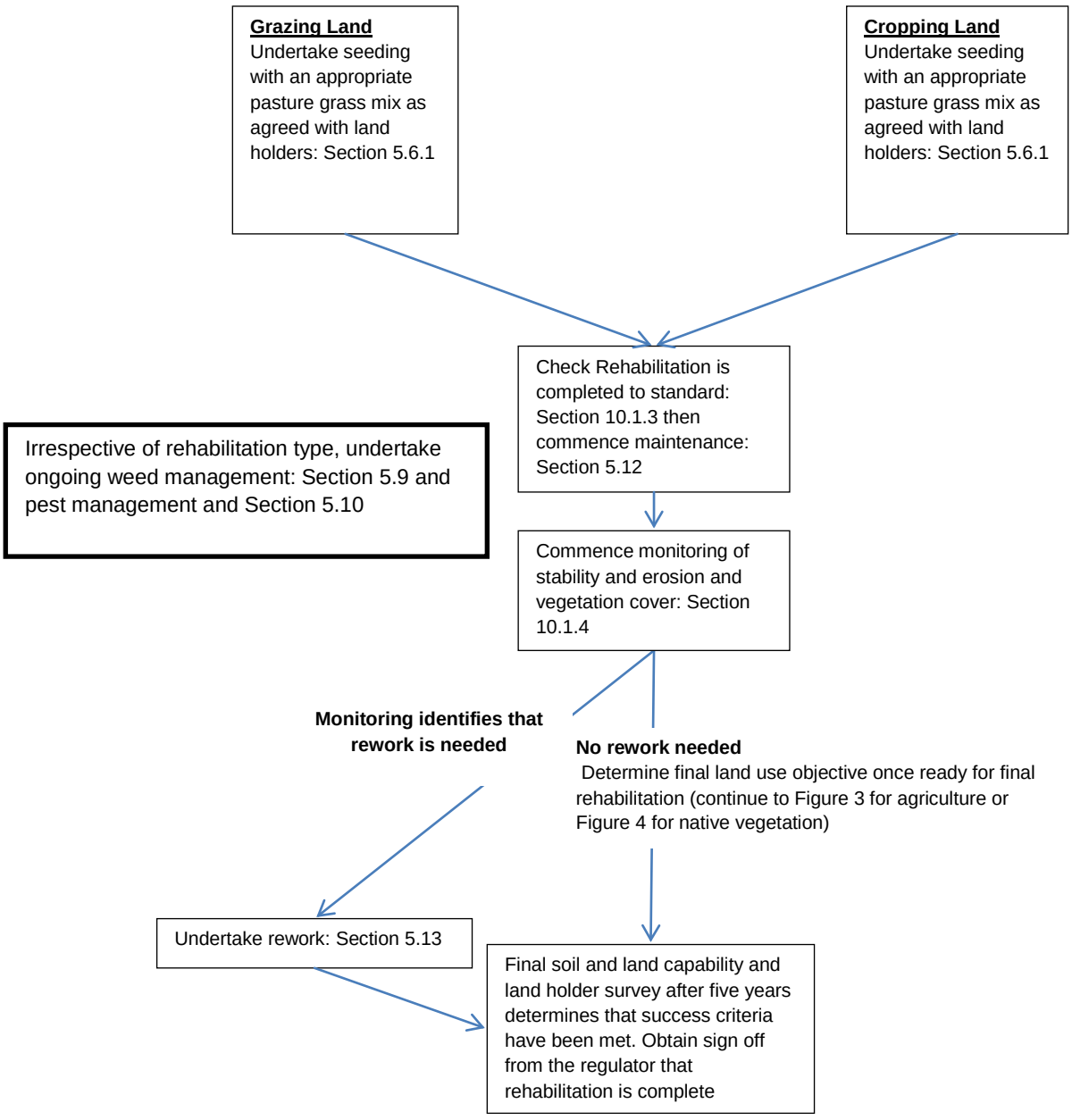

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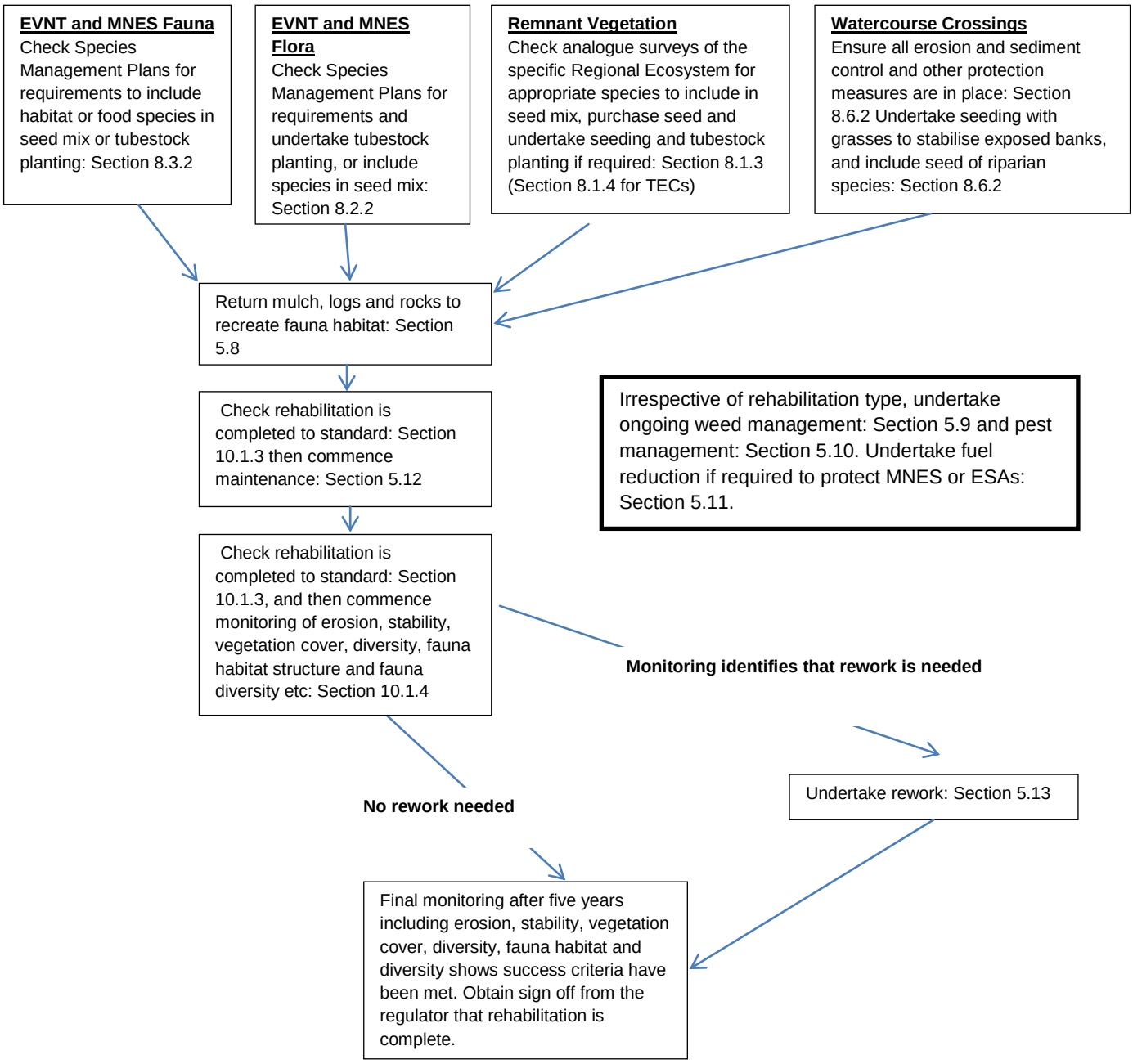
Figure 4 Flow Chart: Revegetation Process for Native Vegetation



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5.1 Vegetation Clearing and Mulching

During vegetation clearing in densely vegetated areas, mulching of timber may be required, but some vegetation may be retained without mulching for re-spreading and habitat re-creation. Cleared vegetation must be stockpiled in a manner that facilitates re-spreading or salvaging and does not impede vehicle, stock or wildlife movements (Condabri EA, PEN 101674310, Schedule D, Land D9). The general procedure for the clearing, mulching and stockpiling of vegetation is as follows:

- mature trees will be identified, and where possible clearing will be avoided (Condabri EA, , PEN 101674310, Schedule D, Land D6d)
- prior to commencing vegetation clearing, trees with hollows or potential nesting sites will be identified by a suitably qualified ecologist and flagged in the field. Prior to commencing vegetation clearing the trees with hollows or potential nesting sites will be checked for the presence of arboreal fauna by a suitably qualified ecologist
- larger logs, hollows and rocks, in particular, may be retained for habitat recreation and will be identified by a GPS point and recorded via the GIS
- a suitable mulcher will be used to mulch vegetation after clearing
- mulched and cleared vegetation will be stockpiled to facilitate re-spreading or salvaging and will be identified by a GPS point and recorded via the GIS
- within well pad leases, the mulch will be stored at the edge of the lease for later spreading, along pipeline routes it will be stored in windrows along the edge of the ROW, with gaps left to facilitate fauna movement, and
- mulch stockpiles will not be wider than 10m and higher than 2m, where practical and managed to reduce fine fuel loads at the base.

On APLNG land vegetation stockpiles will be managed with a graded, slashed, ploughed or chemically controlled barrier. In a controlled burned event, the stock piles could be protected by forming a wet break at the base and allowing the fire to burn away from the piles.

5.2 Waste Management and Removal

The removal of infrastructure and waste created during this process will be addressed in a separate decommissioning plan. Waste materials will be removed prior to rehabilitation; however, waste may be generated during the rehabilitation process. All waste will be removed on the completion of rehabilitation and appropriately disposed of, including flagging, signage, surplus pipeline, litter and stockpiles of unsuitable or surplus material. No non-biodegradable material will be left in the field.

Australia Pacific LNG will seek opportunities to eliminate the generation of wastes from the rehabilitation process through the monitoring of the types and volume of wastes generated with a view to substitute a product/or material where possible. Where a waste cannot be eliminated Australia Pacific LNG will review opportunities to reuse waste streams, recycle produced wastes whether internally or via an external service provider or operation and assess these options as a viable waste management method. Where no other option is available wastes are to be disposed of in accordance with the relevant regulatory requirements and the requirements of the APLNG Upstream Waste Management Plan.

Waste removal will be undertaken following the Condabri EA, PEN 101674310, Schedule G, Waste, G1-G3, as outlined below:

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- all general waste will be removed from the site and sent to a recycling facility or disposal facility licensed to accept the waste under the EP Act
- all regulated waste will only be removed from the site by a person who holds a current authority to transport such waste under the provisions of the EP Act and sent to a recycling facility or disposal facility licensed to accept the waste, and
- waste will not be burned or be allowed to be burned on the site.

5.3 Natural Regeneration

Trees and shrubs will be allowed to regenerate naturally on cleared areas not required to be kept tree free for the purpose of operation and maintenance, where the re-establishment of native vegetation is the final land use objective. This will reduce barriers to fauna movement, especially to ground-dwelling fauna.

Natural regeneration is especially important for Brigalow communities where the dominant species *Acacia harpophylla* (Brigalow) re-establishes through root suckering. However, natural regeneration is only likely to occur in areas where the topsoil, which contains roots, seeds and other vegetative propagules, is not removed, or if removed and stockpiled, is placed back immediately before the soil seed bank declines. As such, natural regeneration will only be solely relied upon in areas where vegetation is required to be removed for construction, but soil does not need to be removed, such as clearing of ROWs. In all other situations regrowth will be supplemented with direct seeding. Where soil does not require removal, root stock will be left in the ground where practicable to facilitate rapid regrowth.

5.4 Soil Management

5.4.1 *Soil Management Groups*

A range of soil types occur within the Australia Pacific LNG Gas Fields development areas as outlined in Chapter 5, Volume 2 of the APLNG EIS. For the purposes of this RRRMP, the wide range of soils has been amalgamated into a series of soil management groups (Table 3). Each soil management group consists of soil types that have similar profile features as well as similar chemical and physical properties.

Table 3 Soil Management Groups

Soil management group	Soil group classification	Australian Soil Classification	Soil characteristics	Erosion rating
A		rudosols	shallow stony/skeletal soils (includes rock outcrop)	low to moderate
B	**a**	sodosols, chromosols, kurosols	shallow texture contrast soils and shallow earths	moderate to very high
	b	sodosols, chromosols, kurosols	medium to deep texture contrast soils	low to moderate
C		vertosols, dermosols	non cracking clays and medium/deep earths/gradational soils	low to moderate
D	**a**	vertosols dermosols	grey/brown/dark cracking clays	low
	b	vertosols, dermosols	gilgaied soils: grey/brown/dark cracking clay with melon-hole	low

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			surface	

The most extensive soil group are the soil management group B soils which are texture contrast soils (sodosols, chromosols and kurosols); these soils mainly have shallow sandy or loamy topsoil with an abrupt change to a medium to heavy clay subsoil. This subsoil is commonly sodic and dispersive and is very susceptible to erosion. Soil management group A soils are shallow gravely loams (rudosols) with a predominance of surface stone and soil management group C and D soils which are shallow to deep-cracking and non-cracking clays (vertosols or dermosols) are also common within the Gas Fields. The soil management group B soils are predominantly used for grazing on improved and native pastures while soil management group A soils with a predominance of stone are used for forestry activities or rough grazing on unimproved native pastures. The soil management group C and D soils are the most productive soils in the region and are used for dryland and irrigated cropping and improved pasture, and are located on the level or gently sloping plains and alluvial areas.

5.4.2 *Topsoil Stripping*

Topsoil contains the majority of nutrients and water required by plants and supports seed growth and germination. The chemical and physical properties of topsoil can be easily altered by handling and storage methods. It is therefore vital that topsoil is stripped and stored appropriately, irrespective of the type of Project disturbance. Care must be exercised when stripping topsoils to minimise mixing soil types and soil layers. As such, the objectives of topsoil stripping are to ensure that:

- the top layer of the soil profile is removed so that it can be re-used for rehabilitation purposes
- topsoil is segregated from other materials, and
- the existing topsoil resource in the Gas Fields is carefully managed.

Site clearance and construction will involve stripping topsoil and associated vegetation to create areas for the new infrastructure. This can result is the loss of topsoil quantity and quality through incorrect stripping, prolonged soil exposure, erosion, nutrient leaching and loss of fertility.

Prior to commencing soil stripping it is necessary to plan the source of topsoil for rehabilitation to maximise direct re-spreading and to minimise the length of time that soil is stockpiled. A soil assessment will be undertaken following the method outlined in the APLNG Project Draft Soil Management Strategy 301001-0044800-EN-PLN-0009. The soil assessment will involve:

- a desktop assessment to identify existing information sources for soils and soil management in the project area
- a desktop review of other investigations which have already been conducted for various project components by other technical specialists
- In regard to the development of the gas transmission pipeline a walkover of the route to identify soil characteristics relevant to development and rehabilitation
- Sampling within GQAL to identify soil excavation depths and mitigation measures for crop production

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- Baseline soil information sampling to the mapping scales and total areas of disturbance as specified in the Condabri EA, PEN 101674310, D21- D23

Where rehabilitation work is proposed, a shortage of topsoil is inevitable in some areas. This is particularly the case in the shallow stony soils, shallow texture contrast soils, and those within soil groups C and D where clay content is significant in the surface material. In such areas, additional topsoil may need to be sourced from zones with substantial topsoil depths or alternative management measures may be required to overcome the potential shortfall.

Topsoils will be stripped with care through observation of soil texture and profile as it is removed by the operator. Care is taken to ensure that structural degradation of the soil is avoided and that excessive compaction does not occur and where practicable, stripped topsoil will be re-used by application to areas where a similar soil type is required for rehabilitation. Where this is not practicable, the topsoil will be stockpiled as advised by the Environment Group. Coarse textured topsoils (groups A and B) will be stockpiled separately from fine grained (groups C and D) soils where it occurs in close proximity.

5.4.3 *Subsoil Stripping*

The objectives of subsoil management are to:

- prevent contamination of topsoil
- prevent degradation of the subsoil structure
- ensure reinstatement in the correct location and in the correct order, and
- ensure effective management of unused subsoil.

The following actions will be implemented in the removal of subsoil, although site specific requirements, as per baseline surveys, will be implemented where necessary as determined by the Environment Group in precedence to those outlined below:

- subsoil will be removed and stockpiled separately from topsoil to prevent blending with topsoil and, ideally, stockpiles will be located close to where they are sourced,

Specific subsoil management measures for individual soil groups encountered will be implemented as outlined in the APLNG Project Soil Management Procedure (Attachment 9, within the Combabula EMP, 16 December 2010). These management measures include:

- different subsoil horizons will be stockpiled separately and additional subsoil storage areas will be provided, where required
- in soils with a sodic subsoil layer, the sodic subsoil may require the addition of gypsum or dolomite prior to reinstatement of topsoil
- saline subsoils, where encountered, will be replaced at depth and covered with topsoil except in areas where there is little topsoil or there is evidence of existing salinisation, in which case topsoil may be imported to facilitate revegetation
- each separate subsoil stockpile will be reinstated to replicate the original soil profile prior to disturbance

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- subsoil displaced by pipes will not be used as a surface capping layer, rather the surplus material may be stockpiled in locations approved by landholders or regulatory authorities for use during operations

- specific subsoil management measures for individual soil groups encountered will be implemented in accordance with Appendix 3.

5.4.4 *Stockpiling*

The objectives of stockpiling are to:

- minimise damage to and maintain fertility of stockpiled material
- ensure soils is stockpiled in a manner that will preserve its biological and chemical properties (Condabri EA, PEN 101674310, Schedule D, LandD6c)
- ensure soils are used for rehabilitation purposes, and
- ensure stockpiles have minimal impact on surrounding environmental values.

In cases where the subsoil must be disturbed, it is essential that subsoil and topsoil be stockpiled separately, with a separation distance to ensure they are not mixed during construction or rehabilitation works. This is because subsoil across APLNG tenements can be highly saline, sodic and dispersive. Any backfill/subsoil material not utilised may be stockpiled in locations approved by landholders or removed prior to topsoil placement. Designated subsoil and topsoil stockpile locations will be determined prior to construction work. The following actions will be implemented when creating stockpiles, although site specific requirements, as per baseline surveys, will be implemented where necessary as determined by the Environment Group in precedence to those outlined below:

- topsoil stockpiles will not exceed 2m in height (Soil Management Procedure, Attachment 9 within the Combabula EMP, 16 December 2010),to minimise damage to topsoil and maintain fertility
- gaps will be left at appropriate intervals to allow for drainage, and permit the movement of vehicles and fauna
- topsoil stockpiled for an extended period (longer than three months) should be revegetated as soon as possible to reduce the impacts of weathering of the stockpile, by direct seeding with grasses to maintain biological activity and prevent weeds from growing, and to prevent soil loss through erosion, in consultation with land holders. Topsoil stockpiles will be reseeded if germination or grass cover is poor.(Soil Management Procedure, Attachment 9 within the Combaula EMP, 16 December 2010).where both topsoil and subsoil are stripped and stockpiled, topsoil and subsoil stockpiles will be clearly sign-posted for easy identification and to avoid any inadvertent losess
- Soil stockpiles, both topsoil and subsoil will be identifiable in the GIS as specified in Section 10.2
- topsoil will be stockpiled within well leases or ROWs and will not be stockpiled against fence lines or vegetation to be retained, and will be stockpiled separately from mulch
- weeds on the stockpiles will be monitored and controlled to prevent establishment and spread

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- soil will be stockpiled close to where it is stripped in a manner that does not block diversion or natural drainage flow paths
- long-term stockpiles will be located above historic flood levels (Q50) where possible
- stockpiles will be located where they will not be disturbed by other activities, and
- erosion and sediment control measures will be implemented where stockpiles are to be located within 200m of watercourses to prevent contamination of waterways.

Site specific requirements would take precedence and alter the stated strategies where physical attributes out of the ordinary within a lease exist such as slope or a vegetation community. An example of a site specific requirement taking precedence would be the construction of a lease within an endangered regional ecosystem. This situation would alter the height at which soil will be stockpiled and a reduction in the space between stockpiles to ensure clearing of vegetation is minimised. These practices will be documented and implemented by the Environment Group.

5.4.5 *Backfilling*

The following actions will be implemented in backfilling of trenches and other areas, although site specific requirements, as per baseline surveys, will be implemented where necessary in precedence to those outlined below:

- pipeline trenches will be backfilled as soon as practicable after pipe laying
- during backfilling of pipeline trenches, soil must be replaced so that soil topsoil does not mix with subsoils
- subsoil will not be contaminated with general rubbish or any foreign material which might damage the pipe during backfill
- topsoil will not be used for backfill
- pipeline backfill and compaction of the fill will be controlled to minimise subsidence and the need for excessive temporary soil mounding
- a suitable, clean backfill material will be imported where subsoils cannot be reused, and
- excess subsoil material will be disposed of appropriately or stockpiled for use in future rehabilitation or respread elsewhere in consultation with landowners, avoiding mixing.

5.4.6 *Re-profiling*

The objective of re-profiling is to reinstate soils to a stable landform, which includes:

- re-establishing surface drainage lines
- reinstating the land to a land surface that is visually consistent with surrounding land features
- re-profiling to original contours and established drainage lines
- minimising the potential for subsidence or erosion gullies to occur, and
- replacing top soil over subsoil.

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Land form reinstatement involves surface contouring to create a stable land formation consistent with the surrounding land form. This ensures water flow over the surface is in cohesion with the surrounding landscape and minimises the risk of potential erosion. It also ensures that the final landform is consistent with the surrounding land features. Surface contouring should be completed prior to re-spreading of topsoil. Contouring should pay particular attention to drainage lines for surface water flows to ensure erosion potential is minimised. Subsidence and erosion from areas re-profiled and subsequently rehabilitated will be monitored as described in Section 10.1 within Table 9.

Earthworks will impact the existing landform through the re-profiling of local topography, alteration of drainage paths and soil destabilisation. In turn, this could change the local drainage patterns, visual character and degrade downstream water quality. General mitigation measures will be addressed throughout the Gas Fields to minimise potential impacts. These measures are:

- in areas of site leveling works, proposed formation levels will be set to reduce the need for significant cut and fill areas
- in areas where access tracks have been constructed the landform will be re-profiled to establish a landform consistent with the surrounding landscape and ensure it is in a stable condition
- re-use of construction materials will be implemented to minimise the volume required from borrow pits
- pipeline backfill and compaction of the fill will be controlled to minimise subsidence and the need for excessive temporary soil mounding
- clearing vegetation or placing fill must not be undertaken on slopes greater than 10% for petroleum activity(ies) other than for pipelines and wells (Condabri EA, PEN 101674310, Schedule D, Land, D7b), and
- a slope stability assessment will be carried out where clearing works are required on steep and very steep slopes with gradients greater than 10%.

5.4.7 *Ripping and Scarification*

Prior to the re-spreading of the topsoil, the ground surface may be ripped. Ripping assists with binding of the soil layers, increases retention time of water on the slope, aids water infiltration into the soil increasing the opportunity of seed germination success and reduces the volume and velocity of runoff generated from the slope. This will be undertaken along contours, particularly on heavily trafficked areas such as temporary access tracks, camps and hardstands and other areas compacted by construction activities. Areas with hard-set mud or clay such as drilling mud pits will also be ripped. Ripping depth will be reduced to no greater than 400mm in areas where pipelines are buried, as ripping any deeper could potentially result in the rupture of buried pipelines. Ripping will be excluded from under the drip lines of retained vegetation to avoid impacts on the root systems of adjacent vegetation.

After topsoil is spread the surface may be lightly scarified to assist with relief of compaction, binding of the soil layers, water penetration and plant establishment. Scarification will be completed prior to seeding (after topsoil is spread) and should ensure no subsoil is ripped to the surface. The scarification should be completed using the rear mounted ripping tynes of a grader or a purpose designed harrowing implement rear mounted on a tractor. Scarification can also be achieved by ploughing of the sub-surface material prior to topsoil reinstatement.

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A figure eight or zigzag rip lines may be appropriate to prevent rill erosion in flat to low gradient areas.

5.4.8 *Topsoil Re-spreading*

Where soil has been removed, soil preparation will include the reapplication of topsoil stockpiled from the original clearing. Topsoil will be re-spread to the following specifications:

- topsoil will be respread over watered and scarified or ripped subsoils in even layers at a thickness appropriate for the intended land use of the area to be rehabilitated
- topsoil is to be spread back over in an even layer and left 'rough' (rather than smooth and compacted) to minimise potential erosion, increase water infiltration and to trap seed or will be scarified as outlined in Section 5.4.7
- topsoil will cover the entire width of the disturbed area so that there is no exposed sub-surface material. This will ensure seeding and germination has the best opportunity to 'take', enabling establishment of groundcover
- a greater amount of topsoil may be re-spread over exposed areas if conditions permit
- if insufficient topsoil exists, additional materials may be sourced from other locations but confirmation of the source and quality, including that it is weed free, must be obtained by the Environment Group. The importing of topsoil must be approved by landholders
- topsoil application will only take place following initial reinstatement of the subsoil, construction of contour banks on steep slopes and compaction of subsoils to account for subsidence
- topsoil stockpiled for extended periods will be turned over and mixed prior to replacement. However, this is only required if thorough mixing is unlikely to occur during re-spreading, and
- vehicle movement will be restricted following topsoil re-spreading
- remediated areas where soil has been replaced will be identifiable within the GIS as rehabilitation areas identified in Section 10.2 and in the field with signage identifying rehabilitation is being conducted.

5.5 Erosion and Sediment Control

Erosion can have an adverse effect on soil productivity and the associated agricultural value. Additional effects can include, but are not limited to, undermining of structures (such as fences), exposure of pipelines, stream bank erosion, downstream sedimentation, decline in fertility through loss of soil structure, and increased dust generation and poor rehabilitation. Further rehabilitation works may be required to stabilise eroded areas.

Erosion levels are expected to be more significant in the coarser textured soils, where there is little structure and organic matter to assist in binding the soil. Deep clay soils (groups C and D) have a low to moderate erosion rating where undisturbed. However, as the subsoils can be sodic to strongly sodic, these soils will erode due to clay dispersion where soil is exposed through vegetation removal. Such soils can be particularly prone to gully and tunnel erosion.

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Where applicable, the following erosion and sediment control measures are proposed:

- where diversion of runoff water around a construction site is required, design will need to be mindful of possible erosion effects, including the instigation or exacerbation of gully and tunnel erosion
- sediment basins will be constructed on the downhill side of major facility sites, such as temporary accommodation facilities, when they are near sensitive water courses
- drainage lines and areas of concentrated water flow near major facilities will be inspected regularly for erosion and to determine whether remedial action is required
- sediment and erosion control measures and areas receiving concentrated flows will be inspected on a regular basis, replaced where damaged and emptied following rainfall events, if required
- erosion and sediment control measures, such as contour banks, will be placed at frequent intervals along flow paths, where appropriate, and multiple discharge locations will be created to ensure discharges have low velocities and volumes, rather than channelling discharges to a central point, which can exacerbate erosion
- point source discharges of runoff will be directed into stable waterways and/or drainage lines with engineering controls, such as scour protection and flow velocity limits, where required
- vegetation will be progressively cleared to minimise the area of soil exposed
- slopes will be re-vegetated as soon as possible after disturbance
- stockpiles and/or exposed soil areas, such as unsealed access tracks, which are exposed for prolonged periods or have been identified as problem soils (erosive/dispersive) will be stabilised as required. This will be done using chemical surface stabilisers, physical alternatives such as crushed rock, or direct seeding with grasses.
- diversion and erosion and sediment control devices will be fully implemented to provide effective erosion control prior to land disturbance activities, and will be kept in place and maintained fully functional until the area has been effectively rehabilitated
- roads and tracks will preferably be aligned across slopes, but where this is not possible, contour banks will be used at intervals appropriate to the slope and soil type to control the flow of surface water
- where pipelines are located along slopes, trench breakers will be installed in the backfill at intervals appropriate to the steepness of the slope to prevent water tunnelling along the buried pipe and contour banks will be installed on the surface to divert water away from the disturbed areas, and
- erosion and sediment control devices are to be constructed with reference to the IECA Best Practice Erosion and Sediment Control Guidelines 2008 and The Institute of Engineers (1996) Soil Erosion and Sediment Control, Engineering Guidelines for Queensland Construction Sites.

Site specific erosion and sediment control plans will be prepared by a suitably qualified person to direct the application of erosion and sediment control measures. Erosion and sediment control plans will identify the measures undertaken to manage erosion and sediment, the type and location of erosion and sediment control devices and management

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measures that have been applied in keeping with IECA Best Practice Erosion and Sediment Control Guidelines 2008 and The Institute of Engineers (1996) Soil Erosion and Sediment Control, Engineering Guidelines for Queensland Construction Sites.

The construction and monitoring of erosion and sediment control devices to ensure they are installed and appropriately designed to the specifications of the site specific erosion and sediment control plans will be the responsibility of the principle contractor on site who has suitably qualified personnel to inspect and monitor the operation of erosion and sediment control devices. The construction and implementation of erosion and sediment control will be initiated prior to and during the development of infrastructure as per the site specific erosion and sediment control plan. The principle contractor will be required to retain an auditable record of construction, visual inspection and maintenance services to erosion and sediment control devices and the measures that have been undertaken to manage these devices. Inspection and maintenance of erosion and sediment control devices will be the applicable method in mitigating effects to water quality downstream from these devices. Water quality monitoring will only be conducted downstream from erosion and sediment control devices if there is a major weather event based failure of the erosion and sediment control device.

5.6 Revegetation

5.6.1 *Pasture Establishment*

Areas where grazing or cropping is the required final land use will be sown appropriate pasture species sourced from reputable local seed suppliers as agreed with landholders. This will be undertaken irrespective of whether the site is to undergo re-instatement or final rehabilitation. Weedy species such as *Megathyrsus maximus* (Green Panic) and *Eragrostis curvula* (African Lovegrass) are to be avoided. Local native grasses such as *Dicanthium sericeum* (Queensland Blue Grass) may be used in some situations, such as where it is desirable to return an area to grazing on unimproved native pasture. Direct seeding with grasses will also be required on all topsoil and subsoil that is to be stored for long periods unless otherwise stabilised with physical alternatives.

A direct seeding method can be undertaken using a spreader attached to the rear of a tractor which delivers seed onto the soil. Seeding is to take place after ploughing, but before harrowing. When harrowing is undertaken after seeding, the seed is covered with a small layer of soil to assist in the germination process. Alternatively a drill seeder with press wheels may be used. In this case harrowing is not required as drilling allows the depth of seed burial to be controlled. Using machinery such as tractors on steep slopes should be avoided. Hand seeding is recommended on steep slopes due to safety concerns regarding the use of machinery in these areas. Rehabilitation crews should assess each site on a case by case basis, according to the topography and level of risk involved if machinery is utilised. Hydro-seeding and hydro-mulching may be used on steep slopes to encourage more rapid revegetation and, therefore, stabilisation of the rehabilitated area. Ground cover as a rehabilitation indicator will be monitored as identified in Table 9 of Section 10.1.

5.6.2 *Seeding for Reinstatement*

In situations where an area is required to remain treeless during Project operations such as above pipelines, the species selected will include seed sourced from reputable local and selected seed suppliers that provide local provenance native grasses and groundcover species only if native vegetation is the final land use objective. If pasture of cropping is the

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final land use objective, the area will be seeded with pasture grasses as outlined in the above section.

5.6.3 *Direct Seeding of Native Species for Final Rehabilitation*

The selection of species that will be used in the rehabilitation process where native vegetation is the final land use objective will be guided by the pre-clearance vegetation as determined from analogue site surveys as outlined in Section 10.1.3. Species selection will also be guided by soil conditions, micro-climate and aspect of the new land form. Analogue site surveys will identify the volume of seed required to be sourced which will require careful planning to ensure supplies are available. Seed will be sourced from reputable local and selected seed suppliers that provide local provenance seed stock.

Seeding is to be undertaken as soon as practicable after the topsoil has been re-spread and natural profile restored, and topsoil has been spread, but before spreading mulch. Sowing will take advantage of the most appropriate season for germination and establishment of seedlings (i.e. immediately before the commencement of the wet season) as manual watering will not be undertaken. Areas to be seeded will be identified with flagging tape. Direct seeding will be undertaken following the technique outlined in Section 5.6.1 above.

Direct seeding with grasses may be undertaken in areas where the rapid re-establishment of vegetation cover is required (e.g. watercourse crossings, steep slopes and other potential high erosion areas). In a situation of intense rainfall, sites may be washed out and will undergo further rehabilitation works as outlined in Section 5.13. Native grasses or sterile exotic grasses must be used to ensure exotic grasses do not become established. Ground cover as a rehabilitation indicator will be monitored as identified in Table 9 of Section 10.1.

Where practicable fencing off from stock may be required, depending on adjacent land use, to facilitate revegetation and regrowth until site stability is established. Fencing will be constructed to the specifications identified in Section 8.2.2 given stakeholder input where MNES are being rehabilitated such as TECs, or EVNT plant species that are prone to damage through grazing.

5.6.4 *Tubestock Planting*

There will be certain situations where tubestock planting will also be required, such as where species unsuited to direct seeding must be established, including Brigalow and some SEVT species. Tubestock planting may also be required to return plant species of conservation significance including MNES and State listed ENVT species. Requirements for tubestock planting are as follows:

- species to be selected for planting will be sourced from local provenance seed
- tubestock will be planted in the early wet season (December – February) to take advantage of rainfall as no manual watering program will be conducted beyond initial planting. Section 8.1.4.2 identifies the need for SEVT plantings requiring supplementary watering during establishment as they are mostly very slow growing
- spacing will be determined according to the species, but will typically be 2m apart for most tree species
- tubestock will be watered immediately following planting
- mulch will be placed around tubestock, but should not touch the stems, and

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- fencing will be required following planting to prevent browsing damage.

Engagement with tubestock suppliers will identify the requirement to deliver local provenance tubestock and be supply will be guided by the list of key species developed for the relevant Regional Ecosystems, in consultation with land holders and based on BioCondition reference data (surveys outlined in Section 10.1.3) in certain situations, mentioned above, where tubestock planting will be required. Identified quantities of tubestock will be sourced from reputable local and specialist nursery stock suppliers. The collection, storage and sourcing of seed for tubestock propagation will be via the engagement of reputable local seed suppliers and specialist seed suppliers by contracted local and specialist nursery stock suppliers.

5.7 Seed Collection

To meet the requirements for direct seeding, seed will be sourced of pasture and native species, with preference for local provenance seed of species adapted to local conditions. It is anticipated seed collection will be affected by:

- climatic conditions such as rainfall and prolonged periods of drought affecting flowering and seed set
- natural predation
- quantity of seed set and management of harvesting quantities within acceptable limits for natural reproduction of native species
- accessibility of seed for harvesting.

Seed purchasing will be guided by the list of key species developed for the relevant Regional Ecosystems, and for pasture species, in consultation with land holders and based on BioCondition reference data (surveys outlined in Section 10.1.3). Seed harvesting will be progressively conducted as to the availability of target species to accommodate the commercial quantities of seed necessary as advised by lists of key species developed for the relevant Regional Ecosystems, and for pasture species, in consultation with land holders and based on BioCondition reference data. Reputable local seed suppliers and specialist seed suppliers will be engaged to collect commercial quantities of seed to meet this demand. Seed will be required to be tested by the supplier and evidence of viability provided before sowing to ensure there will be adequate germination rates.

5.8 Vegetation Re-spreading

Native vegetation, mulch and other fauna habitat elements (surface rocks and felled tree trunks) will be relocated where practical to site operations with consideration to site characteristics and safety. Stockpiles will be identified by GPS and recorded in GIS. Native vegetation, mulch and other fauna habitat elements will be re-spread after seeding as follows:

- material will be evenly spread over the area to assist in the distribution of seed stock and provide shelter for fauna
- to prevent weed and soil pathogen spread and assist with appropriate revegetation and soil micro-organism recovery, topsoil, mulch and habitat elements will be sourced from salvage specific to that site

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- felled vegetation will not be burnt unless directed by the regulatory authority
- any large logs or hollows will be returned to provide habitat for local species. On steep slopes these will be re-laid along the contour
- mulch should be spread evenly once seeding and planting has been completed. It is important that mulch is spread in a thin layer (50mm or less). This will allow seeds to germinate and will not inhibit seed growth and therefore groundcover establishment. If the mulch is spread too thick, the seeds will take longer to germinate slowing the rehabilitation process, and
- if excess mulch needs to be utilised, contour banks and erosion control structures can be constructed using mulch instead of soil.

5.9 Weed Management

5.9.1 *Weed Species*

Declared weeds under the Queensland *Land Protection (Land and Stock Route Management) Act 2002* (LP Act) such as *Lantana camara* (Lantana), *Parkinsonia aculeata* (Parkinsonia), and *Parthenium hysterophorus* (Parthenium) are present within the Gas Fields area.

Some weed species are a potential threat to rehabilitation, and to MNES, given the nature of the proposed activities (particularly clearing and soil disturbance during construction). Declared weed species are a rehabilitation indictor monitored after the completion of rehabilitation as described in Table 9 of Section 10.1. Those species of particular note are:

- *Bryophyllum delagoense* (and hybrids) (Mother of Millions)
- *Opuntia aurantiaca* (Tiger Pear)
- *Opuntia stricta and O. tomentosa* (Prickly Pear species)
- *Parthenium hysterophorus* (Parthenium)
- *Lycium ferocissimum* (African Boxthorn)
- *Eragrostis curvula* (African Lovegrass)
- *Cenchrus incertus* (Spiny Burrgrass)
- *Verbesina encelioides* (Crown Beard)
- *Froelichia floridana* (Snake Cotton)
- *Phyla canescens* (Lippia), and
- *Harrisia martini* (Harissia Cactus).

Many species that are suitable for improved pasture may be weeds in areas where native vegetation is the desired land use. These include Green Panic, Buffel Grass (*Pennisetum ciliare*), and Rhodes Grass (*Chloris gayana* hybrids).

5.9.2 *Prevention of Spread*

Vehicle and plant equipment movement are significant contributor to the introduction and/or spread of weed species. The main focus will be on preventing weed introduction and spread through implementing vehicle hygiene procedures, controlling access, staff and contractor

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training in weed identification, and managing known infestations that lie directly within, or adjacent to, the disturbance sites.

Prevention is the most effective way to manage weeds by minimising the introduction of new weed species and spread of existing weed species across the Project Area. Measures to prevent the introduction and/or spread of significant weed species across the Project area and to the surrounding land are summarised in the APLNG Upstream Phase 1 Biosecurity Management Plan (Origin 2011), and Origin's Vehicle Weed Hygiene Procedure OEUP-1000-PRO-ENV-025.

APLNG Upstream Phase 1 Biosecurity Management Plan (Origin 2011) identifies the following preventative measures:

- Vehicles, machinery and plant equipment imported from overseas will be inspected by quarantine and customs in accordance with the requirements and protocols of AQIS and
- Materials including gravel, mulch, packing materials, sand and soil from interstate shall be inspected and be certified weed and pest free before being brought into Queensland utilising the DEEDI weed hygiene declaration forms.

Origin's Vehicle Weed Hygiene Procedure OEUP-1000-PRO-ENV-025 and inspection report follows the requirements of DEEDI and identifies the following preventative measures at all Project sites:

- all vehicles, machinery and plant must be inspected by qualified Project personnel or a third party inspector for weeds and high risk materials such as soil prior to entering a project site.
- an inspection report will be issued once the inspector confirms the vehicle is free of all organic material.
- the following activities do not require a vehicle or equipment to undergo inspection or require an inspection report:
  - Any vehicle/equipment travelling exclusively on formed roads to a major facility administration area (e.g. to a car parking area)
  - Emergency vehicles responding to an emergency
  - Private landholders who are moving around their own properties and where Australia Pacific LNG is constructing or maintaining an asset
  - Guests of landholders that are visiting a property on non- Australia Pacific LNG business and where Australia Pacific LNG is constructing or maintaining an asset
  - Where an emergency has been declared on all Project sites all authorised vehicles are exempt.

- it is the responsibility of the driver or machine operator to organise this inspection prior to travelling to site. Drivers and machine operators may inspect their own vehicle/machinery if they are a trained staff member or authorised third-party inspector.
- a register of trained staff members is to be kept at each site.
- the level of inspection and wash-down requirements are determined using the weed risk matrix

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- a copy of the valid inspection report is to be kept within the vehicle. A duplicate copy of the vehicle/equipment inspection report must be retained by the inspector and these copies handed over to Origin administration staff when a new book of vehicle/equipment inspection reports is issued.
- administration staff will keep a record of vehicle/equipment inspection report forms for a period of no less than 5 years as required by the LP Act.
- all vehicles entering a project site must have a valid inspection report in the vehicle at all times.
- vehicles/equipment will be directed to leave site immediately if they are found without a valid inspection report and will be undergo washdown on leaving the site.

5.9.3 *Weed Treatment*

Priority weed infestations will be identified during pre-clearance survey and these will be the focus of treatment application works for the site to reduce the potential for these species to spread to new, unaffected areas across the Project area and to surrounding lands. Treatment applications will be selected on a species-by-species basis depending on the effectiveness of the application to control each species, the size and growth stage of each infestation and the timing of application. Surrounding land use and weather conditions will also be considered when choosing a treatment application.

Treatment applications may employ mechanical, chemical, biological and land management methods to reduce the size of infestations and minimise the potential to spread to new, unaffected areas. Treatment applications will be documented including the use of photo monitoring to assess the effectiveness of control. Specific control methods are summarised in the APLNG Upstream Phase 1 Biosecurity Management Plan.

Control methods are species specific and control can include:

- herbicide control applications such as spraying, (seasonal and repeat foliar applications), basal bark, cut stump and injection
- biological control agents
- fire management control methods
- mechanical removal
- hand removal and
- integrated control strategies

5.10 Pest Management

Pest animals have major economic, environmental and social impacts and can cause significant damage to crops and seriously affect Australia's livestock industries by preying on stock and competing for pasture as well as causing severe land degradation by promoting soil erosion, stream turbidity and the spread of weeds. Under the LP Act, it is a legal requirement of all landowners or landowning state agencies to control declared pests.

Pest animal species that are likely to be present include:

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- *Oryctolagus cuniculus* (European Rabbit)
- *Sus scrofa* (Feral Pig)
- *Canis familiaris* (wild Dogs including Dingoes and Dingo hybrids)
- *Canis vulpes* (Red Fox)
- *Felis catus* (Feral Cat)
- *Mus musculus* (Mice), and
- Macropods.

Control of these pests will be undertaken by landholders. However, Australia Pacific LNG will support regional pest control activities. Where pest species are observed to have an impact on an area of conservation significance (i.e. an ESA or area containing MNES), such as wallowing or severe browsing, Australia Pacific LNG will arrange pest control to ensure that impacts on MNES and ESAs are reduced.

A more specific management strategy to control pest animals across the Gas Fields is provided in the APLNG Upstream Phase 1 Biosecurity Management Plan. Pest animal management within the gas fields, which consist of particular sized land units, is achievable when a pest species remains within the project area and control is feasible within that specifically sized area. Some control measures such as trapping and shooting will not be feasible within smaller geographic units. If the development of Australia Pacific LNG infrastructure occurs within an area frequented by a pest species, or a declared pest species becomes resident within an area managed by Australia Pacific LNG, the species will be managed in accordance with legislative requirements.

5.11 Fire Management

5.11.1 *Fire Prevention Measures*

The risk of bushfire is a concern of all landholders and rehabilitation works as a bushfire can severely impact upon all land uses. The damage to crops, fodder, buildings and other farm infrastructure from fire can be devastating to landholder livelihoods. Gas Fields development must maintain the safety of people and property by either avoiding areas of high or medium bushfire hazard; or by mitigating any introduced risk. Given the nature of the Project and its rural setting, it is impractical to locate all project components to avoid medium and high bushfire hazard areas. Hence, bushfire risk within APLNG owned properties will be managed by the Land Use and Water Strategy Group utilising a variety of measures as follows:

- monitoring of a bushfire weather forecasting and forewarning system
- observation of fire bans for high risk days/seasons where practical
- implement fire prevention measures during construction
- staff and contractor bushfire education and training
- preparation and implementation of emergency response plans tailored to individual project component situations
- implementation of fire prevention, fire watch, and fire response procedures during construction and operation, particularly within forested areas

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- fire breaks will be mapped and recorded in the GIS, maintained by herbicide spraying, slashed or graded at a width 4 to 6 metres around major facilities, plant and equipment. The maintenance of access tracks and RoWs will contribute to fire break provisions through properties.
- cooperate with the Rural Fire Service in respect to any controlled burning
- regular consultation with the Rural Fire Service and landowners on matters of mutual interest (e.g. defining which Australia Pacific LNG dams can be used for fire water, and clearly sign posting dams that are unsuitable for fire fighting purposes)
- installation of emergency shutdown systems, and
- design, siting and construction of facilities using fire resistant materials and in accordance with the Australian Standard 3959 – 2009 Construction of Buildings in Bushfire-prone Areas Third edition.

The Draft Fire Management Strategy outlines aspects such as fire management strategies, preparedness, risk management and also details the development of fire management plans. Fire management plans will be developed for current APLNG properties and further fire management plans will be developed as APLNG acquires land under its management. Fire management plan controls will include but not be limited to:

- fuel risk management controls
- ignition source risk management controls
- life safety and asset loss risk management controls
- environmental and cultural heritage loss management controls

Fire management plans will be developed and implemented by the Land Use and Water Strategy Group. Fire management planning outside of APLNG properties will be through engagement with landholders, fire authorities and all relevant stakeholders where APLNG assets are located.

5.11.2 *Fuel Reduction*

Fuel reduction may be undertaken to protect significant environmental areas from fire. This may include populations of EVNT listed flora and fauna species, and other MNES such as TEC's including Brigalow and SEVT. Fuel load assessments will be undertaken as to be prescribed in fire management planning utilising the *Overall fuel hazard assessment guide 4th edition July 2010*, and will require identification of:

- Assessing surface fine fuel hazard
- Assessing bark hazard
- Assessing elevated fuel hazard
- Overall fuel hazard assessment

Fuel load assessments will be undertaken by suitably qualified APLNG personnel or external provider. Fire management will be undertaken on properties owned by APLNG and planned, implemented and managed by the Land Use and Water Strategy Group.

Fuel reduction strategies may include:

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- stick raking
- herbicide control maintenance lines
- mechanical management strategies involving grading, dozing, slashing or ploughing
- Prescribed burns in negotiation with all relevant fire authorities and stakeholders, landholders and suitably qualified APLNG personnel
- combination of any of these methods.

On a long term basis, it may involve burning of adjacent timbered areas on a three to eight year rotation to reduce the fuel loads and the consequent intensity of a wildfire passing through the area.

5.11.3 *Ecological Fire Requirements*

Fire sensitive plant communities are those that can be killed or severely damaged by fire. These communities contain species that are not adapted to fire and are therefore fire intolerant. Fire is not required as an ecological process to promote regeneration of species in such communities. Examples of fire sensitive vegetation types in the Gas Fields include EPBC listed TECs such as Brigalow woodlands and semi-evergreen vine thicket (SEVT). In addition to plant communities, individual flora and fauna species and their habitats, including Commonwealth and State listed EVNT species may be prone to fire. As such, fire may need to be excluded from populations and habitats. Individual Significant Species Management Plans, both for TECs and listed EVNT species should be referred to for specific ecological fire requirements.

Fire sensitive vegetation types can be naturally protected from fire by growing in sheltered or rocky areas. However, in the current altered landscape many examples of fire-sensitive vegetation are now highly prone to fire due to clearing up to their margins and replacement of the ground layer with improved pastures, such as Buffel Grass and Green Panic, which further promote flammability. Given the decimation of the Brigalow woodland and SEVT TECs in the region by clearing, the exclusion of fire from within these communities is of high priority.

Fuel reduction strategies to protect fire sensitive ecological communities may include:

- stick raking
- herbicide control maintenance lines
- mechanical management strategies involving grading, dozing, slashing or ploughing
- prescribed burns to manage the edge of fire sensitive vegetation in negotiation with relevant fire authorities and stakeholders, landholders and suitably qualified APLNG personnel
- combination of any of these methods.

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5.12 Rehabilitation Maintenance

Following rehabilitation works, limited access to infrastructure will be allowed to perform essential maintenance requirements. All other traffic is prohibited on topsoil areas and should remain off the rehabilitation areas to enable successful establishment of groundcover. Fencing of rehabilitation areas may be required to prevent grazing, with fences to be removed once sufficient vegetation cover has established (i.e. 80% of the cover of analogue sites after 24 months).

Maintenance will take place to ensure the following objectives are met:

- landforms remain stable
- erosion control measures remain effective
- stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters
- plants show healthy growth and recruitment is occurring, and
- declared weed species are controlled on rehabilitated areas to a level consistent with the surrounding property and prevented from spreading to unaffected areas.

It will not be feasible to water all seeded areas, however creek banks and steep slopes are to be selected for watering. This will ensure groundcover is established and erosion is minimised. Rehabilitation areas of the SEVT TEC, where there is a high water requirement for the establishment of vine thicket species, will also require watering. Wherever tubestock planting is undertaken, follow-up watering will also be undertaken. Depending on rainfall watering is to be conducted on a weekly basis until sufficient groundcover is achieved. Watering is to be undertaken with water of a quality suitable for the purpose that meets EA standards. Rehabilitation indictors monitored and their frequency after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

5.13 Rework

Sites not displaying stability (after 12 months) and adequate vegetation cover (80% of the cover of analogue sites after 24 months) (based on success criteria outlined in Section 9.1) through either regrowth or direct seeding will undergo re-seeding. In areas where native vegetation is required, and direct seeding was unsuccessful, follow up tubestock planting may be required. Where further rehabilitation works are required the following will be undertaken as a minimum:

- works will be conducted in consultation with the relevant landholder
- re-contouring of erosion control measures, re-seeding, or reinforcement of scour protection on stream banks if damaged during flood activity
- the re-seeding will be determined from an assessment of existing vegetation type
- where the area is to return to native vegetation local provenance species relevant to the Regional Ecosystem will be used in re-seeding or tubestock planting
- access will be restricted, with consideration of landholder access requirements, to facilitate rehabilitation until monitoring identifies that rehabilitation has been successful

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- if subsidence is observed, corrective actions will include backfilling of depressions and re-seeding, and
- appropriate weed control will be undertaken as required.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6. Disturbance Type

This section provides a summary of the types of infrastructure to be constructed, and where relevant specific details for the rehabilitation of this infrastructure. Depending of the length of operation, rehabilitation may include reinstatement after installation only, or rehabilitation after the removal of infrastructure. Specific techniques for infrastructure types are summarised in Table 4.

Prior to the commencement of disturbance (i.e. vegetation clearing), and the final site selection, environmental, cultural heritage, landholder and engineering constraints will be addressed as per the Environmental Constraints Planning and Field Development Protocol Q-LNG01-15-MP_0109 (the Protocol).

Table 4 Rehabilitation Techniques for Infrastructure (Disturbance) Types

Infrastructure Type	Rehabilitation Technique
Well Pads	• Reinstatement following the completion of drilling to reduce well pad to an 80 x 30 m area. Reprofiling will not occur at this time • Revegetation with native grasses and ground cover species (remnant vegetation) or pasture grasses (cropping or grazing (Section 5.6.2) • On the completion of operations, undertake decommissioning and final rehabilitation, including reprofiling of cut and fill batters
Stimulation Ponds	• Remove remaining water for treatment • Remove synthetic liners • Management of clay core materials: Where clay has been used in embankments or as a liner, this will be re-spread, shaped and capped with topsoil for revegetation or stockpiled for reuse • Site profiling: The pond embankments would be pushed in and depressions filled to return landforms to match surrounding topography. Any retained subsoil would be used to infill ponds • Topsoil re-spreading: Topsoil will be placed to a minimum depth of 250mm • Revegetation in accordance with Section 5.6
Gas and Water Gathering Lines	• Allow portion of ROWs not required to remain open to regenerate

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Infrastructure Type	Rehabilitation Technique
	naturally • Back fill trenches with subsoil then re-spread topsoil (Section 5.4) • Seed areas required to remain open with native grasses and ground cover species (remnant vegetation) or pasture grasses (cropping or grazing (Section 5.6.2) • Seed areas not required to remain open with tree species determined from analogue site surveys (remnant vegetation) or pasture grasses (cropping or grazing) Section 5.6
Gas Processing Facilities	• Undertake reinstatement of areas not required to remain open during operations (Section 5.6.2) • On the completion of operations, undertake decommissioning and final rehabilitation
Main Line	• Allow portion of ROWs not required to remain open to regenerate naturally • Backfill trenches with subsoil then re-spread topsoil (Section 5.4) • Seed areas required to remain open with native grasses and ground cover species (remnant vegetation) (Section 5.6.2) or pasture grasses (cropping or grazing) • Seed areas not required to remain open with tree species determined from analogue site surveys (remnant vegetation) or pasture grasses (cropping or grazing) Section 5.6
Water Transfer Stations and Water Transfer Pipelines	Ponds to be rehabilitated as per other ponds (below) Pipelines ROWs to be rehabilitated by: • Allowing a portion of ROWs not required to remain open to regenerate naturally if soil is not removed • Backfill trenches with subsoil then re-spread topsoil (Section 5.4) • Seed areas required to remain open with native grasses and ground cover species (remnant vegetation)) or pasture grasses (cropping or grazing (Section 5.6.2), and • Seed areas not required to remain open with tree species determined from analogue site surveys (remnant vegetation) or pasture grasses (cropping or grazing (Section 5.6.).
Water Treatment Facilities	• Undertake reinstatement of areas not required to remain open during operations (Section 5.6.2) • On the completion of operations, undertake decommissioning and final rehabilitation.

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Infrastructure Type	Rehabilitation Technique
Ponds	• Treatment/remediation of pond contents (Section 7) • Management of clay core materials: Where clay has been used in embankments or as a liner, this would be re-spread, shaped and capped with topsoil for revegetation or stockpiled for reuse • Site profiling: The pond embankments will be pushed in and depressions filled to return landforms to match surrounding topography. Any retained subsoil would be used to infill ponds • Topsoil Re-spreading: Topsoil will be placed to a minimum depth of 250mm • Undertake re-seeding of topsoil with a seed mix appropriate for the final land use as agreed to by landholders or determined from analogue surveys in accordance with Section 5.6
Above Ground Power lines	• Undertake reinstatement of areas not required to remain open during operations (Section 5.6.2) • On the completion of operations, undertake decommissioning and final rehabilitation
Below Ground Power lines	• Backfill trenches with subsoil then topsoil (Section 5.4) • Seed areas above power lines with native grasses and ground cover species (remnant vegetation) or pasture grasses (cropping or grazing) (Section 5.6.2)
Access Tracks	• Where tracks are to be retained, any wheel ruts will be graded and erosion-control measures such as the construction of diversion drains will installed before handing back to the landholder • Temporary access roads not required for operations or to be retained by the landholder will be rehabilitated by ripping to remove compaction (Section 5.4.7), re-spreading stockpiled topsoil (Section 5.4.8) and revegetation following Section 5.6
Camps	• Undertake reinstatement of areas not required to remain open during operations (Section 5.6.2) • On the completion of operations, undertake decommissioning and final rehabilitation
Borrow Pits	• Backfill with stockpiled subsoil, re-profile, undertake ripping and spread topsoil (Section 5.4) • Undertake re-seeding of topsoil with a seed mix appropriate for the final land use as agreed to by landholders or determined from analogue surveys in accordance with Section 5.6

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6.1 Well Pads

6.1.1 *Description of Activity*

Australia Pacific LNG is proposing to drill up to 10,000 wells over the life of the Project. Typically wells are spaced at 750m, though spacing varies according to a range of site physical and environmental constraints. The maximum area of disturbance associated with the establishment of each well is 1ha. This disturbance footprint is reduced at the completion of drilling / establishment to an area of 80m x 30m and this is maintained for the operational life of the well, typically up to 30 years.

Well lease sites have an irregular shape determined on site to minimise the footprint and maintain safety.

6.1.2 *Installation Process*

The installation process includes the establishment of access tracks and the well site. The shape of the well site is determined based on relief and field physical or environmental constraints.

The sites are cleared, and vegetation where present may be mulched and stockpiled (see Section 5.7). The topsoil is stripped and stockpiled for later use in rehabilitation and or temporary reinstatement. The well site is levelled to provide access to vehicles and equipment. Drilling of the wells is a multistage process involving a primary drilling rig and a completion drilling rig.

At the completion of the well installation typical surface facilities associated with a CSG well are:

- a wellhead through which the gas and associated water is brought to the surface
- a pump that lifts the associated water to the surface
- a micro-turbine or other power supply to drive the pump
- a wellhead separator with associated control devices, and
- fencing to prevent entrapment by livestock and wildlife.

Condabri EA,PEN101674310, Schedule D, Land, D45 requires an assessment of well sites to determine impacts to areas of medium or high environmental value prior to construction and specifies pad drilling or alternative layouts to reduce impacts. The latest generation of drilling rigs support minimal disturbance through directional drilling potentially allowing for multiple well sites to be collocated and or a reduction in the number of required well sites.

6.1.3 *Rehabilitation Process*

Rehabilitation of well sites will consist of two primary processes, reinstatement and final rehabilitation after decommissioning. Reinstatement will commence within 48 hours of the completion of primary drilling but before the completion rig is mobilised. Works will include the removal of any drilling fluids. Supernatant is transported and disposed of at an appropriately licensed facility. Mud within the sumps will be allowed to solidify. Sumps will then be backfilled; solidified mud is mixed with subsoil and compacted to create a hard surface then capped with topsoil. The mixing of solidified mud with subsoil in sumps and capping with topsoil is a globally accepted method to mix and bury sumps for rehabilitation.

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Following the removal of the completion rig, further reinstatement will take place. The disturbance footprint will be reduced to an 80m x 30m area including a hardstand. Ripping of compacted muds will be required before soil is replaced. Reinstatement will include site stabilisation and seeding with grasses as outlined in Section 5.6.2. Re-profiling of cut and fill batters will not occur until final rehabilitation.

Final rehabilitation of well sites will include the following steps:

- decommissioning/removal of infrastructure (to be addressed in a separate decommissioning plan)
- cut and fill batters will be profiled to re-instate the land surface (Section 5.4.6)
- compacted hardstand areas will be ripped (Section 5.4.7)
- stockpiled topsoil will be respread (Section 5.4.8), and
- topsoil will be seeded with pasture grasses, or native species where native vegetation is the required final land use (Section 5.6).

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.2 Stimulation Ponds

6.2.1 *Description of Activity*

Some wells will require stimulation to enable successful gas production as part of the completion of the well. This will primarily be by hydraulic fracture stimulation or 'fraccing', and occasionally by cavitation. Fraccing involves pumping treated fluid (97% water) containing sand grains into coal cleats at a high rate and pressure to form and extend a fracture in the coal reservoir. This creates a high conductivity pathway to the well bore and increases the production capacity of the well. Water for hydraulic stimulation will be sourced from a pond of approximately 4 megalitres, nominally 33m wide and 44m long. The ponds where practical will be collocated on the well pad and will store water sourced from surface runoff or bore water. These ponds may be replaced with tanks or bladders or a single pond that will service a network of wells. Alternatively, associated water may be reused for fraccing.

Ponds will be decommissioned once fraccing is completed, or ponds are replaced with alternative water sources.

After fraccing, the production fluids will be stored in a 4 megalitre tank located on a pad or central produced water dam before transport to a Treatment Facility for treatment. During the field development phase the 4 megalitre tanks are typically replaced with a water gathering system which gathers the produced fluid to pre-treatment dams prior to treatment through the Water Treatment Facility.

6.2.2 *Installation Process*

Source water ponds will be excavated and lined with a suitable liner that prevents loss of stored water through infiltration. Associated water used as source water will be contained in accordance with Condabri EA, PEN101674310, Schedule C, Dams, C1-C4 for low hazard dams.

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Produced water tanks are designed to appropriate engineering standards and will consist of a 4 megalitre iron ring tank with PE liner and concrete foundations for structural support.

Produced water ponds will be lined with a composite liner of highly impermeable 2 mm thick high density polyethylene (HDPE) geotextile membrane overlaying compacted clay that will prevent any loss of water.

Produced water tanks and ponds will be emptied on a needs basis and will be pumped out and transported to a water treatment facility for treatment.

6.2.3 *Rehabilitation Process*

Source water ponds will be decommissioned once the hydraulic fracture simulation treatment has been completed. Produced water ponds or tanks would be decommissioned once the pilot well meets its objective. Decommissioning of the pond will take place within 6 months of a pond or dam no longer being required and rehabilitation of the site will follow. The process of rehabilitation will be as follows:

- **remove remaining water:** remaining water will be pumped out and transported to a Treatment Facility for treatment
- **remove synthetic liners:** options for recycling of the liner materials such as a feed stock for a pyrolytic process for the production of liquid fuels are being identified. Should appropriate recycling options not be identified liners will be disposed of in landfill
- **management of clay core materials:** where clay has been used in embankments or as a liner, this would be respread, shaped and capped with topsoil for revegetation or stockpiled for reuse
- **site profiling:** the pond embankments would be pushed in and depressions filled to return landforms to match surrounding topography. Any retained subsoil would be used to infill ponds
- **topsoil re-spreading:** topsoil will be placed to a minimum depth of 250mm in accordance with Condabri EA, PEN101674310, Schedule C, Dams, C35 and Section 5.4.8. The landform will be re-instated such that it will no longer function as a dam and will be stable, and
- **revegetation:** revegetation will then take place in accordance with Section 5.6.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress. Ponds may also be decommissioned for a beneficial use provided it is agreed to by the landholder or the administering authority.

The process for rehabilitating of tanks will involve the following:

- **remove remaining water:** remaining water will be pumped out and transported to a treatment facility for treatment
- **removal of tank:** the tank structure will be removed and recycled
- **break up of concrete:** the concrete foundations will be broken up and removed for recycling

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- **topsoil re-spreading:** stockpiled soil will be spread back over the area in accordance with Section 5.4.8, and
- **revegetation:** revegetation will then take place in accordance with Section 5.6.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.3 Gas and Water Gathering Line

6.3.1 *Description of Activity*

Flow from each well is separated into water and gas in a small vessel called a wellhead separator. After separation occurs at the wellhead, the low pressure CSG from each of the wellhead separators flows into a system of low pressure buried pipelines which will operate for the life of the Project. In addition, to enable delivery of the CSG to the LNG facility at Gladstone, a network of in-field high pressure pipelines will be developed which will collect gas from a number of GPFs in the Gas Fields and deliver it to the main gas pipelines.

Low pressure pipelines interconnect all wells operating in a specific area to form the gas gathering system. The entire gas gathering system up to the GPF will be constructed from high density polyethylene pipe buried at least 750mm below ground level.

The ROW for the gas and water gathering lines will be dependent on the number of parallel pipelines within the ROW where MNES are present as outlined in EPBC 2009/4974 Condition 5 m ii.

Where possible, the gathering network will be installed in areas of previous disturbance. This includes adjacent to existing infrastructure, access roads and tracks, property and fence boundaries where environmental impact is minimised.

6.3.2 *Installation Process*

The gas and water gathering systems will be designed and constructed considering topography to optimise gravitational pressure and retain a low pressure gathering system to reduce energy requirements.

The low pressure gas and water gathering networks will be installed as follows once vegetation clearing and stockpiling and topsoil soil stripping and stockpiling has been completed:

- surface water drainage and erosion will be managed appropriately to reduce scour and suspension of sediments in overland runoff. Measures such as contour drains and sediment traps will be implemented as outlined in Section 5.5
- The period of time open and length of trenches are kept to a minimum as determined by the construction crew supervisor to reduce the risk of animals falling into the trench, injury to third parties or trench slumping. The length and period of time open is dependent on a number of factors, which include geotechnical conditions, fauna entrapment, water pump out issues, crossing locations, construction crew size and soil conditions.

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- the pipeline will be strung out adjacent to the trench along the gathering network ROW. Pipe-end caps are kept in place to prevent fauna from entering the pipe. The strung pipe will be welded together using special polyethylene pipe welders and lowered into the trench, and
- the trench will be backfilled and re-profiled consistent with the surrounding area. Once re-profiling is completed, the rehabilitation of ROWs will commence.

Staging facilities will be developed to effectively support the gathering network construction. These staging areas may be up to 4ha (Table 3.4 within the Combabula EMP, 16 December 2010), and where possible will be co-located with WTFs and GPFs.

6.3.3 *Rehabilitation*

Pipelines trenches will be backfilled as soon as practicable after pipe laying and rehabilitated as soon as practicable but not longer than three months after completion (Condabri EA, PEN101674310, Schedule H, Rehabilitation, H4). During backfilling of pipeline trenches, soils will be replaced so that the topsoil and subsoil are consistent with the immediately surrounding area. This will allow for natural regeneration, with an access track remaining.

Following soil replacement, areas will be revegetated, as outlined in Section 5.7. Areas required to remain open for ongoing operational access for project operations (access tracks and areas above pipelines) will be revegetated with pasture grasses (where cropping is the final land use), or native grasses and ground cover species (where native vegetation is the final land use).

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.4 Gas Processing Facility

6.4.1 *Description of Activity*

Coal seam gas enters a Gas Processing Facility (GPF) via the gas gathering system. The CSG is compressed in the GPF and dehydrated to remove any remaining water which may have been transferred with the gas through the gas gathering system. The compressed CSG is then sent to the high pressure gas pipeline system for transmission to the main gas transmission pipeline (the main gas pipeline). Construction of each GPF will require the clearing of an area of approximately 50ha, but varying between 32ha and 118ha (Table 3.4 within the Combabula EMP, 16 December 2010).

Based on a conservative 9km drainage circle radius, the Project could have a maximum of 23 GPFs across the entire development area over the 30-year life of the Project; however, the final design will aim to minimise the number of installed facilities. GPFs will not be decommissioned until Project completion; however, some small areas not required to remain open for Project operations will be progressively rehabilitated.

The gas processing facility equipment mainly consists of a raw gas inlet and separation system, a gas compression system, a gas dehydration system, and ancillary equipment.

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6.4.2 *Installation Process*

Construction of GPF facilities will be undertaken as follows, once vegetation clearing and stockpiling and topsoil soil stripping and stockpiling has been completed:

- cut and fill will be used to produce a flat pad and to minimise the requirements for cartage of additional fill material. Local material will be sourced for hardstand areas when required from borrow pits
- contouring will be completed to ensure any existing runoff is diverted around the construction site. Runoff within the facilities will be captured in first flush on-site sediment ponds. Erosion and sediment control plans will identify the measures undertaken to manage erosion and sediment, the type and location of erosion and sediment control devices and management measures that have been applied in keeping with IECA Best Practice Erosion and Sediment Control Guidelines 2008.
- concrete foundations will be constructed to provide support to facility infrastructure as required
- mechanical installation will involve placing the main processing modules, and constructing above ground steel piping connections between each module, and
- electrical and instrument cabling will be installed for each processing module, connecting back to a main control room. This is usually installed in above-ground cable trays alongside the main piping runs.

A number of ancillary support facilities and services will be provided during the construction phase including site offices, temporary accommodation facilities, lunch rooms, ablution blocks and a sewage treatment facility. These facilities will typically be modular transportable buildings, powered by diesel generators, unless reticulated power is available.

6.4.3 *Rehabilitation*

Disturbed areas not required for operations will be reinstated as outlined in Section 5. Following decommissioning at the completion of the project the remaining areas associated with GPF's will be rehabilitated to the surrounding land use in accordance with Section 5.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.5 Main Line

6.5.1 *Description of Activity*

The sections of the main pipeline running through the Gas Fields covered by this RRRMP include the Woleebee Lateral (excluding WKP46.5 to Hub) and the Condabri Lateral (excluding CKP23 to the Hub) which connect to the main pipeline to Gladstone.

The main pipelines have a diameter of 914.4mm (Condabri Lateral) and 762mm (Woleebee Lateral). Pipelines will be located within a 40m ROW which will be reduced to a maximum width of 12m following progressive rehabilitation after installation.

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The pipelines will be buried at a minimum depth of 750mm. However, specifications will apply as per Australian Standard 2885 including the following depth requirements:

- residential, cropping and potential cropping – minimum 900mm
- deep ploughing – to be determined in discussion with landowner
- road crossings/road reserves – minimum 1,200mm
- watercourse crossings – minimum 1,200mm, and
- railway crossings – minimum 2,000mm.

6.5.2 *Installation Process*

Clear and grade will be carried out to provide a safe construction ROW for vehicular movement including pipe trucks, trenching and other construction activities. This clear and grade will occur within a 40m ROW at most locations. During clearing, root stock will be left in the ground where practicable to reduce erosion and to facilitate rapid rehabilitation. Topsoil will be removed and stockpiled as outlined in Section 5.4. In non-cropping areas, topsoil removal may be reduced to a narrow strip (blade-width) over the trench at some locations. In cropping areas, the entire width of the construction ROW will be stripped of topsoil to prevent soil damage.

The following general procedures will be followed for clear and grade activities:

- Topsoil may be graded on both sides of the ROW
- disturbance to natural drainage patterns will be minimised and blockages of channels with graded material will be avoided where practicable
- erosion controls will divert run-off to stable areas off the ROW, such as vegetated areas, without affecting existing overland flow paths, and
- grading of slopes will be kept to a minimum, but the impacts related to slope grading will be mitigated when considered necessary by limiting the grading of narrow ridges and sharp changes of slope to the extent required to allow the pipe to be constructed within the limits of pipe bending, and to permit the safe passage of heavy equipment.

The following procedures will be followed for laying of pipes in trenches:

- subsoil will be stockpiled on the non-working side of the ROW, separate from topsoil
- during construction the length of open trench will be kept to a minimum and will vary depending on the number of construction teams and progress
- trench plugs will be used at appropriate intervals to allow access across the construction corridor and to make it easy for fauna to exit the trench
- ramps will be installed approximately every 500m in the trench to allow fauna to exit the trench
- at crossings of pipelines, utilities, and other foreign services, additional location and excavation procedures will be applied to prevent damage by trench excavation equipment
- the time between trenching and backfilling will be minimised
- at watercourse crossings, trenching will not take place until the welded pipe is ready to install, and

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- trench dewatering will be required if rainfall occurs between trenching and backfilling. Dewatering will be directed onto areas where erosion risk is low, and away from waterways.

The trench will then be backfilled with subsoil as per Section 7.4 and compacted by wheel-rolling in most areas. Pipeline markers will be located at inter-visible intervals along the gas pipeline, in accordance with Australian Standard 2885. The marker signs will be placed on both sides of bends, road, track, railway and watercourse crossings, and at property fence lines and utility crossings.

Open cut trenching across watercourses is the preferred construction methodology for all watercourse crossings. A handful of watercourses that hold high ecological value are being assessed for the suitability of Horizontal Directional Drilling (HDD). The assessment of high risk watercourses (stream order 4 and above) is undertaken in several parts. These parts include aquatic ecological assessments, sediment and erosion assessments, construction, engineering and geotechnical feasibility. The construction methodology will be determined via a risk assessment with input from Construction, Engineering, Environment and Land Access Groups.

6.5.3 *Rehabilitation Process*

Following backfilling of trenches rehabilitation will commence following the methods outlined in Section 5. Direct seeding will be carried out in areas at risk of erosion or in densely vegetated watercourses to enhance natural regeneration. This will include native grasses and groundcover species where native vegetation is the desired final land use.

An operational pipeline access within the easement will be maintained with a maximum width of 12m following re-instatement (Co-ordinator General's Report, Appendix 3, Part 4 Condition E36). The remaining accesses will normally be 4WD tracks and will be limited at sensitive watercourse crossings and other ESAs to the minimum required for vehicle and emergency response equipment access. An area of approximately 3m either side of the pipeline will be maintained without tree cover. This area will include the access.

Temporary construction gates will be removed and fencing will be restored to equal or better condition. Generally a permanent gate will be installed where on-going operations access is required.

6.6 Water Transfer Stations and Water Transfer Pipelines

6.6.1 *Description of Activity*

After separation from gas at the wellhead, the CSG water flows into a buried HDPE water pipeline network. This forms the CSG water gathering network which channels the water to the nearest WTF. A network comprising of low pressure piping, trunklines, pumping stations, tanks and ponds will convey produced water from the various WTS sites to the main feed ponds at the WTFs.

The WTSs are typically comprised of a lined and fenced holding (transfer) pond and pumping station constructed on a concrete pad (200 x 300m) with total operating area required up to 6ha. This area will not be available for rehabilitation until after decommissioning of the WTS.

WTS locations will be determined on a site specific basis as they are dependent on the surrounding terrain, and would ideally be located in existing cleared areas.

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6.6.2 *Installation Process*

Water pipelines will be installed as per other pipes (gas and electrical) by trenching and backfilling (see Section 6.3.2).

WTS's may be either tanks or ponds and will be installed as per Section 6.2.2.

6.6.3 *Rehabilitation Process*

Rehabilitation will take place at the completion of the Project. Ponds will be decommissioned and rehabilitated as per the method for pilot ponds outlined in Section 6.2.3.

Rehabilitation of water transfer pipelines will be undertaken as per the method for gas transmission lines as outlined in Section 6.3.3.

The majority of the equipment contained within the WTS is modular and can be removed as individual units. Equipment will be purged, vented and drained, including any above ground storage tanks before being removed from site. Following removal, rehabilitation will take place as outlined in Section 5.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.7 Water Treatment Facilities

6.7.1 *Description of Activity*

Associated water from the low pressure gathering system is delivered to the Water Treatment Facilities (WTF) feed pond. Associated water typically contains a range of salts which include sodium chloride, sodium carbonate and sodium bi-carbonate. At the WTF, the associated water is treated using a variety of processes. The water treatment facilities will vary in size depending on the volume of associated water produced, being between 32 and 118ha (co-located with GPFs) (Table 3.4 within the Combaula EMP, 16 December 2010). The main treatment technology being considered is desalination via reverse osmosis technology. The result is a 'permeate' stream, while the dissolved salts are kept aside as a concentrated saline solution (brine stream).

Water Treatment Facilities will not be available for rehabilitation until the completion of water treatment. However, some small areas not required to remain open for Project operations will be progressively rehabilitated.

6.7.2 *Installation Process*

The typical infrastructure associated with a WTF is the treatment building containing filtration and reverse osmosis units, lined feed water ponds, lined storage ponds for saline effluent and neutralised backwash effluent, treated CSG water ponds, a chemical storage facility and internal roads. The facilities are modular and responsive to actual development sequence and CSG water flow rates.

Construction of the WTFs will be undertaken following the general installation process for GPFs outlined in Section 5.5.2.

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6.7.3 *Rehabilitation Process*

Disturbed areas not required for operations will be rehabilitated following the method outlined in Section 5. Remaining areas associated with the WTF will be rehabilitated in accordance with Section 5 at Project completion.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.8 Ponds

6.8.1 *Description of Activity*

Several types of ponds will operate for the treatment of associated water and other by-products. These include:

- pilot ponds
- water transfer stations
- permeate ponds
- saline effluent (brine) ponds
- neutralised backwash effluent ponds, and
- feed ponds

Requirements for the design and management of dams are outlined in the Condabri EA, PEN101674310, Schedule C, Dams, and are detailed below if relevant to pond or dam rehabilitation. All ponds will be fenced following construction to prevent access to waters by livestock and wildlife (Condabri EA, PEN101674310, Schedule D. Land, D30).

Ponds are designed and will be operated such that adequate free capacity exists above the maximum water level to contain a wet season rainfall (4months over summer) that would occur only once in 100 years for brine ponds and other CSG water ponds which are considered to be high hazard (based on downstream receptors); and once in 20 years for other CSG water ponds. That is not to say that such an event would certainly lead to overtopping as a number of other conservative assumptions are used in the sizing calculation. As for the infrastructure that conveys water from and around the ponds that is designed to convey flows from an event of a probability less than one in 5000 years.

The rate of leakage from the primary liner in systems where leak collection and removal systems are used (brine ponds) will be continually monitored. Leak detection system will provide a daily picture of liner resistivity where that is used (other CSG ponds). Monitoring of groundwater monitoring networks around each pond will be carried biennially and a report produced on the results of all leakage monitoring systems.

The ponds will have a maximum base area of 21ha (Table 3.4 within the Combabula EMP, 16 December 2010).Descriptions of each of the pond types listed above are provided below.

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6.8.1.1 Pilot Ponds

Prior to production scale development of the Gas Fields, pilot projects are undertaken to verify the gas reserves in existence.

Each pilot project typically involves a small number of wells (generally between 1 and 10) together with a small water and gas handling network. The pilot wells are operated for between 6 and 18 months to gather data about the reserves and plan the development of a full production scale field. These ponds will be decommissioned within five years after the completion of use, allowing for evaporation and sedimentation to take place.

Larger volumes of water are most efficiently accommodated in lined earthen ponds whilst smaller volumes may be stored in steel panel tanks.

Ponds constructed for this purpose are defined as regulated dams under Condabri EA, PEN101674310, Schedule C, Dams, C5 and C6. This necessitates particular design considerations to minimise the risk of loss of containment through seepage, overtopping or structural failure. Hydraulic design parameters and liner performance requirements are provided in DERM's *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*.

6.8.1.2 Brine Ponds

The salts removed from the associated water during reverse osmosis treatment are concentrated into a low volume reject or 'brine' stream. This stream has a salt content of between 20 and 70 g/l. This brine will be stored in fully engineered, purpose-built, lined ponds to further concentrate the stream by evaporation.

A separate stream of saline effluent will result from the neutralisation of process fluids used in the regeneration of ion exchange resins used as part of pre-treatment processes. This stream will be sent to separate effluent ponds which are constructed and operated to the same standard of containment as the brine ponds.

Brine ponds will be constructed over the life of the project as the capacity of the existing ponds is consumed. Crystallised salt and supersaturated salt solution will be removed from the ponds periodically and at the decommissioning stage. Australia Pacific LNG is currently conducting negotiations with a number of parties engaged in the crystallisation and marketing of salt products and a number of trials are underway. Any residual salt which is not available for sale is proposed to be transported to a third party waste facility. Decommissioning will be undertaken as the field water flows begin to decrease and ponds are no longer required which is likely to be after approximately 15 years. Any disposal of salts will likely occur after a period of 15 years of evapoconcentration of the salt solution in ponds.

Due to the nature of the contents of the brine ponds, they are also classified as regulated dams under Condabri EA, PEN101674310, Schedule C, Dams, C5 and C6 This also necessitates particular design considerations provided in DERM's *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*.

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6.8.1.3 Feed Ponds

The feed pond is a storage area into which CSG water from the low pressure gathering system will flow from the extraction wells to where the WTF inflow will be drawn. The ponds will be divided into two compartments; a feed compartment and buffer storage compartment.

The two compartments will also allow coarse sediment to settle, allow any free gases entrained in the water to escape, and reduce the temperature to less than 35°C.

6.8.2 *Installation Process*

6.8.2.1 Pilot Ponds

All pilot ponds incorporate a continuous polymer geomembrane liner over a compacted clay under liner to limit the potential for seepage to move beyond the bounds of the ponds. After installation of the membrane, it will then be subjected to electric leakage detection in accordance with Australian Standard TM 7002/7007 (as applicable) and repair of any leaks which are detected. Ongoing leakage monitoring involves a shallow groundwater monitoring program in the vicinity of the ponds as well as periodic leakage detection through similar electric methods as the initial testing.

6.8.2.2 Brine Ponds

Ponds will be of the “turkey’s nest” style with an earthen bund constructed of suitable selected and compacted material. Generally the bunds will be battered at a slope of 1:3 depending on the material selected. Design top operating water level will be 4.7m above the base of the ponds with a design storage allowance and spillway freeboard to be contained above that level. Bunds will incorporate an emergency spillway and a vehicle access track along the crest. Location and external drainage of the ponds will seek to exclude all external runoff from entering the ponds. Downstream surfaces will be vegetated to reduce erosion and anywhere that concentrated surface water flows could be expected against the toe of the batter, rock protection will be applied.

Internal surfaces of the bunds and the floor of the ponds will be continuously lined with an advanced liner system. The current base case liner system to be deployed consists of a dual layer with intermediate drainage. A highly impermeable 2mm thick high density polyethylene (HDPE) geomembrane material forms the uppermost layer and whilst intact will prevent any loss of stored effluent. As a contingency in case of a leak developing in the primary HDPE liner, a secondary HDPE liner is laid underneath.

In order that any leakage from the primary layer is detected and removed before it can build up a pressure on the secondary layer, a drainage network is to be incorporated. The drainage layer is formed by a layer of structured plastic drainage product which is intersected by a network of graded slotted pipe bedded in coarse sand. This network will collect and centralise any effluent that enters the drainage system to a pumping sump from where it can be returned to the pond.

6.8.2.3 Feed Ponds

Feed ponds will be lined with a composite liner of highly impermeable 2mm thick high density polyethylene (HDPE) geomembrane layer that will prevent any loss of stored water. This will

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overlay a compacted clay layer. The clay used can be matched to be compatible with the stored water in order to ensure continued containment for the life of the pond.

6.8.2.4 Pond Embankments

Stabilisation of pond batters is required following construction to ensure the ongoing integrity of these facilities. Options for establishing vegetation cover include selecting grass species that establish through runners that will stabilise the soil, or using hydro-mulching. Hydro-mulching is a combination of spraying a mix of seed, fertiliser, organic mulch, a binder and water onto the soil surface.

6.8.3 *Rehabilitation Process*

6.8.3.1 Pilot Ponds

Pilot pond decommissioning will be conducted within five years of the completion of the CSG associated activities. Pond will be maintained so as to prevent environmental harm until the pond is decommissioned. As per state policy, landholders upon whose land ponds are built will be given the option to keep the ponds for their own water storage purposes, if also agreed to by the administering authority. Prior to this occurring however any residual in the pond must be quantified and tested to demonstrate that it is safe and would have no ongoing adverse impacts on the landholder's use of the pond. Any water remaining in the pond after removal of the bulk of the water will be tested in independent laboratories to ensure it is below trigger salinity levels. In the case where significant leakage events occurred a contaminated land assessment and remediation process will be triggered.In other cases, ponds will remain in use as transfer ponds as an intermediate aggregation point for CSG water from ongoing operations being conveyed to WTFs.

Given uncertainty in alternative reuse options, there will be a portion of salt residue or salt contaminated material which will require disposal. Due to the potential for this waste to produce highly saline solution on contact with water, and subsequent environmental damage associated with failure to contain that solution, it will likely be classified as regulated waste and the appropriate controls will need to be put in place for its transport, transfer and disposal. In most cases however, salt will be removed from the pilot ponds in a dissolved state. The ponds remaining liquid contents will be transferred for treatment to a brine pond.

In line with the waste management hierarchy which underpins the *Environmental Protection (Waste Management) Policy/Regulation 2000*, the volume of material sent for disposal will be minimised through consideration of higher order strategies such as recycling. Australia Pacific LNG will assess disposal options available for contaminated material including salts and dam liners in accordance with the waste management hierarchy.

Ponds which are no longer required will be decommissioned in a manner which eliminates any ongoing environmental hazard. Once the saline liquor is removed, the ponds will require rehabilitation to remove any source of potential contaminants and return the land to a useable form. The landform will be re-instated such that it will no longer function as a dam and will be stable. The process for decommissioning and rehabilitation the pilot ponds will involve the following major components:

- remove and recycle synthetic liners

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- assess any land contamination which may have occurred. In the case were some leakage of the liner system has occurred a full contaminated land assessment will be undertaken as per the *National Environment Protection (Site Assessment) Measure 1999*
- remediate soils through removal to a soil remediation area or in-situ treatment of contaminated soils where required through the site assessment by a suitably qualified and experienced person to the satisfaction of the regulator and in accordance with the National Environment Protection (Site Assessment) Measure 1999.
- retain clay materials where clay has been used as part of the containment system. Clay will be stockpiled for reuse where appropriate or shaped and capped with topsoil for revegetation. Where clay cannot be reused, it will be ripped and covered with subsoil, and
- rehabilitate the site by pushing in pond embankments and filling in depressions to return landforms to match surrounding topography. Any retained subsoil would be used to infill ponds and topsoil will be placed to a minimum depth of 250mm. The topsoil will be revegetated following Section 5.6.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.8.3.2 Brine Ponds

The decommissioning of saline effluent ponds can only be undertaken when the water used to flush the processing equipment and pipelines has been collected and treated by the water treatment facility.

Disposal of salt would commence from the point at which solid salt can be isolated through evaporation in ponds or enhanced crystallisation processes. Under the base case, ponds are expected to reach significant solids contents after approximately 15 years. However, depending on the favoured options for brine crystallisation, further processing and beneficial use of pond contents is likely to commence in advance of this timeframe. Any residual brine and/or solid salt which is unsuitable for beneficial use, will be removed and transported to an off-site facility that can lawfully reuse, recycle or dispose of such waste under the EP Act.

Once taken offline, the brine ponds which are no longer required will be decommissioned in a manner which eliminates any ongoing environmental hazard, and will be rehabilitated to return the land to a useable form. The landform will be re-instated such that it will no longer function as a dam and will be stable. The process for the decommissioning and rehabilitation of ponds will involve the major components listed above for Pilot Ponds.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.8.3.3 Feed Ponds

Once no longer required, and all water has been treated, the process for decommissioning and rehabilitation of ponds will involve the major components listed above for Pilot Ponds.

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6.9 Above Ground Power Lines

6.9.1 *Description of Activity*

Early grid power to each of APLNG's proposed GPFs will be supplied with high voltage electricity from an Ergon or Powerlink 132kV switching station, located on land provided by APLNG. These proposed switching stations will be connected via a 132kV transmission line. Later grid power is to be provided by a proposed Powerlink 275kV line.

6.9.2 *Installation Process*

The footprint of each switching station is approximately 120m x 120m and will be located within a Powerlink owned property measuring 200m x 250m (total area 5ha). Construction of each GPF will require an area of approximately 50ha, of which approximately 5ha is dedicated to the switching station and will be developed by Powerlink (Powerlink 2011).

6.9.3 *Rehabilitation Process*

Energy infrastructure may remain if a further appropriate use can be foreseen. Otherwise it will be dismantled for recycling, scrap metals or transported to a waste disposal facility at Project completion.

Rehabilitation will follow Section 5 and will reflect the surrounding land use.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.10 Below Ground Power Lines

6.10.1 *Description of Activity*

Step down transformers at the GPF will provide 22kV electrical supply for the plant operation and for the wellhead electrification distribution network. The electricity infrastructure to service well pads will comprise of a 22kV supply main to nodal substations. Each nodal point (there may be several for each supply) may feed up to 12 well sites. Each nodal point will have an isolation consisting of 22KV to 1,000V transformers. The individual well feeds will be by a 1,000V underground cable.

Prior to the construction of GPFs power will be provided by reciprocating, engine driven generators, which are to be located at the GPF. In addition, some remote sites are to be excluded from wellhead electrification and will be provided with a local gas fuelled generator.

The electrical cables are to be direct buried in a trench, within the same ROW as the trench for gas and water piping. Where there is a single LV cable, the electrical LV cable will be located in the same trench used for gas and water piping. This area will be progressively rehabilitated to an operating ROW with an open access track.

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6.10.2 *Installation Process*

The nodal substations will be pre-assembled, kiosk type substations delivered as a modular unit. Details of the design of nodal substations are provided in the APLNG Wellhead Electrification Design Basis Q-LNG01-60-PH-0002. Nodal substations will be located within the wellhead lease area.

The proposed depth of trenching is approximately 1,100mm with the depth of the LV cable being 1,050mm after the laying of cable bedding material. The depth of cabling will be deeper where the cable is to cross under gas and water pipelines. The depth of trenching will be deeper at some obstacles, such as sealed roads, railways, and the crossing of large creeks and the Condamine River. Trenches will be 300/500mm wide. Methods for the excavation of trenches and the laying of cables are outlined in the APLNG Wellhead Electrification Design Basis Q-LNG01-60-PH-0002.

6.10.3 *Rehabilitation Process*

Trenches will be backfilled immediately after cable laying and rehabilitated as soon as practicable but not longer than three months after completion (Condabri EA, PEN101674310, Schedule H, Rehabilitation, H4). Following backfilling and topsoil re-spreading areas will be reinstated, as outlined in Section 5.6.2.

6.11 Access Tracks

6.11.1 *Description of Activity*

Some access roads will need to be constructed to provide temporary and permanent access to project facilities within the Gas Fields including gas pipeline infrastructure. All weather access is required to GPFs throughout the life of the Project. In determining the location of these facilities, consideration will be given to the proximity of existing roads and the local environment. Clearing of remnant vegetation for the establishment of tracks will not exceed 10m width for the purpose of establishing tracks and 20m width for dual carriageway roads (Condabri EA, PEN101674310, Schedule D, Land, D8). However in Category B or C ESAs clearing for establishing tracks will not exceed 6m width (Condabri EA, PEN101674310, Schedule D, Land, D15b).

6.11.2 *Construction Process*

Roads will be designed to a standard suitable for the expected quantity of traffic, with the following considered:

- the roads will be constructed such that it can support the intended volume of traffic for the duration of the well, or provision made to maintain it
- erosion control in the form of flat-bed drains, diversion banks or ripping, will be included in the design
- roads and tracks will be constructed across slopes where possible. Where tracks must go down slopes, contour banks will be used at intervals appropriate to the slope to control the flow of surface water so as to minimise erosion, and
- during road construction, surface leveling and clearance of vegetation will be minimised by selecting the most stable and previously cleared path possible.

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Where a watercourse crossing is required the following measures will be put in place:

- wherever practicable, the existing road network and private access tracks will be used to access the proposed ROW and associated construction sites, and for moving equipment and personnel
- access across watercourses is likely to be required where the construction is not adjacent to an existing track. For dry watercourses the access will need to be in place for the duration of construction. Access tracks through dry waterways will be a bed level crossing constructed no higher than the natural bed level. The track will be constructed from rocks similar to the natural bed material at the site and the surface will be left rough and not over compacted.
- for watercourse the access would vary depending upon the level of flow. For low flow watercourses flumes/ culverts would be used and designed to state regulations to prevent obstruction and to maintain the water flow and the access maintained until the construction activities at the site are fully reinstated. Site specific erosion control plans will be implemented in conjunction with the design of the flume/culvert and implemented. For high flows alternative access locations would be sought normally utilizing existing fords or bridges, and
- the width of any new access track will be restricted to the minimum required to enable safe vehicle movement; where possible, existing tracks will be used to minimise additional clearing.

In addition to the above, the following mitigation measures will be put in place:

- periods of stream flow will be avoided where possible when constructing roads across watercourses (particularly major watercourses). The flow of water within the watercourse will not be blocked off in any way without a permit to do so under the *Water Act 2000*. Flow diversion will only be temporary, with previous flow restored as soon as practical in compliance with permit conditions
- clearing of mature trees (e.g. Coolibah, River Red Gums, or Queensland Blue Gum) and thick vegetation will be avoided where possible, and
- banks and beds of watercourses will be reinstated to the state that existed prior to construction and to a stable condition. Site specific erosion control plans and measures from these plans(e.g. off-take drains, stone mattresses) will be installed on banks where it appears that gullying is likely to occur and on upslope sections of the road and access tracks to prevent erosion on or off the access.

6.11.3 *Rehabilitation Process*

APLNG will close access roads to temporary facilities, laydown areas and stockpile sites that have been constructed as part of the Project, unless relevant government agencies or landowners agree with APLNG to leave them in place (Chapter 1, Volume 6, APLNG EIS, commitment 6.1.15).

Temporary access roads not required for operations or to be retained by the landholder will be closed and reinstated to a condition compatible with the surrounding land use. This will involve ripping to remove compaction (Section 5.4.7), re-spreading stockpiled topsoil (Section 5.4.8), and revegetation following Section 5.6. Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

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Access tracks in existence prior to construction will have access re-instated and will not to be blocked in anyway. Where tracks are to be retained, any wheel ruts will be graded and erosion-control measures such as the construction of diversion drains will installed before handing back to the landholder.

6.12 Camps

6.12.1 *Description of Activity*

Accommodation camps are co-located with the GPFs. These camps include accommodation to house up to 450 personnel and associated facilities. As these camps are to operate in the long-term they are not expected to be available for rehabilitation until the completion of Project operations.

A number of short term camps and support facilities and services will be provided during the construction phase including site offices, lunch rooms and ablution blocks. Temporary accommodation facilities will include individual units, mess halls, recreational facilities, utilities, car parking, sewage treatment plants, administration facilities and waste management areas.

6.12.2 *Construction Process*

Most campsite buildings will be constructed by locating modular transportable buildings, powered by diesel generators, unless reticulated power is available.

6.12.3 *Rehabilitation Process*

Temporary camps will be rehabilitated following the completion of use. However, long-term camps will not be available for rehabilitation until final project decommissioning. Areas not required to remain open may however be rehabilitated.

Since the buildings in temporary camps are modular transportable buildings, they will be transported off-site before rehabilitation commences.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

6.13 Borrow Pits

6.13.1 *Description of Activity*

Borrow pits are an incidental activity under the *Petroleum and Gas (Production and Safety) Act* necessary for the construction of infrastructure.

Material to be extracted is likely to include gravel (for roads and drill pads) sand and clay (for lining ponds). Borrow pits will be operational until the required material has been extracted. These borrow pits will be decommissioned and rehabilitated as soon as extraction is completed.

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6.13.2 *Construction Process*

Prior to the construction of borrow pits APLNG will undertake an assessment of the environmental values, potential impacts, and mitigation measures for the siting, construction, operation, decommissioning and rehabilitation of borrow pits and will provide this assessment to the administering authority (Co-ordinator Generals Report, Appendix 2, Part 2, Condition 15).

The following steps will be used to extract gravel, sand or clay:

- access road and hard stand area creation, either by cutting into the slope or placing and compacting subsoil material
- push downing on the advancing bench face with a dozer or excavator and depositing in a temporary stockpile, and
- retrieving stockpiled material and processing through a vibrating screen (if required) or retrieving stockpiled material and loading directly into trucks for transportation off site.

6.13.3 *Rehabilitation Process*

Once the quarry material from a borrow pit site has been exhausted, rehabilitation of the borrow pit will commence. Backfilling of the site with subsoil is required to ensure the surface is in close alignment with the natural contours of the existing landscape while allowing for a lower surface due to material that has been extracted. Backfilling should be completed to ensure surface subsidence is avoided.

Following the replacement of topsoil, direct seeding will be required following Section 5.6.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

7. Remediation

7.1 Notifiable Activities

Activities that have been identified as likely to cause land contamination are listed in Schedule 3 of the *Environmental Protection Act 1994*. Under the Act, landowners or occupiers and local government must inform the department (DERM) that land has been or is being used for a notifiable activity. Land that has been or is being used for a notifiable activity is recorded on the Environmental Management Register (EMR), which is maintained by DERM.

Australia Pacific LNG Project Gas Field EMP's list the range of notifiable activities associated with Gas Field development and they are listed below as they appear in Schedule 3 *Environmental Protection Act 1994*:

- 7. Chemical storage (other than petroleum products or oil under item 29)-storing more than 10t of chemicals (other than compressed or liquefied gases) that are dangerous goods under the dangerous goods code

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- 23. Metal treatment or coating-treating or coating metal including, for example, anodising, galvanising, pickling, electroplating, heat treatment using cyanide compounds and spray painting using more than 5L of paint per week (other than spray painting within a fully enclosed booth)

- 29. Petroleum product or oil storage-storing petroleum products or oil-

  (a) in underground tanks with more than 200L capacity; or

  (b) in above ground tanks with-

  (i) for petroleum products or oil in class 3 in packaging groups 1 and 2 of the dangerous goods code-more than 2500L capacity; or

  (ii) for petroleum products or oil in class 3 in packaging groups 3 of the dangerous goods code-more than 5000L capacity; or

  (iii) for petroleum products that are combustible liquids in class C1 or C2 in Australian Standard AS 1940, 'The storage and handling of flammable and combustible liquids' published by Standards Australia-more than 25 000L capacity.

- 37. Waste storage, treatment or disposal-storing, treating, reprocessing or disposing of regulated waste (other than at the place it is generated), including operating a nightsoil disposal site or sewage treatment plant where the site or plant has a design capacity that is more than the equivalent of 50,000 persons having sludge drying beds or on-site disposal facilities.

Areas within the Gas Field operation that include these notifiable activities will be registered on the EMR. Land may be removed from the EMR if the landowner or occupier has information that shows the listing was either incorrect, i.e. the land has not been used for a notifiable activity or that the land is not contaminated. Land is removed from the EMR if, after a site investigation report has been submitted to the administering authority no contamination is found or work is done to satisfactorily remediate the land.

Section 7.3 provides an outline of the site investigation process to be employed in association with any land parcels where notifiable activities have taken place and or hazardous materials have been released.

7.2 Hazardous Materials

The list of hazardous materials in use by the Project and present within the Gas Fields is provided in the Gas Field EMP's:

- Talinga Orana EMP refer to Section 4 or http://www.aplng.com.au/talingaorana-environmental-management-plan

- Combabula EMP refer to Section 3 or http://www.aplng.com.au/combabula-environmental-management-plan

- Condabri EMP refer Section 3 or http://www.aplng.com.au/condabri-environmental-management-plan

All chemicals will be stored and handled in accordance with the relevant legislative requirements and Australian Standards including the provisions of:

- AS 3780:2008 - The storage and handling of corrosive substances

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- AS 1940:2004 - The storage and handling of flammable and combustible liquids.

7.2.1 *Notification of Hazardous Material Release*

The existing HSE incident reporting system 'Origin Collective Intelligence System' OCIS will be used for all field activities conducted by the workforce including contractors. Environmental incidents and observations will be reported using the HSE Alert process included within the system.

Australia Pacific LNG will notify DERMs Pollution Hotline (1300 130 372) or local office as soon as practicable after becoming aware of any release of contaminants not in accordance with the conditions of the environmental authority or any event where environmental harm has been caused or may be caused.

Gas Field EMPs provide detailed processes for notification and reporting the release of contaminants refer to Section 5.7 of the Combabula EMP (Australia Pacific LNG and Worley Parsons, 16 December 2010).

The notification of emergencies or incidents will include the following information

- the environmental authority number and name
- the name and telephone number of the designated contact person
- the location of the emergency or incident
- the date and time of the release
- the time the authority holder became aware of the emergency or incident
- the estimated quantity and type of any substances involved in the incident
- the actual or potential suspected cause of the release
- a description of the effects of the incident including any environmental harm that has occurred

or may occur as a result of the release

- any sampling conducted or proposed, relevant to the emergency or incident
- actions taken to prevent any further release and mitigate any environmental harm caused by the release.

A written report will be provided to the administering authority within 10 days following the initial notification of an emergency or incident or receipt of monitoring results (whichever is the later). The report will include:

- results and interpretation of samples taken at the time of the incident and analysed

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- outcomes of actions taken at the time of the incident to prevent or minimise environmental harm

- proposed actions to prevent a recurrence of the emergency or incident.

Within six weeks of any environmental monitoring performed in relation to the emergency or incident, a written report on the results of any such monitoring will be provided to the administering authority.

7.3 Site Investigation

Preliminary site investigations are conducted to determine the presence or absence of site contamination where notifiable activities have been conducted, where evidence of leakage or spillage of hazardous material is detected.

A preliminary site investigation will includes the following components:

- development of a site history
- an inspection of the site
- a basic sampling program to determine if contamination is present, and
- report preparation.

Investigations will be conducted by suitably qualified persons. The *Environmental Protection Act 1994* requires persons submitting contaminated site investigation reports to be members of a prescribed professional organisation listed in Schedule 8 of the *Environmental Protection Regulation 2008*. Persons conducting site investigations should hold appropriate qualifications, have experience relevant to the investigation and be approved by DERM.

A comprehensive site history of the investigation area will identify all past and present potentially contaminating activities. Information obtained from the site history research will be used to assess the potential for contamination on the site and determine the most appropriate locations for sampling. Sampling is required in areas where the site history research indicates that possible contaminating activities have been conducted. Site history information will be supported by all available copies of original site plans, local authority zoning records, flammable and combustible liquids licence details, sewerage/trade waste and stormwater drainage plans, aerial photographs, environmental licences etc. All available evidence, including verbal interviews and analysis reports, will be included. Interviewees' relationship to site activities should be documented.

The possibility of contamination due to activities on adjacent land and the possibility of contamination extending beyond the site boundaries should also be examined.

Areas which have received imported fill should also be assessed.

Site investigations should be conducted in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* and attending Schedules and the provisions of the *Environmental Protection Act 1994*.

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7.4 Remediation

7.4.1 *Saline Ponds and Dams*

Several types of ponds and dams will operate for the treatment of associated water and other by-products. These facilities are defined as regulated dams under DERM's draft Manual for Assessing Hazard Categories and Hydraulic Performance of Dams where hydraulic design parameters and liner performance requirements are specified.

The purpose of these facilities, their construction technique, size and duration of use is described in Section 6.8.

These ponds generally incorporate a continuous polymer geomembrane liner over a compacted clay under liner to limit the potential for seepage. At construction ponds and dams are subjected to electric leakage detection in accordance with Australian Standard TM 7002/7007 (as applicable). Ongoing leakage monitoring involves a shallow groundwater monitoring program in the vicinity of the ponds as well as periodic leakage detection through similar electric methods as the initial testing.

In some designs a drainage network is incorporated for the management of potential leakage. The drainage layer is formed by a layer of structured plastic drainage product which is intersected by a network of graded slotted pipe bedded in coarse sand. This network collects and centralises effluent that enters the drainage system to a pumping sump from where it can be returned to the ponds.

In line with the waste management hierarchy which underpins the *Environmental Protection (Waste Management) Policy/Regulation 2000*, the volume of materials sent for disposal is minimised through consideration of higher order strategies such as recycling. APLNG will assess disposal options available for contaminated material associated with these facilities including salts and dam liners in accordance with the waste management hierarchy.

Once taken offline, residual materials within the saline ponds and dams are removed to the nearest Australia Pacific LNG operated WTF for either further processing or disposal. In some cases decommissioning includes a period of up to five years to allow evaporation and sedimentation to progress, refer to Section 6.8 for details.

Ponds which are no longer required will be decommissioned in a manner which eliminates any ongoing environmental hazard. Once saline liquor and waste products are removed the facilities will require rehabilitation to remove any source of potential contaminants and return the land to a useable form. The landform will be re-instated such that it will no longer function as a dam and will be stable. The process for remediation of these facilities will involve the following major components.

- removal of saline wastes and liquors for further treatment or disposal
- remove and recycle synthetic liners
- assess any land contamination which may have occurred. In the case were some leakage of the liner system has occurred a full contaminated land assessment will be undertaken as per the *National Environment Protection (Site Assessment) Measure 1999*, and

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- remediate soils by removing to a soil remediation area or in-situ treatment of contaminated soils where required through the site assessment, refer to Section 7.4.2.

7.4.2 *Soils*

Soils will be remediated following the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. As outlined in the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites,* the preferred order or options for site clean-up and management are:

- on-site treatment of the soil so that the contaminant is destroyed or the associated hazard is reduced to an acceptable level, and
- off-site treatment of excavated soil' so that the contaminant is destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site.

Purpose built soil remediation areas may be established for the remediation of contaminated soil from various locations. These locations are yet to be confirmed and current remediation of soils involves transportation to licensed waste disposal facilities. Contaminated soils are to be transported by a regulated waste removal provider to the proposed purpose built soil remediation areas for remediation or a current licensed waste disposal facility. Following the removal of contaminated soils visual inspections and contamination testing will be undertaken to confirm that all contaminated soil has been removed. Documentation for the transport, disposal (permits and disposal dockets) and reports for contaminated soil analyses will be retained by APLNG and data stored as identified in section 10.2.
Soil remediation strategies may include:

- excavating contaminated soil and burying it at one location on site (this reduces the area containing contaminated soil)
- installing horizontal, vertical or reactive barriers
- constructing an engineered landfill cell on site (for situations with shallow groundwater, permeable soils, leachable contaminants or very high results)
- solidifying (locking contaminants in solidified matrix) or stabilising (converting contaminants to a less mobile and/or less toxic form, typically by chemical reaction) when contaminants are highly leachable, then incorporating with one of the above options
- land farming volatile contaminants and reusing soil on-site (if no sensitive receptors are nearby)
- land farming volatile contaminants at an offsite location then returning the soil to site
- on-site or off-site treatment, for example thermal desorption, and
- in-situ biological (e.g. air stripping, sparging or venting) or chemical treatments. These be considered for permeable soils but are usually slow processes.

  The appropriate soil remediation strategy will be determined by engagement with Environment Group who will identify a strategy in compliance with *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* with the preferred order for site clean-up and management applied. The selected soil remediation strategy will be documented and strategy chosen will be a reflection of

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the level of contamination, the type of contaminant and the surrounding environment where contamination has occurred.

8. Rehabilitation Type

8.1 Remnant Vegetation

8.1.1 *Disturbance Limits*

Ecological communities existing within the Gas Fields include listed ecological communities under the EPBC Act (Commonwealth), and Endangered, Of Concern, Least Concern or Not of Concern Regional Ecosystems under the *Vegetation Management Act 1999* (VM Act) (Queensland).

Threatened Ecological Communities (TECs) (EPBC status) present within the Gas Fields area include Brigalow, SEVT and Weeping Myall open woodland. No clearing of Weeping Myall woodland is permitted under the EPBC Approval 2009/4974, however clearing of 94.61ha of Brigalow woodland and 4.91ha of SEVT is permitted.

Threatened Ecological Communities (TECs) (EPBC status) not identified within the gas fields include:

- Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland TEC
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and derived native Grassland

As the above threatened ecological communities have not been identified within the gas fields development area and clearing of Weeping Myall woodland is not permitted under the EPBC Approval 2009/4974, these TECs have not been addressed within this plan. If the above ecological communities are detected APLNG will develop and submit to DSEWPaC for approval rehabilitation techniques for these TECs.

Where there are direct impacts on TECs, compliance with the following policies and draft policies will be implemented:

- Queensland Government *Environmental Offset Policy* (QGEOP)
- Draft Policy Statement: Use of environmental offsets under the environment Protection and Biodiversity Conservation Act 1999

The Queensland Department of Environment and Resource Management Policy for Vegetation Management Offsets VEG/2006/2888 – version 2.4 (21/10/2009) will not be referred in this plan. Environmental protection aspects of petroleum extraction are regulated under the *Environmental Protection Act* 1994 (Qld) and this policy does not apply to the Project.
More specifically Threatened Ecological Community Management Plans (TECMP) for the TECs have been submitted and are currently under review. TECMP will make specific references to the recovery of these threatened ecological communities and include measures on avoidance, mitigation and management practices to minimise impacts and aid recovery.

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8.1.2 *Rehabilitation Objective*

The overall objective for the rehabilitation of native vegetation listed as a TEC under the EPBC Act is to achieve active site remediation and rehabilitation of impacted areas to promote and maintain long term recovery of affected environments (EPBC 2009/4974, condition 4c). The aim of the rehabilitation following disturbance of all other remnant vegetation is to restore remnant vegetation, connectivity and the fauna habitat of the Regional Ecosystem.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

8.1.3 *Rehabilitation Technique*

There are slight differences in the techniques for revegetation of the dominant species within each RE, based on these species natural regeneration processes in response to fire and other natural disturbances. As such specific rehabilitation techniques for broad vegetation groups (based on the dominant species which the REs share) are provided in Appendix F, except for TECs where rehabilitation techniques are provided in Section 8.1.4 below. General soil handling and site preparation techniques as outlined in Section 5 will be similar irrespective of the broad vegetation group.

The general revegetation technique for remnant vegetation will be direct seeding as outlined in Section 5.6.3. However there will be certain situations where tubestock planting will also be required, such as where species unsuited to direct seeding must be established, e.g. Brigalow and some SEVT species (refer to Section 8.1.4 below for specific requirements for TECs.

The seed mix for areas of remnant vegetation will be determined by the vegetation composition of the Regional Ecosystem as determined by analogue surveys (Section 10.2.1). Consideration will be given to a seed mix including native grass species that will provide good protection from erosion in the short term but also allow shrubs and tree seedlings to establish successfully. Where it is necessary to keep areas free of trees during project operations (such as along pipeline ROWs) a seed mix containing native grasses and ground cover species only will be used. In areas where vegetation is removed, but the soil and roots are not extensively disturbed, natural regeneration only will be relied upon only for revegetation.

Each ecosystem contains a range of species with different germination and seedling establishment requirements. Some plants germinate from the topsoil without any action required. Some species only require seed to be collected and sown across the site (direct seeding), while others require some seed treatment, e.g. exposure to smoke, prior to sowing. Determining the germination and seedling establishment requirements of a range of appropriate plant species will be required. Specific seed treatment requirements are outlined in Appendix F.

8.1.4 *Rehabilitation Techniques for TECs*

This section contains specific rehabilitation techniques for vegetation communities listed as TECs under the EPBC Act. Specific rehabilitation techniques for other vegetation communities are provided in Appendix E.

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8.1.4.1 Brigalow

Within the project area, Brigalow Regional Ecosystems consist of REs 11.3.1, 11.3.17, 11.4.3, 11.4.7, 11.4.10, 11.9.4, 11.9.5, 11.9.10 and analogous regrowth vegetation not cleared since 31 December 1989. All of these REs are Endangered (EPBC Act and VM Act), except 11.3.17 and 11.9.10, which are Of Concern under the VM Act.

These REs represent forests and woodlands dominated or co-dominated by *Acacia harpophylla* (Brigalow) and/or *Casuarina cristata* (Belah). Brigalow and Belah are damaged by intense fires which can effect key habitat requirements for animal species that associate with Brigalow ecological communities. Any regrowth is usually whip-stick sucker regrowth.

Promoting existing regrowth of Brigalow is the most efficient way to rehabilitate these REs. Natural germination events of Brigalow are extremely rare (e.g. once every few decades). Brigalow is soft-seeded, so germination is not promoted by fire. Propagation of Brigalow from root suckers could be trialled and planting of tubestock should be considered where there is limited regrowth due to soil disturbance. Engagement with reputable local and selected seed suppliers that provide local provenance stock will be undertaken to ensure a necessary supply of Brigalow propagates can be obtained to service the rehabilitation needs for these TECs. Sourced propagates can be provided to, or propagated by a suitably qualified nursery stock provider to deliver Brigalow tubestock for revegetation efforts on a needs basis.

Belah seeds develop within capsules that remain unopened on the tree for a few years. Store capsules in a paper bag, where the capsules will open and drop seed within days of collection from the tree. No seed treatment is necessary. Sow fresh seed of Belah directly onto the site. Typically associated eucalypts include *Eucalyptus coolabah*, *E. cambageana* and *E. populnea*. The seed of these eucalypts falls from the capsules when mature, although seed is not always produced annually. Collect mature capsules before or as seed is released. Seed should be sown fresh with no pre-treatment necessary.

Fire prevention for Brigalow woodlands will involve maintaining low fuel loads in adjacent eucalypt woodlands, through grazing, slashing or low-intensity burning. The maintenance measures for maintaining low fuel loads within Brigalow woodlands will be undertaken on properties owned by APLNG and conducted by the Land Use and Water Strategy Group. The landowners on estates adjacent to the development area are responsible for the management of the vegetation. Where Brigalow woodlands are invaded by exotic grasses, especially Buffel Grass, reduction of the fuel loads through stock grazing, or herbicide control of grasses on the margins. The use of very low intensity, mild fires on the margin of Buffel Grass invaded Brigalow, followed by herbicide spraying of Buffel Grass regrowth is a successful way of reducing Buffel Grass dominance.

Many of the weed and pest species identified in Section 5.9 and 5.10 are invaders of Brigalow communities. Weed species cause greatest impact where edge to area ratio is high. Feral pigs are identified as the most likely pest species to cause the greatest impact on Brigalow communities.

For existing Brigalow communities adjacent to infrastructure on-ground management activities likely to assist in recovery as outlined in the Brigalow (*Acacia harpophylla* dominant and co-dominant) Conservation Advice (DSEWPaC 2011) include:

- limiting disturbance (e.g. clearing for, or maintenance of, fence lines and roads) in or adjacent to remnants to minimise weed incursion

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- avoiding fragmentation of Brigalow communities
- appropriately manage grazing pressure of livestock in agreement with landholder
- making regular checks and carrying out appropriate treatment to avoid weed invasion (especially by exotic grasses), and
- managing grass fuel loads and maintaining fire breaks to avoid hot fires in remnants
- maintaining quality of litter cover and woody debris.

8.1.4.2 Semi-evergreen Vine Thicket (SEVT)

Within the Gas Fields area SEVT is represented in REs 11.8.3 and 11.9.4 and analogous regrowth not cleared since 31 December 1989. RE 11.8.3 is Endangered under both the EPBC Act and the VM Act, and RE 11.9.4 is Endangered under the EPBC Act and Of Concern under the VM Act.

These REs represent vine thickets dominated by species such as *Ehretia membranifolia, Apophyllum anomalum, Geijera parviflora, Capparis* spp., *Croton phebalioides, Erythroxylum australe, Alectryon diversifolius, Cadellia pentastylis* and *Carissa ovata*. SEVTs may also have Brigalow trees. *Brachychiton* species (Bottle Trees) may form an emergent layer above the vine thicket.

Semi-evergreen vine thickets have a high diversity of tree and shrub species compared to other ecosystems in the region. Their rehabilitation will best be achieved by enhancing the regrowth of existing remnant patches. SEVTs can be damaged by cattle, with seedling establishment often inhibited, so fencing of rehabilitation areas will be required.

Seeds of SEVT species are produced within capsules that open to release seeds (e.g. *Brachychiton* species, *Denhamia oleaster,* and *Geijera parviflora*) or are surrounded by a fleshy pulp (e.g. *Ehretia membranifolia*, and *Erythroxylum australe*). Seeds produced within capsules can be collected by tying bags over near-mature fruits to collect seed as they mature and fall, or by collecting nearly mature capsules and storing within bags. No seed treatment is required. For some SEVT species planting of tubestock will be required. Engagement with reputable local and selected seed suppliers that provide local provenance stock will be undertaken to ensure a necessary supply of SEVT species seeds can be obtained to service the rehabilitation needs for this TEC. Sourced seed can be provided to, or propagated by a suitably qualified nursery stock provider to deliver SEVT species tubestock for revegetation efforts on a needs basis.

Vine thicket plantings will require supplementary watering during establishment as they are mostly very slow growing. Plantings are prone to invasion by weeds, especially grasses, and will require several maintenance treatments over the first 3-5 years.

Semi-evergreen vine thicket plants are damaged by fires, even of a low intensity. While some scrub plants may re-shoot following a fire, their canopy height is lost and they are slow to recover. Fires allow grasses to invade the SEVTs, which promote subsequent fires. Keeping fire out of rehabilitation areas is important for all rehabilitating ecosystems, but especially so for SEVTs. Low fuel loads should be maintained in woodlands adjacent to vine thickets, through grazing or regular, low intensity burning of eucalypt woodlands.

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Further best practice management practices for SEVTs are outlined in the National Recovery Plan for SEVTs (MacDonald 2010). For existing SEVT communities adjacent to infrastructure on-ground management activities likely to assist in recovery as outlined in the National Recovery Plan for SEVTs (DSEWPaC 2011) include:

- limiting disturbance (e.g. clearing for, or maintenance of, fence lines and roads) in or adjacent to remnants to minimise weed incursion
- manage feral animal impacts as stated in Section 5.10
- making regular checks and carrying out appropriate treatment to avoid weed invasion (especially by exotic grasses), and
- managing grass fuel loads and maintaining fire breaks to avoid hot fires in remnants.

8.2 Flora Species of Conservation Significance

Flora species of conservation significance are those species listed under the EPBC Act as Extinct, Extinct in the wild, Critically Endangered, Endangered, Vulnerable or Conservation dependent and/or the under the NC Act as Endangered, Vulnerable or Near Threatened (EVNT). Thirty-one Threatened and Near Threatened flora species are known or potentially occur within the Gas Fields area (Australia Pacific LNG Species Management Plan Flora, Q-LNG01-15-MP-0108(submitted for review).

8.2.1 *Rehabilitation Objective*

The primary Project objective will be to avoid populations of flora species of conservation significance as outlined in the Protocol and Species Management Plans Flora (Australia Pacific LNG Species Management Plan Flora, Q-LNG01-15-MP-0108 (submitted for review). Where impacts are unavoidable the rehabilitation objective in relation to significant flora is the successful rehabilitation of flora species, or successful translocation or establishment of offsets to ensure no net loss of individuals or populations (as determined from pre-clearance surveys outlined in Section 10.1.1). This will be determined for specific sites where populations are detected on an individual species basis on the advice of an approved ecologist and outlined in individual Species Management Plans.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

8.2.2 *Rehabilitation Techniques*

Natural regeneration will be used to rehabilitate areas containing flora species of conservation significance if the soil is not removed. Direct seeding with native tree and shrub species representative of the RE and habitat will also be undertaken. Translocation, propagation and replanting of tubestock of plant species will be undertaken where established to be effective for that particular species (refer to individual Species Management Plans and individual species recovery plans). Specific requirements for propagation by seed, cuttings or other techniques are outlined in Species Management Plans.

In addition to the general rehabilitation techniques listed above, the following specific control measures may need to be put in place during the rehabilitation process:

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- install erosion and sediment control measures as per site specific specifications of erosion and sediment control plans to protect the location/s of conservation significant flora from scouring and sedimentation without significantly altering surface water conditions
- avoid broad-scale spraying of herbicides for weed management in proximity to populations of flora species of conservation significance
- undertake the construction of 1200mm, four strand barb wire fencing of areas until plant populations have re-established, to prevent grazing or browsing damage
- implement weed control measures where weeds are identified a threat to flora species of conservation significance as outlined in Section 5.9
- implement pest animal control measures as outlined in Section 5.10, and
- implement ecological fire management guidelines as outlined in Section 5.11.

8.3 Habitat of Fauna Species of Conservation Significance

Seventy-two fauna species of conservation significance are known or potentially occur within the Gas Fields area (Australia Pacific LNG Species Management Plan Fauna, Q-LNG01-15-MP-0113 (submitted for review)).

8.3.1 *Rehabilitation Objective*

The primary Project objective is to avoid habitat of fauna species of conservation significance as outlined in the Protocol and the Australia Pacific LNG Species Management Plan Fauna Q-LNG01-15-MP-0113 (submitted for review). Where impacts are unavoidable the rehabilitation objective in relation to fauna habitat is the successful rehabilitation of fauna species habitat, or re-establishment of populations in translocation sites and/or establishment of offsets as outlined in Australia Pacific LNG Species Management Plan Fauna Q-LNG01-15-MP-0113 (submitted for review) and any relevant offset proposals.

Fauna habitat structures within rehabilitated areas are a rehabilitation indictor monitored after the completion of rehabilitation as described in Table 9 of Section 10.1.

8.3.2 *Rehabilitation Techniques*

Natural regeneration will be used to rehabilitate the habitat of fauna species of conservation significance where soil is not removed. Direct seeding or tree planting with native tree and shrub species representative of the RE and habitat will also be undertaken. It will be necessary to ensure rehabilitation includes food trees appropriate to the fauna species, the habitat, and land tenure type (e.g. Belah for Glossy Black Cockatoo or Spotted Gum for Sugar Glider). Species specific requirements are outlined in Australia Pacific LNG Species Management Plan Fauna Q-LNG01-15-MP-0113 (submitted for review).

In addition to revegetation, the retention of habitat features such as logs, hollows and litter will be vital for maintaining habitat values. The following measures will be put in place to maintain habitat features during Project operations, in particular during clearing and re-spreading of timber:

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- where trees with hollows or nests are to be felled, engage a fauna spotter to check hollows or nests for inhabitants immediately prior to felling and relocate animals where possible
- relocation of fauna to adjacent areas which are not to be cleared will be conducted by a suitably experienced fauna spotter who must have the authority to maintain their legal obligations and direct vegetation clearing activities where necessary to prevent harm to fauna
- advise and supervise appropriate felling techniques to reduce potential injury for animals that cannot be removed, and take into care abandoned juveniles or injured animals
- vegetation will be cleared sequentially maintaining habitat links during clearing activities. Clearing will be directed by work packs outlining the permitted area of disturbance within the construction zone
- clearing will commence from already cleared or highly disturbed locations, moving towards vegetated areas, where practicable, so as to minimise isolating individuals and to facilitate their escape to adjacent habitat
- where trees with hollows are felled and suitable equipment is present on site, excise the section of the tree containing the hollow and relocate the hollow to suitable adjacent habitat, where practical
- retain some felled timber to locate within adjacent habitat to increase sheltering opportunities for displaced animals, where practical
- re-spread timber and leaf litter into the area to assist in the restoration of micro-habitat and artificially increase ground debris if frequent fire has reduced fallen timber, where practical, and
- install suitable nest boxes, if recommended by an ecologist or outlined in a Species Management Plan, within surrounding confirmed habitat if trees bearing medium to large hollows are felled, and where practicable, fencing off from stock may be required, depending on adjacent land use, to prevent degradation of habitat of listed fauna species.

If habitat of species of conservation significance is located within riparian vegetation downstream of the clearing site or in adjacent wetland areas, the following measures will also be implemented:

- install erosion and sediment control measures as per site specific specifications of erosion and sediment control plans to protect the habitat from scouring and sedimentation without significantly altering surface water conditions
- minimise impacts of infrastructure on temporary shallow wetlands through alteration of drainage conditions or siltation, and
- avoid the broad application of herbicides, insecticides and other chemicals near wetlands and other water bodies.

Australia Pacific LNG Species Management Plans Fauna Q-LNG01-15-MP-0113 will make specific reference to the measures necessary to be undertaken within the gas field development more specifically adopted for MNES.

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8.4 Pastoral Land

8.4.1 *Disturbance Summary*

Pastoral land occurs within the Gas Fields area, including Class B limited cropping land and Class C1 and C2 pastoral land as defined by the *Planning Guidelines: the Identification of Good Quality Agricultural Land.*

In terms of individual properties, the level of disruption to agricultural land uses will depend upon the siting of wells, access roads, underground pipelines and treatment facilities. Given the nature of the gas resource, there is some flexibility to vary the location of wells (subject to operational needs), from the sites forming the nominal 750m x 750m well site location grid. Similarly, the location of access tracks and pipelines easements may be varied to a limited degree. It is Australia Pacific LNG's intention to discuss the location of these items with landholders to reduce the level of potential disruption.

The Project will put in place mitigation measures where the potential to disrupt farming practices exists. These measures would include the exchange of information about proposed Project activities with individual property owners. Such information will include an overview of infrastructure layouts, activity outlines, timetable of events, environmental and vehicle hygiene management plans and potential compensation arrangements. Landholders will be encouraged to contact a member of the Australia Pacific LNG landholder liaison group in relation to their property and/or the Project.

8.4.2 *Rehabilitation Objective*

The aim of rehabilitation is to restore the production potential of pastoral land. Australia Pacific LNG will determine the required land use of individual properties in consultation with landholders. This will guide soil preparation and determine the seed mix that is applied.

Grass cover within rehabilitated areas is a rehabilitation indictor monitored after the completion of rehabilitation as described in Table 9 of Section 10.1.

8.4.3 *Rehabilitation Technique*

Areas where grazing is the required final land use will be sown appropriate pasture species as agreed with landholders. Weedy species such as Green Panic and African Lovegrass are to be avoided. Local native grasses such as Queensland Blue Grass may be used in some situations, such as where it is desirable to return an area to grazing on unimproved native pasture.

Fencing off from stock, in negotiation with the landholder, may be required to facilitate pasture establishment, until such time as sufficient vegetation cover has established to stabilise soils.

8.5 Cropping Land

8.5.1 *Disturbance Summary*

Class A GQAL (crop land) and Strategic Cropping Land occurs in the Gas Fields area.

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The location of major infrastructure such as the plants, accommodation facilities and ponds has been selected to minimise the impact to agricultural land's productive capacity. Well pads will be sited to ensure that Strategic Cropping Land (SCL) is avoided, and where SCL is present options for pad drilling will be assessed (Condabri EA, PEN101674310, Schedule D, Land, D45).

A soils ground-truthing and mapping at a scale of 1:250,000 will be undertaken including Good Quality Agricultural Land and SCL (Condabri EA, PEN101674310, Schedule D, Land D21). The survey methodology is outlined in Section 5.4.2. Landholders will be consulted where Project infrastructure (such as access tracks and pipelines) is to be established through GQAL to ensure timing of the works does not unduly affect farming operations. Where possible, access tracks and associated pipelines will use existing tracks, fence lines and road reserves.

8.5.2 *Rehabilitation Objective*

The aim of rehabilitation is to restore the production potential of cropping land. APLNG will determine the required land use of individual properties in consultation with landholders. This will guide soil preparation. Although cropping is the desired final land use, areas may be sown with sterile grass species to stabilise soils.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

8.5.3 *Rehabilitation Technique*

Where disturbance of cropping land is unavoidable, the careful management of topsoil and subsoil will form an important component of the rehabilitation strategy. On cropping land access tracks may not be gravelled and may be a wheel rut track only. At the completion of construction, wastes will be removed, temporary access routes will be closed and soils will be replaced in the order in which excavation was carried out.

Where installation of the main pipeline is to occur within croplands, particularly where deep ripping may be used, additional depth of cover will be required as determined by design engineers in compliance with Australian Standard 2885. This will also be the subject of consultation with affected landholders to ensure timing of the works does not unduly affect farming operations.

Before topsoil re-spreading on cropping land, topsoil that has been stockpiled for long periods will be re-analysed. Re-analysis will, as a minimum, require the analysis of pH, electrical conductivity, chloride, cations (calcium, magnesium and sodium), exchangeable sodium percentage and soil fertility (including nitrogen, phosphorous, potassium, sulphur and micronutrients). Additional nutrients (specifically nitrogen and phosphorus-based fertilisers, depending on the type of revegetation planned) or conditioners may be required to improve topsoils and return them to a productive state for cropping. Fertilisers and soil supplements will be used only as necessary and with the agreement of landholders.

Following topsoil re-spreading, areas will be sown with appropriate cover grass species, as agreed with landholders, while ensuring weedy species such as Green Panic and African Lovegrass are avoided. Fencing off from stock, in negotiation with the landholder, may be required to facilitate grass establishment, until such time as sufficient vegetation cover has established to stabilise soils.

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8.6 Riparian Areas and Watercourse Crossings

Riparian areas and watercourses have the potential for higher in biodiversity than the surrounding landscape. They provide water for many flora and fauna species adapted to specialist habitats characterised by permanent/semi-permanent surface water.

The Gas Fields area is dissected by creek systems with associated alluvial soils that support open forests of *Eucalyptus tereticornis* (Queensland Blue Gum), *E. camaldulensis* (River Red Gum), *Angophora floribunda* (Rough-barked Apple), *A. leiocarpa* (Smooth-barked Apple) and *Casuarina cunninghamiana* (River She-oak). These communities have often been retained as a vegetated riparian corridor through cleared agricultural land. They provide an important habitat for a wide variety of fauna.

The Gas Fields area contains several significant major creeks and it will be necessary for pipelines and access tracks to cross them in some locations

8.6.1 *Rehabilitation Objective*

The primary objective is to minimise impacts to riparian areas and watercourses a as outlined in the Condabri EA, PEN101674310, Section B, Water, B8-B14. Where this is unavoidable, mitigation measures will be adopted including minimising the area of disturbance and impacts on riparian vegetation and water quality.

Where clearing of riparian vegetation is unavoidable the objective will be to reinstate the creek banks and riparian vegetation immediately as soon as practical post-construction. This reinstatement will be consistent with the surrounding environment and contours of the channel at the time of construction (Chapter 2, Volume 1, APLNG EIS, commitment 6.1.3). A further objective is to minimise erosion and destabilisation of creek banks, and restore vegetation and fauna habitat.

8.6.2 *Rehabilitation Techniques*

Rehabilitation of waterway crossings will involve re-contouring disturbed areas to match the surrounding land as soon as practicable after pipe laying and backfilling. Erosion controls will be constructed or installed, where necessary. The surface will usually be lightly scarified before spreading the topsoil, to promote vegetation re-growth and protect against the topsoil loss.

Rehabilitation will be undertaken and will ensure that:

- any water ingress into trenches will be handled with pumping from the trench utilising APIA Code methods for sediment and erosion control
- temporary facilities such as waterway barriers will be removed and the areas rehabilitated
- Seed spreading will be carried out in areas at risk of erosion or in densely vegetated watercourses to enhance natural regeneration, and
- pipelines will be backfilled and normal flow reinstated as soon as practicable.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

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8.7 Stock Routes

The primary purpose of the stock route network is to provide for travelling stock, although other secondary uses may occur within a stock route. These other uses may include the short-term adjustment of parts of the route, the establishment of watering agreements with private landholders, and the construction and maintenance of stock route facilities. A road that is a stock route may be used as a transport corridor for vehicles or for communication and utility infrastructure facilities, for example phone, power and gas lines. Impacts on stock routes will generally arise from the clearing of vegetation and ground disturbance associated with the laying of gas and water pipeline networks. No plant or water storage sites will be located within a stock route.

8.7.1 *Rehabilitation Objective*

It is a Coordinator General's condition (Coordinator General's Report, Appendix 1, Part 1, Condition 6) that parts of the stock route network disturbed or affected by works be rehabilitated upon completion of the project to a state that is safe for travelling stock and drovers, and the travelling public, and is consistent with the area's pre-disturbance state unless otherwise agreed by DERM and the local government.

8.7.2 *Rehabilitation Techniques*

Ground disturbance to stock routes will be rehabilitated as soon as practicable following the cessation of construction activities. Stock routes will be rehabilitated so as to return the disturbed areas to a status consistent with the surrounding area. Rehabilitation will be undertaken following the method outlined in Section 5.

Rehabilitation indictors monitored and the frequency of monitoring after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

9. Success Criteria

9.1 By Approval Conditions

Rehabilitation success criteria are provided in the Condabri EA, PEN101674310, Schedule H, Rehabilitation, H10. Measurable success criteria have been developed based on these conditions for application to rehabilitated areas within the Gas Fields (Table 5). Rehabilitation site success is identified in comparison to analogue site baseline information measured at each reference site as outlined in section 10.1.1.3 and is determined by meeting the measurable success criteria indicated in Table 5. Success criteria in relation to MNES to address EPBC 2009/4974 Condition 14e are provided in Table 6.

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Table 5 Rehabilitation success criteria as outlined in the Condabri EA, PEN101674310, Schedule H, H10 and measurable success criteria

Application	Success Criteria as per Schedule H, H10	Indicators	Measurable success criteria
All significantly disturbed land	H6 a. Land is reinstated to the pre-disturbed land use unless otherwise agreed to by APLNG, the landholder and the administering authority	Land suitability	Land holder and administering authority agree in writing that land supports the pre-disturbance land use
All significantly disturbed land	b. Land is reinstated to the pre-disturbed soil suitability class	Soil suitability	Soil suitability is equivalent to pre-disturbed soil suitability class as determined by a soil suitability study
All significantly disturbed land	c. Landform is safe for humans and fauna	Subsidence and erosion	No subsidence or erosion observed for at least five years
All significantly disturbed land	d. The landform is stable with no subsidence or erosion gullies for at least five years	Subsidence and erosion	No subsidence or erosion observed for at least five years
Disturbed remnant vegetation	e. A minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least three years	Foliage cover	Maintain 80% of the foliage cover in analogue sites as determined through BioCondition monitoring for three years
Disturbed remnant vegetation	f. A minimum of 80% of the flora species diversity in analogue sites is maintained in the rehabilitated sites for at least three years	Flora species diversity	Maintain 80% of the floral diversity in analogue sites as determined through BioCondition monitoring for three years
Disturbed remnant vegetation	g. A minimum equal density of habitat structures, including but not limited to litter cover, fallen woody material and hollow logs, as in analogue sites	Fauna species diversity	Maintain a minimum equal density of habitat structures in analogue sites as determined through BioCondition monitoring for three years
Erosion prone areas	h. Erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person	Erosion control measures installed	Erosion control measures installed as per checklist for completed rehabilitation (Table 7)
Residual voids or water	i. Water quality meets criteria for subsequent	Water quality	Water quality monitoring parameters to be defined

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Application	Success Criteria as per Schedule H, H10	Indicators	Measurable success criteria
bodies	uses and does not have the potential to cause environmental harm		from monitoring of regulated dams
Waterways	j. There is no ongoing contamination of waters	Water quality	Water quality monitoring parameters to be defined
Dams or monocells	j. There is no ongoing contamination to groundwater from dams or monocells	Groundwater quality and leak detection	Monitoring shows no adverse impacts on groundwater quality No leakage detected
Agricultural areas	k. The maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activity(ies)	Maintenance requirements	Maintenance is no greater than that required for the land prior to its disturbance as determined by a landholder survey

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9.2 By Disturbance Type

Success criteria will apply to all areas irrespective of the type of infrastructure that was located on the site. However, there are certain infrastructure that will require specific criteria due to the nature of disturbance, such as saline effluent ponds. Separate criteria are required for the main pipelines as approvals are to be covered in a separate Environmental Authority to the Gas Fields. For the main pipeline Model Conditions within the Coordinator General's Report (Appendix 3, Part 4, Schedule E, E36-43) have been used to develop success criteria.

Success criteria specific to certain infrastructure are outlined in Table 6 below. Otherwise the general criteria listed in Table 5 above will apply.

Table 6 Rehabilitation Success Criteria for specific disturbance type

Disturbance Type	Rehabilitation Objective	Indicators	Measureable Success Criteria	Corrective Actions
Borrow Pits	Surface is in close alignment with the natural contours of the existing landscape while allowing for a lower surface due to material that has been extracted	Visual consistency Land surface	Photo monitoring shows the land features blend in with the surrounding area Level of backfilled borrow pits is consistent with surrounding soil, while allowing for a lower surface due to extraction	Rework site if monitoring of surface alignment is significantly altered between monitoring events
Pipeline ROWs (following backfilling and rehabilitation)	A stable landform	Subsidence and erosion gullies	No subsidence or erosion gullies observed for at least five years	Rework site to remediate land to a stable landform and re-install erosion and sediment control mitigation measures
	Exhibit no subsidence or erosion gullies for the life of the operational pipeline	Subsidence and erosion gullies	No subsidence or erosion gullies observed for at least five years	Remediate land and re-install erosion and sediment control mitigation measures
	Be re-profiled to a level consistent with the surrounding soils	Land surface	Level of backfilled pipelines is consistent with surrounding soil	Rework site if monitoring of surface alignment is significantly altered between monitoring

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Disturbance Type	Rehabilitation Objective	Indicators	Measureable Success Criteria	Corrective Actions
				events
	Be re-profiled to original contours and established drainage lines	Land surface and drainage lines	Original contours and drainage lines re-established	Rework site to remediate land to a re-establish drainage lines and re-install erosion and sediment control mitigation measures
	Be visually consistent with surrounding land features	Visual consistency	Photo monitoring shows the land features of pipeline rows are visually consistent with the surrounding area	Rework site if monitoring of surface alignment is significantly altered between monitoring events
	Be vegetated with groundcover as a minimum to ensure erosion is minimised	Vegetation cover	A minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least three years	Revegetate via direct seeding or tubestock planting if monitoring indicates vegetation is significantly altered or ineffective between monitoring events
Main pipe line ROW	Objectives as per other pipelines (refer above)	Indicators above	Measurable success criteria above	Corrective actions above
	Self-sustaining vegetation cover with same species cover to that of surrounding undisturbed areas, except over the area that must be maintained free of large flora species for pipeline integrity and access (Coordinator General's Report A3P4E40)	Vegetation cover Flora species diversity Ground cover diversity	A minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least three years A minimum of 80% of the flora species diversity in analogue sites is maintained in the rehabilitated sites for at least three years In areas required to remain free of large flora species a minimum of 80% of the groundcover and	Revegetate via direct seeding or tubestock planting if monitoring indicates vegetation is significantly altered or ineffective between monitoring events

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Disturbance Type	Rehabilitation Objective	Indicators	Measureable Success Criteria	Corrective Actions
			shrub layer cover of analogue sites is maintained in the rehabilitated sites for at least three years	
	Successful rehabilitation with minimal fragmentation of fauna habitat	Pipeline ROW width	Pipeline ROW is re-instated to a maximum width of 12 metres once the pipeline is completed (Coordinator General's Report A3P4E36)	Revegetate via direct seeding if monitoring indicates vegetation is significantly altered or ineffective between monitoring events
	Management for designated agricultural land use (Coordinator General's Report A3P4E43)	Land holder satisfaction Soil and land suitability	Land holder is satisfied that no greater management input than for other land in the area being used for a similar purpose after at least three years All significantly disturbed land is reinstated to the pre-disturbed land suitability Soil suitability is equivalent to pre-disturbed soil suitability class as determined by a soil suitability study	Rework site if land holder satisfaction cannot be reached. Asses soil and land suitability and rework site if assessment and landholder approval prove unsatisfactory
	Maximum re-establishment of native vegetation including shrubby understorey and groundcover, providing habitat for small ground dwelling species and restoration of landscape connectivity (Coordinator General's Report A3P4E38).	Vegetation cover	A minimum of 80% of the groundcover and shrub layer cover of analogue sites is maintained in the rehabilitated sites for at least three years	Revegetate via direct seeding or tubestock planting if monitoring indicates vegetation is significantly altered or ineffective between monitoring events
		Flora diversity	A minimum of 80% of the flora species diversity of the ground layer and shrub layer in analogue sites is	Revegetate via direct seeding or tubestock planting if monitoring

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Disturbance Type	Rehabilitation Objective	Indicators	Measureable Success Criteria	Corrective Actions
			maintained in the rehabilitated sites for at least three years	indicates vegetation is significantly altered or ineffective between monitoring events
Ponds	No ongoing contamination to groundwater from pond sites	Ground water quality	Monitoring shows no adverse impacts on groundwater quality	If primary detection systems identify leakage the pond would need to be assessed for leakage and repairs made and site remediated
Decommissioned ponds	Adequate vegetation cover	Topsoil cover Vegetation cover	A minimum of 250mm of soil placed over decommissioned ponds A minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least three years	Revegetate via direct seeding or tubestock planting if monitoring indicates vegetation is significantly altered or ineffective between monitoring events
	Landform re-instated such that it will not operate as a pond	Land surface and drainage lines	Original contours and drainage lines re-established	Rework site to remediate land to a re-establish drainage lines and re-install erosion and sediment control mitigation measures
	Landform will be stable and sustainable for the foreseeable future	Subsidence and erosion gullies	No subsidence or erosion gullies for at least five years	Rework site to remediate land to a stable landform and re-install erosion and sediment control mitigation measures

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9.3 By Rehabilitation Type

Rehabilitation success criteria will also differ by the final land use (rehabilitation type) of the area to be rehabilitated, as outlined in **Table 7**. Success criteria in relation to MNES to address EPBC 2009/4974 Condition 14e are also provided.

Table 7 Rehabilitation Success Criteria based on rehabilitation type

Rehabilitation Type	Rehabilitation Objective	Indicators	Measurable Success Criteria	Corrective Actions
Remnant native vegetation including TECs	Restore remnant vegetation, connectivity and fauna habitat status of the regional ecosystem	Vegetation cover Flora species diversity Fauna species diversity	A minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least three years A minimum of 80% of the flora species diversity in analogue sites is maintained in the rehabilitated sites for at least three years A minimum equal density of habitat structures, including but not limited to litter cover, fallen woody material and hollow logs, as that in analogue sites	Evaluate the success of rehabilitation methods undertaken to meet 80% cover for 3 years when compared to analogue RE. Continue to evaluate site progress and maintenance towards success criteria or if progress to success criteria is not evident rework site to meet the measurable success criteria
EVNT listed and MNES flora species	Successful rehabilitation of flora species, or successful translocation and establishment within offset sites	Re-establishment of flora species (count of individuals)	Populations re-established to a density equal or greater to that found in surveys outlined in Section 10.1.1.2	Undertake propagation of flora species from local provenance propagates and re-establish populations to meet success criteria
EVNT listed and MNES fauna habitat	Successful rehabilitation of fauna species habitat	Habitat structure	A minimum equal density of habitat structures, including but not limited to litter cover, fallen woody material and hollow logs, as that in analogue sites	Monitor habitat development for progress towards success criteria. If habitat features fail to recover, source habitat structures comparable to analogue sites

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Rehabilitation Type	Rehabilitation Objective	Indicators	Measurable Success Criteria	Corrective Actions
				and install in applicable sites to meet success criteria
MNES listed fauna	Successful rehabilitation of fauna species habitat	Presence of fauna species	Fauna species detected in pre-clearing surveys to be detected after 5 years using DSEWPaC survey guidelines	Evaluate habitat features and habitat structure to identify missing elements to the recruitment of fauna species. Monitor habitat development for progress towards success criteria. If habitat features fail to recover, source habitat structures comparable to analogue sites and install in applicable sites to meet success criteria
Watercourse crossings	Rehabilitation consistent with surrounding environment and contours of the channel at the time of construction	Erosion control measures in place Channel contours Water quality	Erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person Creek rehabilitation will be consistent with surrounding environment and contours of the channel at the time of construction No ongoing contamination of waterways	Remediate land and re-install erosion and sediment control mitigation measures Rework site if surrounding environment and contours of the channel are significantly altered from original time of construction
Cropping land	Restore the production potential of cropping land	land holder satisfaction soil and land suitability	land holder is satisfied that no greater management input than for other land in the area being	Rework site if measurable success criteria and land holder satisfaction

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Rehabilitation Type	Rehabilitation Objective	Indicators	Measurable Success Criteria	Corrective Actions
			used for a similar purpose is required for it be used for cropping all significantly disturbed land is reinstated to the pre-disturbed land suitability Soil suitability is equivalent to pre-disturbed soil suitability class as determined by a soil suitability study	cannot be reached
Cropping Land GQAL class A, B or C1 (main pipeline)	Restore production potential of cropping land	Pipeline depth	Pipeline buried at least 0.9m below finished land surface, or greater if deep ripping is a normal practice (Coordinator Generals Report A3P2 Condition9d)	Survey pipeline depth and bury pipeline to applicable depth if depth is not compatible to the production of cropping land
Grazing land	Restore the production potential of pastoral land	Land holder satisfaction soil and land suitability	Land holder is satisfied that no greater management input than for other land in the area being used for a similar purpose is required for it be used for grazing All significantly disturbed land is reinstated to the pre-disturbed land suitability Soil suitability is equivalent to pre-disturbed soil suitability class as determined by a soil suitability study	Rework site if land holder satisfaction cannot be reached. Asses soil and land suitability and rework site if assessment and landholder approval prove unsatisfactory
Stock routes	Safe for travelling stock and drovers, and the travelling public	Subsidence and erosion	No subsidence or major erosion gullies	Remediate land and re-install erosion and sediment control mitigation measures
	Consistency with the	Land surface and	Original contours and	Remediate land

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Rehabilitation Type	Rehabilitation Objective	Indicators	Measurable Success Criteria	Corrective Actions
	area's pre-disturbance state	drainage lines	drainage lines re-established	and re-install erosion and sediment control mitigation measures

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10. Monitoring and Compliance Reporting

10.1 Monitoring Type, Method and Frequency

10.1.1 *Surveys and Monitoring Prior to Construction*

10.1.1.1 Preclearance Ecological Assessment

State Requirements

A pre-clearance ecological assessment will be undertaken prior to undertaking petroleum activities that involve significant disturbance to land to meet conditions under the Condabri EA PEN101674310, Schedule D, Land, D2-D4), following the methods outlined in the Protocol. The survey will be undertaken to ground truth and map REs and ESAs and confirm the location of EVNT listed flora and fauna species and MNES. This will include assessment of the condition, type and ecological value of any vegetation in any areas where significant disturbance is proposed to take place.

This assessment will be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas and the presence of species classed as endangered, vulnerable or near threatened under the *Nature Conservation Act 1992* (Condabri EA PEN101674310, Schedule D, Land, D3).

If the assessment indicates that a Regional Ecosystem mapped as Endangered or Of Concern by the Queensland Herbarium is of a different conservation value classification, APLNG will advise DERM in writing before any significant disturbance to land takes place. Condabri EA PEN101674310, Schedule D, Land, D4).

Commonwealth Requirements

During the infrastructure planning phase, targeted threatened species surveys will be undertaken to confirm the absence or presence of threatened species and MNES in areas proposed to be disturbed as outlined in EPBC2009/4974 (Condition 5o) and outlined Section 6.2 of the Protocol, including the following:

- will be undertaken in accordance with DSEWPaC survey guidelines in effect at the time of survey, for example, a survey of threatened reptile species will be undertaken following DSEWPaCs Survey Guidelines for Australia's Threatened Reptiles
- will take into account and reference previous ecological surveys undertaken in the area and relevant new information on likely presence of absence of MNES
- are undertaken by suitably qualified ecologist approved by DSEWPaC or suitably qualified environment officer (depending on sensitivity classes)
- will document the survey methodology, results and significant findings in relation to MNES
- will apply best practice site assessment and ecological survey methods appropriate for each listed threatened species, migratory species, their habitat and listed TECs, and

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- will publish reports on the internet 20 business days before clearance of native vegetation in an infrastructure impact area and will be provided to DSEWPaC on request.

10.1.1.2 Monitoring of Areas of Conservation Significance

Monitoring the condition of EPBC and State listed species and communities and endangered regional ecosystems (including EPBC listed TECs) will be undertaken through assessment of representative monitoring sites located within 200m of major project disturbance activities. This will occur in accordance with the following procedure as outlined in the Protocol:

- on the advice of an approved ecologist, select representative monitoring sites in potentially affected EPBC and NC Act listed species habitat areas across the project area that are within 200m of disturbance activity
- where possible, locate and monitor a control population of the same species within the vicinity but greater than 100m away from project disturbance including edge effects (control population)
- monitoring of baseline conditions to be undertaken prior to disturbance activity
- assess site condition in accordance with the State environment agency's condition assessment methodology (BioCondition survey methodology, Eyre *et al*. 2011)
- where reference sites are not provided by the State environmental agency, reference (analogue) sites will be developed using an appropriate methodology (BioCondition reference site methodology, Eyre *et al.* 2006).
- where populations are large and/or very dense, monitoring can be adapted to permanently marked plots that sub-sample the entire population
- all parameters monitored for the impact population to be repeated on the control population at the same time for statistical comparison, and
- this monitoring zone will be clearly marked in order to inform repeat active searches.

10.1.1.3 Analogue Site Survey

Information on the vegetation structure and species composition, including abundance, will be collected at established analogue (reference) sites to compare and monitor the effectiveness of rehabilitation efforts during the life of the Project. Reference sites will be established and surveyed using the BioCondition reference site methodology (Eyre *et al*. 2006). Reference sites may include pre-existing disturbances where this represents site conditions where Australia Pacific LNG will undertake activities. This will be identified prior to commencing site disturbances. Reference sites will be selected to be representative of each of the Endangered, Of Concern, and Least Concern REs to be disturbed. At each reference site the following will be measured:

- the percentage foliage cover of tree and shrub species
- height of each vegetation stratum
- flora species richness and diversity, and
- fauna habitat features litter cover, fallen woody material and the number of hollow logs.

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The Queensland Herbarium's Methodology for the Establishment and Survey of Reference Sites for BioCondition (Eyre *et al*. 2006) will be used to select survey sites and for the survey of vegetation, along with fauna surveys of the reference sites. This methodology requires that a minimum of three reference sites be set up and surveyed for each RE. Photo monitoring points will be numbered, located by GPS and maintained in a spatial database.

10.1.1.4 Pre-clearing Photo Monitoring

Pre-clearing photos will be taken of sites undergoing significant disturbance, at permanent photo monitoring points to be established. These photos will provide a record of what the pre-clearance land use was, provide a benchmark for rehabilitation and set minimum visual standards against which erosion and vegetation regeneration can be assessed for land form.

10.1.1.5 Soil and Land Capability Survey

A pre-disturbance soil survey of areas to be disturbed will be undertaken following the methodology outlined in the APLNG Project Draft Soil Management Strategy 301001-0044800-EN-PLN-0009. This will ensure that conditions in the Condabri EA, PEN101674310, Schedule D, Land, D21 in regard to soil assessment and management are met.

Soil and land consistency are rehabilitation indictors monitored after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

10.1.2 *Monitoring During Operation*

10.1.2.1 Visual Land-form Monitoring

The following monitoring regime will be implemented to ensure management actions for the prevention of erosion and sedimentation during vegetation clearing, topsoil stripping, subsoil management, stockpiling activities, rehabilitation activities, weed control, water diversion, erosion and sediment control activities and watercourse protection activities are being implemented and are appropriate for the site conditions:

- daily visual monitoring using a checklist and photographic records to ensure all actions are being implemented in accordance with the requirements outlined in this procedure
- weekly formal inspections using a checklist and photographic records to ensure there are no incidences of soil subsidence or erosion resulting from construction activities and to identify any erosion repair works that might be required
- following high rainfall events all watercourse crossings of pipelines and tracks will be inspected to assess the stability of the channel and banks, and
- record keeping of the above in a GIS database including the GPS locations of all monitoring.

Visual landform monitoring is rehabilitation indictor monitored after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

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10.1.2.2 Weed Monitoring

The distribution of weeds will be recorded through an active inventory of declared and environmental weeds, including the distribution of weeds within rehabilitated areas. To ensure this is regularly updated, all staff and contractors will be trained in the identification of weeds and required to report their occurrence to the Environment Group.

Monitoring of the extent and distribution of weed populations including new infestations and weeds within rehabilitated areas will include the following:

- weed checks and photo monitoring of sites will be conducted prior to and post construction. Monitoring will include previously disturbed and rehabilitated areas, retained vegetation, and buffer areas
- monitoring of known weed infestations will be taken before and a suitable time frame after treatment to determine treatment success
- photos will be taken prior to and a suitable time frame after treatment applications to provide a visual assessment of the effectiveness of methods to reduce weed density, and
- updating and maintain an active inventory of declared and environmental weeds within a weed identification layer in the Project GIS.

Declared weed species monitoring is rehabilitation indictor monitored after the completion of rehabilitation as described in Table 9 of Section 10.1 will be conducted to observe rehabilitation progress.

10.1.3 *Monitoring on the Completion of Rehabilitation*

A sign-off of rehabilitation is required on completion to ensure rehabilitation has been completed to the required standard. The checklist provided in Table 8 ensures that rehabilitation has addressed the requirements of this RRRMP.

Table 8 Checklist to be completed on the completion of rehabilitation

Checklist	Yes	No
Checklists relating to site clean up		
All waste has been removed and appropriately disposed of including flagging, signage, surplus pipeline, litter and stockpiles of unsuitable or surplus material		
Stockpiles of unsuitable material have been cleaned up and removed		
Site of any oil/fuel/chemical spills has been cleaned up and adequately remediated		
Checklists relating to soil preparation and revegetation		
If compaction of soil has occurred, has the affected area ripped or scarified prior to rehabilitation?		

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Checklist	Yes	No
Topsoil and stockpiled vegetation (either whole or mulched) has been re-spread evenly and the soil ripped if required		
Has the area been seeded or does it require, re-seeding with an appropriate seed mix for the final land use that will provide sufficient groundcover to prevent erosion.		
Third party, stock and wildlife access to rehabilitated areas been restricted to promote rehabilitation of sensitive areas		
Have species specific flora or fauna requirements been addressed in accordance with Species Management Plans?		
Suitable and adequate erosion and sediment control measures have been installed as necessary		
Remaining access tracks have been graded to a suitable condition for future access if required to remain open		
Areas are free of declared weed species		
Checklists relating to the rehabilitation of watercourses		
Rehabilitation is such that the flow of water in watercourses is not impeded		
Stabilisation of creek banks and construction of upslope contour banks has been constructed as required		
Creek banks have been restored to their original land form		
Scour protection measures/ erosion control measures in stream crossings have been installed that conform with original land form		
Point discharges have been directed to stable waterways and/or drainage lines with appropriate engineering controls, such as scour protection and flow velocity limits		
Checklist of additional requirements from Condabri EA, PEN101674310 conditions		
A minimum depth of 250mm topsoil has been placed over decommissioned storage ponds (Schedule C, C35)		
Construction area has been re-profiled to original contours and drainage lines and a stable landform (Schedule H, H6a and d)		
There is no evidence of subsidence or erosion gullies (Schedule H, H10d)		
The landform appears visually consistent with the surrounding landform (Schedule H, H6e)		
If the area was remnant vegetation has the area been seeded with an appropriate seed mix or planted with tubestock appropriate to the particular RE (i.e. will ensure return of at least 80% of flora species) as determined from analogue site surveys? (Schedule H, H10f)		
Checklist in regard to MNES, if present		

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Checklist	Yes	No
Have MNES listed flora species been returned through direct seeding or tubestock planting sourced from reputable local or selected seed/nursery suppliers where required?		
Has rehabilitation been undertaken to sufficient standard to ensure the return of TECs, for example tubestock planting of SEVT species?		
Have the requirements of MNES fauna been addressed including re-spreading of mulch and timber?		
Have areas containing MNES been fenced to reduce grazing pressure if required?		
Has weed and pest control been undertaken, where these are a potential threat to MNES?		
Has fuel reduction or other fire prevention measures been put in place as required for MNES?		
Checklists relating to the main pipeline		
Have disturbed QGAL areas been lightly ripped, and has topsoil been replaced and the surface returned to a land use condition that serves the preconstruction use (Coordinator General's Report A3P2C9c)		
Has the pipeline been buried at least 0.9m below the finished land surface on land with GQAL class A, B or C1, or greater if deep ripping is a normal practice. (Coordinator General's Report A3P2C9d)		
Has the pipeline ROW been right of way is reinstated to a maximum width of 12 metres once construction of the pipeline is completed (Coordinator General's Report A3P2E36)		
For areas with native vegetation, revegetation has used seed sources from local provenance native species, where available (Coordinator General's Report A3P2E37)		

In addition to the checks above Australia Pacific LNG will monitor rehabilitated buried transmission pipeline corridors and flow lines for subsidence and erosion at least every 20 business days for the first 120 business days after rehabilitation.

10.1.4 *Ongoing Monitoring*

Monitoring will be required a various intervals for a range of parameters to ensure that success criteria are being met. Monitoring intervals of completed rehabilitation are identified for several variables and frequency of monitoring within Table 9. While some success criteria require maintenance of an indicator at a particular level for at least three years, land form stability must be demonstrated for at least five years (Condabri EA, PEN101674310, Schedule H, Rehabilitation, H10d). As such, monitoring will be undertaken for five years or longer, until rehabilitation is determined to be successful. A final soil and land suitability study will be undertaken after five years to ensure that all land can be used for its pre-disturbance land use. This will include a land holder survey to determine that maintenance requirements are no greater than for surrounding areas, and obtain approval in writing that land can be used for its pre-disturbance land use. This survey will however be undertaken after 3 years for the main pipeline to ensure success criteria within the Coordinator Generals Report (Appendix 3, Part 4, Schedule E, E43) are met.

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Were relevant, monitoring will involve comparison with data collected during pre-clearing surveys, analogue site surveys and monitoring of areas of conservation significance. Details of indicators to be monitored and the frequency of monitoring are provided in Table 9.

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Table 9 Monitoring interval and details of monitoring for rehabilitation indicators

Rehabilitation Indicator				Monitoring Interval (time since completion of rehabilitation)					
	20 Business days	120 Business days	6 Months	One year	18 Months	Two years	Three years	Four years	Five years
Visual consistency	Visual observations of stability, erosion, subsidence etc	Visual observations of stability, erosion, subsidence etc	Photos from monitoring points	Photos from monitoring points	Photos from monitoring points	Photos from monitoring points	Photos from monitoring points	Photos from monitoring points	Photos from monitoring points
Subsidence and erosion	Erosion and subsidence to be noted every 20 business days	Erosion and subsidence to be noted	Erosion and subsidence to be noted	Erosion and subsidence to be noted	Erosion and subsidence to be noted	Erosion and subsidence to be noted	Erosion and subsidence to be noted	Erosion and subsidence to be noted	Erosion and subsidence to be noted
Level of land surface			Photo monitoring shows land-form to be equivalent to original land-form and blends in with surrounding land-form	Photo monitoring shows land-form to be equivalent to original land-form and blends in with surrounding land-form	Photo monitoring shows land-form to be equivalent to original land-form and blends in with surrounding land-form	Photo monitoring shows land-form to be equivalent to original land-form and blends in with surrounding land-form	Photo monitoring shows land-form to be equivalent to original land-form and blends in with surrounding land-form	Photo monitoring shows land-form to be equivalent to original land-form and blends in with surrounding land-form	Photo monitoring shows land-form to be equivalent to original land-form and blends in with surrounding land-form
Land surface and drainage lines			Photo monitoring shows land surface and drainage lines are consistent with original and	Photo monitoring shows land surface and drainage lines are consistent with original and surrounding	Photo monitoring shows land surface and drainage lines are consistent with original and surrounding	Photo monitoring shows land surface and drainage lines are consistent with original and surrounding	Photo monitoring shows land surface and drainage lines are consistent with original and surrounding	Photo monitoring shows land surface and drainage lines are consistent with original and surrounding	Photo monitoring shows land surface and drainage lines are consistent with original and surrounding

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Rehabilitation Indicator				Monitoring Interval (time since completion of rehabilitation)					
	20 Business days	**120 Business days**	**6 Months**	**One year**	**18 Months**	**Two years**	**Three years**	**Four years**	**Five years**
			surrounding drainage lines	drainage lines	drainage lines	drainage lines	drainage lines	drainage lines	drainage lines
Vegetation cover (remnant vegetation areas including TECs)				Vegetation cover measured through a BioCondition survey (comparison to analogue sites)		Vegetation cover measured through a BioCondition survey (comparison to analogue sites)	Vegetation cover measured through a BioCondition survey (comparison to analogue sites)	Vegetation cover measured through a BioCondition survey (comparison to analogue sites)	Vegetation cover measured through a BioCondition survey (comparison to analogue sites)
Ground cover (all areas)			Ground cover (20 % of analogue expected)	Ground cover (40 % of analogue expected)	Ground cover (80 % of analogue expected)	Ground cover (80 % of analogue expected)	Ground cover (80 % of analogue expected)		
Flora diversity (remnant vegetation areas including TECs)				Flora diversity to be measured through a BioCondition survey (comparison to analogue sites)		Flora diversity to be measured through a BioCondition survey (comparison to analogue sites)	Flora diversity to be measured through a BioCondition survey (comparison to analogue sites)	Flora diversity to be measured through a BioCondition survey (comparison to analogue sites)	Flora diversity to be measured through a BioCondition survey (comparison to analogue sites)
Fauna habitat				Salvage logs and fallen timber installed as litter, logs and other habitat		Salvage logs and fallen timber installed as litter, logs and other habitat	Salvage logs and fallen timber installed as litter, logs and other habitat	Salvage logs and fallen timber installed as litter, logs and other habitat	Salvage logs and fallen timber installed as litter, logs and other habitat

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Rehabilitation Indicator				Monitoring Interval (time since completion of rehabilitation)					
	20 Business days	**120 Business days**	**6 Months**	**One year**	**18 Months**	**Two years**	**Three years**	**Four years**	**Five years**
				features measured through a BioCondition survey (comparison to analogue sites)		features measured through a BioCondition survey (comparison to analogue sites)	features measured through a BioCondition survey (comparison to analogue sites)	features measured through a BioCondition survey (comparison to analogue sites	features measured through a BioCondition survey (comparison to analogue sites
MNES listed fauna									Survey for MNES species as per DSEWPaC Survey Guidelines
Re-establishment of flora species (EVNT and MNES species)				The location where the species was found will be surveyed, and the number of individuals counted		The location where the species was found will be surveyed, and the number of individuals counted	The location where the species was found will be surveyed, and the number of individuals counted	The location where the species was found will be surveyed, and the number of individuals counted	The location where the species was found will be surveyed, and the number of individuals counted
Declared weed species			Weed checks and photo monitoring	Weed checks and photo monitoring	Weed checks and photo monitoring	Weed checks and photo monitoring	Weed checks and photo monitoring.	Weed checks and photo monitoring	Weed checks and photo monitoring
Land holder satisfaction							Land holder to provide written approval*		Land holder to provide written approval

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Rehabilitation Indicator				Monitoring Interval (time since completion of rehabilitation)					
	20 Business days	**120 Business days**	**6 Months**	**One year**	**18 Months**	**Two years**	**Three years**	**Four years**	**Five years**
Soil and land suitability							Final soil and land capability study*		Final soil and land capability study
Maintenance requirements				.			Land holders to be surveyed for management inputs required*		Land holders to be surveyed for management inputs required

*surveys required for the main pipeline only

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10.2 Data Management

Australia Pacific LNG will set up a data management system that will include:

- a GIS with the GPS location of every monitoring point and GIS layers for every variable monitored
- procedures to ensure all rehabilitation steps are recorded in GIS at every disturbance site, and
- a photographic record of all photo monitoring with the GPS locations and direction of orientation off all photo monitoring points
- Document management systems operating as an information storage.

10.3 Compliance Reporting, Contents and Frequency

10.3.1 *Record of Impacts to MNES*

If an impact occurs (which may include a presumed impact where a species is presumed to be present) to a MNES during Gas Field development, operation, or decommissioning the Australia Pacific LNG will record the impact, (as required by EPBC 2009/4974 Condition 13 a) by reference to the:

- location, specific site and type of infrastructure or activity
- each MNES subject to disturbance
- the related site assessment or field ecological survey documentation and recommendations, or the decision that the particular MNES was presumed to be present
- the total disturbance limit
- the remaining disturbance limit for each affected MNES
- the reason for the decision, including justification for the action taken, description of the efforts to avoid the impact, and an explanation why other constraints might justify the impact on the MNES, and
- actions and commitments by the APLNG to remediate, rehabilitate, or make good any unauthorised disturbance.

This information must be recorded to a standard that can be independently audited.

10.3.2 *Annual Environmental Return*

An Annual Environmental Return will be provided to DSEWPaC which will address compliance with EPBC 2009/4974, Conditions 112 and 113) and contains the following:

- records any unavoidable adverse impacts to MNES
- outlines mitigation measures applied to avoid adverse impacts on MNES
- outlines any rehabilitation work undertaken in connection with any unavoidable adverse impact on MNES
- identifies all non-compliances with DSEWPaC conditions, and

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- identify any amendments to plans (including this RRRMP) to achieve compliance with EPBC 2009/4974 conditions).

The Annual Environmental Return will be published on the internet in March of each year.

10.3.3 *Environmental Authority Reporting*

An annual monitoring report will be prepared and submitted to the administering authority (DERM) upon request as required under the Condabri EA, PEN101674310, Schedule A, A45. This will cover reporting on the following rehabilitation monitoring required under the Condabri EA, PEN101674310, Schedule H, Monitoring, H15-H17:

- **Buried Transmission Pipeline and Flow Line Rehabilitation Monitoring:** monitor rehabilitated buried transmission pipeline corridors and flowlines for subsidence and erosion at least every 20 business days for the first 120 business days after rehabilitation
- **Progressive Rehabilitation Monitoring:** regular maintenance and at least yearly monitoring of rehabilitated areas must take place to measure compliance with requirements regarding progressive rehabilitation, and
- **Monitoring of Rehabilitation Success:** at least yearly monitoring must be undertaken to demonstrate compliance with final success criteria for significantly disturbed land for a minimum of five years after rehabilitation is completed.

The report on the above will include, but not necessarily be limited to the following, as outlined in the Condabri EA, PEN101674310, Schedule A, Monitoring, A45:

- a summary of the previous 12 months monitoring results obtained under all monitoring programs required under the EA and a comparison of the previous 12 months monitoring results
- the date and time on which the samples was taken
- the monitoring point at which the sample was taken
- the release flow rate of any authorised discharges to waters from all release points
- the results of all monitoring and details of any exceedances with the conditions of the EA and the dates and times these exceedances were reported to the administering authority
- a summary of all records of quantities of releases required to be kept under the EA including the total volume of any authorised discharges to waters for the previous yearly period from all release points and the individual daily volume of any authorised discharges to waters from all release points
- details of all maintenance or work carried out on any discharge meter(s) and the impact (if any) on the release volume readings
- an evaluation / explanation of the data derived from any monitoring programs
- data analyses and interpretation to assess the nature and extent of any contamination and the level of environmental harm caused as a result of the contamination and the environmentally relevant activity(ies), and

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- an outline of actions taken or proposed to minimise the risk of environmental harm from any condition or elevated contaminant levels identified by the monitoring or recording programs.

11. Review of the RRRMP

Australia Pacific LNG will engage an independent qualified ecologist, or other experts, approved by DSEWPaC to review the Remediation, Rehabilitation, Recovery and Monitoring Plan every 5 years. This review will take into account any new information available to Australia Pacific LNG, including any information and advice provided by Commonwealth or Queensland Government agencies or available from other CSG proponents. New information relevant to the RRRMP will be stored in the Australia Pacific LNG document management systems and made available to the independent qualified ecologist, or other experts and will be appropriately incorporated into subsequent revisions of the RRRMP.

The five yearly review program will involve an internal review by key relevant internal stakeholders to incorporate data and knowledge acquired in the preceding 24 months. Identification of review will be via a document retention schedule managed by internal compliance personnel. An independent qualified ecologist, or other experts, approved by DSEWPaC who are not an existing consultant involved in the preparation of the RRRMP or associated documentation will be engaged to conduct a fully independent review. The review program will be structured to involve:

- Access to APLNG GIS data sets and layers in relation to rehabilitation, remediation and monitoring records and activities
- Access to the APLNG documents, reports and annual returns which contribute to the supporting information and reporting for the RRRMP

12. Responsibility

12.1 Australia Pacific LNG

12.1.1 *Inductions and Training*

Australia Pacific LNG will develop inductions and training for all staff and contractors undertaking rehabilitation works, to ensure they are familiar with the procedures outlined in this RRRMP and are able to locate and report weed infestations and other hazards.

12.1.2 *Environment Group*

The Environment Group will be responsible for undertaking on-site checks to ensure the procedures in this RRRMP are followed. They will be also responsible for determining if site specific control measures (such as erosion and sediment control measures and weed control) are required.

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Appendix A - Map of the APLNG Project Area

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Appendix B - Environmental Impact Statement Conditions

Requirement Source	Requirement
EIS Vol. 1 Overview Ch. 6 Commitments – Gas Fields	6.1.3 Geology and soils Australia Pacific LNG commits to the following for the construction, operation, and decommissioning of the Project within the gas fields: • avoid areas of severe erosion potential where practicable • minimise erosion risk by refining construction techniques, and erosion and sediment control methods • creek rehabilitation will be consistent with surrounding environment and contours of the channel at the time of construction • point discharges will be directed to stable waterways and/or drainage lines with appropriate engineering controls, such as scour protection and flow velocity limits, and • develop and implement procedures and monitoring programs to identify, investigate and conduct necessary remedial works for potential site contamination to retain environmental values. 6.1.5 Landscape and visual amenity • remove surface infrastructure, where no longer required, during decommissioning and rehabilitate to a condition as close to its original state as possible. 6.1.15 Traffic and transport Australia Pacific LNG will: • rehabilitate, post construction, impacted stock routes • work with the Australian, Queensland and local governments and industry in regard to infrastructure alterations which may be required to meet the increased demands on the regional and local transport network which may include access road construction, flood mitigation measures, intersection and road modifications, pavement rehabilitation and road maintenance • decommission access roads to temporary facilities, laydown areas and stockpile sites that have been constructed as part of the Project, unless relevant government agencies or landowners agree with Australia Pacific LNG to leave them in place • implement measures to reduce, as far as practicable, the generation of dust by project vehicles, and • participate in pro-active weed management and will work closely with regional councils.

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Appendix C - Commonwealth Approval Conditions (EPBC 2009/4974)

Requirement Source	Requirement
DSEWPaC Approval Conditions EPBC 2009/4974 Record of impacts	13. If an impact occurs (which may include a presumed impact where the species is presumed to be present) to a MNES during gas field development, operation, or decommissioning the proponent must: a. record the impact by reference to: i. Location, specific site and type of infrastructure or activity ii. Each MNES subject to disturbance iii. The related site assessment or field ecological survey documentation and recommendations, or the decision that the particular MNES was presumed to be present iv. The total disturbance limit v. The remaining disturbance limit for each affected MNES vi. The reason for the decision, including justification for the action take, description of the efforts to avoid the impact; and an explanation why other constraints might justify the impact on the MNES vii. actions and commitments by the proponent to remediate, rehabilitate, or make good any unauthorised disturbance viii. record the information to a standard that can be independently audited.
DSEWPaC Approval Conditions Remediation, Rehabilitation, Recovery and Monitoring Plan	14. Where a direct or indirect impact has occurred to a MNES (which may include a presumed impact where the species is presumed to be present) the proponent under the Protocol must apply remediation, rehabilitation and recovery measures appropriate for each MNES to restore connectivity or rehabilitate disturbed areas to pre-clearance quality or better and to minimize cumulative impacts throughout the life of the Project. 15. Before commencement of gas field development the proponent must develop a Remediation, Rehabilitation, Recovery and Monitoring Plan. The Plan must: a. include site remediation measures including timeframes and standards for preventing erosion and stabilising disturbed soil in impact areas b. include measures to support recovery of listed species' habitat and recovery of listed ecological communities affected by gas field development c. include responses to threats to MNES from the proponent's operational activities and land management activities including the disposal and use of associated water, damage by livestock, and impacts from feral animals and weeds d. provide for fire prevention and management regimes during construction, operation and decommission of protected MNES e. include performance measures and related monitoring to assess site remediation, rehabilitation and recovery f. provide for reporting on the implementation of the Remediation, Rehabilitation, Recovery and Monitoring Plan including monitoring and performance standard which can be independently audited

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Requirement Source	Requirement
	g. reference relevant conservation advice, recovery plans, species management plans, or policies, practices, standards or guidelines endorsed or approved from time to time by the Department 16. The Remediation, Rehabilitation, Recovery and Monitoring Plan must be submitted for the approval of the Minister. Commencement of gas field development must not occur without approval of the Minister. The proponent may undertake activities that are critical to commencement that are associated with mobilisation of plant and equipment, materials, machinery and personnel prior to the start of development only if such activities will have no adverse impact on MNES, and only if the proponent has notified the Department in writing before an activity is undertaken. The approved Remediation, Rehabilitation, Recovery and Monitoring Plan must be implemented. 17. The proponent must establish a program to routinely review the Remediation, Rehabilitation, Recovery and Monitoring Plan by an independent qualified ecologist, or other experts, approved by the Department to take into account any new information available to the proponent, including any information and advice provided by Commonwealth or Queensland Government agencies or available from other CSG proponents. 18. The minister may require through a request in writing the periodic review of the Remediation, Rehabilitation, Recovery and Monitoring Plan by the Department or alternatively qualified ecologist, or other experts, approved by the Department. Plans must be approved by the Department in writing. 19. Independent review of the plans will be at financial expense of the proponent. Once independently reviewed, plans must be submitted for written approval to the Department. Approved plans must be implemented.

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Appendix D - Coordinator General's Conditions

Requirement Source	Requirement
Appendix 1, Conditions that apply to the whole project – gas fields, gas transmission pipelines and LNG facility Part 1 General	Condition 6, Stock routes The parts of the stock route network disturbed or affected by the works must be rehabilitated upon completion of the project to a state that is safe for travelling stock and drovers, and the travelling public, and is consistent with the area's pre-disturbance state unless otherwise agreed by DERM and the local government.
Appendix 2, Conditions that apply to the Gas Fields Part 2 Environmental	Condition 15, Borrow Pits Prior to the construction of borrow pits the proponent must undertake an assessment of the environmental values, potential impacts, mitigation measures for the siting, construction, operation, decommissioning and rehabilitation of borrow pits required for petroleum activities and will provide this assessment to the administering authority.
Appendix 2, Conditions that apply to the Gas Fields Part 2 Environmental	Condition 18, Dam decommissioning Decommissioned dams are to be rehabilitated and the landform must be reinstated such that it will not function as a dam and will be stable and sustainable for the foreseeable future (unless otherwise negotiated with landholders). A minimum depth of 0.25m topsoil must be placed over decommissioned storage dams to ensure an adequate vegetal cover can be established.
Appendix 2, Conditions that apply to the Gas Fields Part 3 CSG Model Conditions Schedule H - Rehabilitation	(H1) The holder of this environmental authority must not abandon any dam but must decommission each dam so as to prevent and/or minimise any environmental harm. (H2) As a minimum, decommissioning must be conducted such that each dam either: a. becomes a stable landform similar to that of surrounding undisturbed areas, that no longer contains substances that will migrate into the environment, or b. is approved or authorised by the administering authority for use by the landholder following cessation of the petroleum activities. (H3) Progressive rehabilitation of disturbed areas must commence as soon as practicable following the completion of any construction or operational works associated with the petroleum activities. (H4) As soon as practicable but no later than 12 months (or longer period agreed in writing by the administering authority) after the end of petroleum activities causing significant disturbance to land, the holder of the authority must: a. remediate contaminated land (e.g. dams containing salt) b. reshape all significantly disturbed land to a stable landform similar to that of surrounding undisturbed areas c. on all significantly disturbed land, take all reasonable and practicable measures to: i. re-establish surface drainage lines ii. reinstate the top layer of the soil profile

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Requirement Source	Requirement
	iii. promote establishment of vegetation. d. undertake rehabilitation in a manner such that any actual and potential acid sulfate soils on the site are either not disturbed, or submerged, or treated so as to not be likely to cause environmental harm e. decommission all inactive buried pipelines in accordance with the requirements of AS 2885 and ensuring that there will not be any subsequent subsidence of land along the pipeline route. (H5) All significantly disturbed land caused by the carrying out of the petroleum activities must be rehabilitated to: a. a stable landform and with a self-sustaining vegetation cover and species that are similar to adjoining undisturbed areas b. ensure that all land is reinstated to the pre-disturbed land use and suitability class c. ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities d. ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm. (H6) Maintenance of rehabilitated areas must take place to ensure and demonstrate: a. stability of landforms b. erosion control measures remain effective c. stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters d. plants show healthy growth and recruitment is occurring e. rehabilitated areas are free of any declared pest plants. H7) Rehabilitation can be considered successful when: a. the site can be managed for its designated land-use (e.g. similar to that of surrounding undisturbed areas) b. no greater management input than for other land in the area being used for a similar purpose is required and there is evidence that the rehabilitation has been successful for at least three (3) years c. the rehabilitation is carried out in accordance with the goals, objectives indicators and completion criteria as specified in *Schedule H, Table 1—Planned rehabilitation specifications*, or d. written agreement is obtained from the landowner/holder and administering authority.
Appendix 3, Conditions that apply to the Gas Transmission Line Part 2, General Conditions	Condition 9, GQAL The proponent must include provisions in the EM Plan for the gas pipeline, ensuring that, on land identified as being good quality agricultural land (GQAL), the pipeline contractor must: e. on completion of construction, remove temporary access tracks f. on completion of construction, lightly rip disturbed areas, replace topsoil and return the surface to a land use condition that serves the

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Requirement Source	Requirement
	preconstruction use g. on completion of construction, implement land management and erosion control measures h. on land with GQAL class A, B or C1, bury the pipeline to at least 0.9m below finished land surface, or greater if deep ripping is a normal practice.
Appendix 3, Conditions that apply to the Gas Transmission Line Part 4, Environmental Authority Conditions Schedule E Land and Waterway Management	Rehabilitation Requirements (E35) Progressive rehabilitation of disturbed areas must commence as soon as practicable following the completion of any construction or operational works associated with the authorised petroleum activities on the relevant petroleum authority. (E36) The holder of this authority must ensure that the pipeline right of way is reinstated to a maximum width of 12 metres once construction of the pipeline is completed. (E37) For areas of native vegetation, revegetation must use seed sourced from local provenance native species, where available. (E38) Rehabilitation of the pipeline corridor should allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity. (E39) As soon as practicable and within three months at the end of petroleum activities that cause any significant disturbance to land, the holder of this authority must investigate contaminated land status in accordance with Environmental Protection Act 1994 requirements and the National Environment Protection (Site Assessment) Measure 1999 where land has been subject to contamination caused by petroleum activities authorised under this authority. (E40) All land significantly disturbed by petroleum activities must be rehabilitated to: a. a stable landform with a self-sustaining vegetation cover with same species and density of cover to that of the surrounding undisturbed areas, except over the area that must be maintained free of large flora species for pipeline integrity and access, and in cases where approval is sought in accordance with Condition (E37); b. ensure that all land is reinstated to the pre-disturbed land use and suitability class; c. ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities. (E41) Notwithstanding Condition (E37), for any planned rehabilitation outcome that will not fulfil the rehabilitation requirements listed in Condition (E42), written agreement must be sought from the administering authority, prior to the rehabilitation being carried out. (E42) Maintenance of rehabilitated areas must take place to ensure and demonstrate: a. stability of landforms; b. erosion control measures remain effective; c. stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters;

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Requirement Source	Requirement
	d. plants show healthy growth and recruitment is occurring; and e. declared pest plants are controlled on rehabilitated areas to a level consistent with the surrounding property and prevented from spreading to unaffected areas through authorised petroleum activities. (E43) Rehabilitation can be considered successful when the site can be managed for its designated land-use (either similar to that of surrounding undisturbed areas or as otherwise agreed in a written document with the landowner/holder and administering authority) without any greater management input than for other land in the area being used for a similar purpose and there is evidence that the rehabilitation has been successful for at least three years

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Appendix E - Condabri EA, EA No: PEN101674310

SCHEDULE H – REHABILITATION

Rehabilitation Plan

(H1) A Rehabilitation Plan which has been certified by a suitably qualified person must be developed prior to carrying out of the petroleum activity (ies).

(H2) The Rehabilitation plan must include strategies for the determination of final land use(s) and rehabilitation goals and details of how rehabilitation objectives will be achieved. The Rehabilitation Plan must include:

(a) a rehabilitation hierarchy for:
  (i) reinstating a native ecosystem as similar as possible to the original ecosystem as the preferred option; then
  (ii) establishing an alternative outcome with a higher environmental value than the previous land use; then
  (iii) reinstating the previous land use (grazing or cropping); and

(b) Methods to achieve rehabilitation goals including, but not necessarily being limited to:
  (i) establishing final land use(s) in consultation with affected landholder(s) and the administering authority;
  (ii) identifying suitable analogue sites to measure rehabilitation success that may either be the pre-disturbed area or another area that has equivalent values and characteristics as the intended final land use(s); and
  (iii) for sites that are being reinstated to a land use other than a native ecosystem, the Rehabilitation Plan must identify any additional and relevant indicators to be measured at both the analogue and rehabilitation site(s) so as to asses progressive and final rehabilitation success for that land use;
  (iv) for sites that are being reinstated to a native ecosystems and the analogue site is the pre-disturbed site, the Rehabilitation Plan must include indicators that, as a minimum include those in condition (H10)(a) – (H10)(d) and will be able to measure success against the progressive and final rehabilitation criteria in this environmental authority;
  (v) Identification of any land use constraints which have resulted from the petroleum activity(ies);
  (vi) residual pollution risks with strategies for managing and mitigation them;
  (vii) landscape planning and landform design principles to achieve stable landforms including slope designs, erosion controls and drainage lines;
  (viii) integrating rehabilitated areas so they are compatible with the surrounding landscape, including linking rehabilitated areas of native vegetation with undisturbed native vegetation to provide larger areas and wildlife corridors where feasible;

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(ix) ensuring that significantly disturbed areas are rehabilitated progressively and that the progressive rehabilitation criteria are routinely measured;
(x) site preparation such as re-profiling, re-instating surface drainage systems;
(xi) top soil management such as top soil handling and stockpiling to preserve soil fertility and biota, respreading techniques, planned thickness, ripping, top soil treatments/amendments and mulching in consideration of analogue data;
(xii) flora to be established, including required species diversity, abundance and composition and projective cover in consideration of analogue data;
(xiii) plant propagation and/or supply methods including seeds/spores of local provenance where feasible;
(xiv) establishment methods to maximise rehabilitation success such as seed treatments, seed spreading, timing of seeding to suit best local climatic conditions, hydro seeding, transplanting;
(xv) weed control
(xvi) sourcing habitat structures for native fauna and installation methods in consideration of matching analogue data;
(xvii) ongoing maintenance program for rehabilitated areas; and
(xviii) rehabilitation monitoring program as required by conditions (H13) and (H14) of this environmental authority

(c) Timeframes for commencing rehabilitation of significantly disturbed areas not required for the ongoing conduct of the petroleum activities, not greater than 3 months for the rehabilitation of buried pipelines and not greater than nine months for any other disturbed area

(H3) The holder of this environmental authority must implement the Rehabilitation Plan.

Progressive Rehabilitation for Significantly Disturbed Land

(H4) Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.

(H5) During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.

(H6) Backfilled and rehabilitated pipeline trenches must:

(a) be a stable landform;

(b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and

(c) be re-profiled to a level consistent with surrounding soils; and

(d) be re-profiled to original contours and established drainage lines; and

(e) be visually consistent with the surrounding land features; and.

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(f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.

(H7) Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity (ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity (ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity (ies).

(H8) Progressive rehabilitation of significantly disturbed land must be undertaken in accordance with the Schedule of Disturbance submitted to the administering authority as part of the financial assurance calculations

(H9) Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity (ies) must:

(a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt);

(b) reshape all significantly disturbed land to a stable landform;

(c) reprofile all significantly disturbed land to original contours;

(d) on all significantly disturbed land:

(i). re-establish surface drainage lines;

(ii). reinstate the top layer of the soil profile;

(iii). establish groundcover to ensure that erosion is minimised;

(iv). establish vegetation of floristic species composition found in analogue sites;

(e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and/or minimise environmental harm.

Final Acceptance Criteria for Significantly Disturbed Land

(H10) All significantly disturbed land caused by the carrying out of the petroleum activity (ies) must be rehabilitated to meet the following final acceptance criteria:

(a) all significantly disturbed land is reinstated to the pre-disturbed land use unless otherwise agreed to between the holder of this environmental authority, the landholder and the administering authority and is provided for in the Operational Plan;

(b) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class;

(c) the landform is safe for humans and fauna;

(d) the landform is stable with no subsidence or erosion gullies for at least five (5) years;

(e) a minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least three (3) years;

(f) a minimum of 80% of the flora species diversity in analogue sites is maintained in the rehabilitated sites for at least three (3) years;

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(g) a minimum equal density of habitat structures, including but not limited to litter cover, fallen woody material and hollow logs, as that in analogue sites;

(h) erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person;

(i) the water quality of any residual void or water bodies constructed by the petroleum activity(ies) meets criteria for subsequent uses and does not have potential to cause environmental harm;

(j) there is no ongoing contamination to waters;

(k) there is no ongoing contamination to groundwater from dams or monocells (demonstrated via groundwater monitoring and leak detection monitoring systems); and

(l) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activity (ies).

(H11) Notwithstanding condition (H10), all buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885.

(H12) Despite condition (H10), any dam may be decommissioned for a beneficial use provided that it:

(a) no longer contains contaminants that will migrate in to the environment; and

(b) the administering authority and the landowner agree in writing that the dam will be used by the landholder following the cessation of the petroleum activity (ies).

Rehabilitation Monitoring Program

(H13) A Rehabilitation Monitoring program which has been certified by a suitable qualified person must be developed by the 9th September 2011

(H14) The rehabilitation Monitoring Program must include, but not necessarily be limited to:

(a) Methods to measure subsidence and erosion rates at rehabilitated buried transmission pipeline corridors and buried flow lines;

(b) Monitoring of indicators identified in the Rehabilitation Plan at analogue sites to measure progressive and final rehabilitation success relevant to the final land use(s); and

(c) Frequency and seasonality of monitoring analogue sites and rehabilitated areas to assess rehabilitation success; and

(d) Identification of the experimental design for analysing analogue and rehabilitated site data including statistical methods of analyses.

(H15) The holder of this environmental authority must implement the Rehabilitation Monitoring Program.

Monitoring of Final Rehabilitation Success

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(H16) At least yearly monitoring of rehabilitated areas must be undertaken to demonstrate compliance with the requirements of Condition (H10) for a minimum of 5 years after rehabilitation is completed.

Progressive Rehabilitation Monitoring

(H17) Regular maintenance and at least yearly monitoring of rehabilitated areas must take place to measure compliance with the requirements of condition H6.

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Appendix F - Rehabilitation Techniques for Broad Vegetation Groups

Rock Pavements

Rock pavements are included in RE 11.7.5 and RE 11.3.6, both of which are listed as Least Concern under the VM Act.

These REs contain species of *Calytrix*, *Hakea*, *Kunzea*, *Micromyrtus*, *Acacia* and *Melaleuca*. Spinifex (*Triodia* spp.) typically dominates the ground layer. Often with scattered or fringing eucalypts.

Although some of the dominant shrubs germinate relatively well, enhancing regrowth of existing stands is more effective than revegetating shrublands from bare areas. A large proportion of the dominant shrub species produce and store seed within capsules which often remain un-opened on the plant for a few years. Examples include species of *Calytrix Hakea, Kunzea, Micromyrtus* and *Melaleuca*. Seeds should be collected by cutting off outer branches containing capsules, allowing to dry and collecting seeds as they are released. This should be applied through direct seeding.

Callitris Dominated or Co-dominated Woodlands

Callitris (Cypress Pine) dominated or co-dominated woodlands are represented by REs 11.10.7a; 11.10.9, 11.3.14, 11.3.18, 11.3.19, 11.5.21 and 11.5.4. All of these REs are listed as Least Concern under the VM Act.

These REs are dominated by *Callitris endlicheri* (Black Cypress Pine) and *C. glaucophylla* (White Cypress Pine) and *Allocasuarina luehmannii* (Bull Oak or Buloke) with co-dominant eucalypts. Seed of the dominant trees of these ecosystems (i.e. Black Cypress Pine, White Cypress Pine and Buloke) germinate easily. Therefore these ecosystems can be revegetated moderately easily and regrowth can be enhanced using direct seeding of these species.

Cypress Pines produce seed within cones which open when mature. Seed should be collected from near-ripe cones, by cutting branches containing cones and allowing to ripen within a paper bag or on a tarp to collect released seed. Sow fresh seed directly onto the site, where a moderate establishment rate should be expected during an adequate wet season. Exposing seeds to ambient temperature smoke before sowing may enhance the germination of Black Cypress Pine and White Cypress Pine.

The associated Buloke holds seed in un-opened capsules on the tree. Seeds will be released from capsules after collection. Sow fresh seed, without any pre-treatment. Buloke is a relatively fast growing tree, which will help re-establish these ecosystems quickly. Wattles are often present, such as *Acacia leiocalyx* and *Acacia wardellii*. Soak wattle seed in hot water over night prior to direct seeding.

Cypress Pines are killed by fires that scorch the entire canopy, but mostly survive fires that burn through the grass without scorching all leaves. Seed germination of Black Cypress Pine and White Cypress Pine can be promoted by fire. Therefore, to maintain Cypress Pine, it is important to restrict any fires to a low intensity. Occasional fires within cypress pine forests may benefit cypress seedling recruitment and promoting associated grasses and herbs.

Lancewood and Bendee Dominated Woodlands

Acacia shirleyae (Lancewood) and *A. catenulata* (Bendee) dominated woodlands are represented by REs 11.10.3 and 11.7.2, both of which are listed as Least Concern under the VM Act.

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Lancewood and Bendee occur in dense thickets or woodlands on poor soils. Lancewood, and to a lesser degree Bendee, have fire-promoted hard seeds. Therefore seed should be soaked in hot water, or scarified, prior to seeding. Other associated wattles, such as *Acacia sparsiflora* and *A. rhodoxylon* would also benefit from soaking seeds in hot water. Alternatively a fire could be implemented in an area that previously contained Lancewood to promote any remaining soil seed reserves. However, Lancewood and Bendee are fire-killed and so fire must be kept out of rehabilitation areas after seedling establishment. Direct sowing of seed is an efficient means of recruiting Lancewood and Bendee.

Lancewood and Bendee are killed by fire. Seed germination of Lancewood can be promoted by fire but seedlings can take 15 years to re-establish mature canopies. Fires allow grasses to invade these forests, which promote subsequent fires. Often Lancewood and Bendee forests grow on rocky outcrops and scarps that naturally reduce the occurrence of fires. However, where fuel loads build up in the surrounding landscape, intense fires can carry into Lancewood and Bendee forests during dry years. Maintain low fuel loads in eucalypt woodlands adjacent to Lancewood and Bendee forests, through grazing or regular, low intensity burning of eucalypt woodlands. Where burning in adjacent woodlands, ignite fires from near the edge of forests to ensure fire burns away from the boundary.

Eucalypt Dominated or Co-dominated Woodlands

Eucalypt dominated or co-dominated woodlands are represented by REs 11.3.2, 11.3.26, 11.3.39, 11.4.12, 11.5.1, 11.5.20, 11.5.5, 11.7.4, 11.7.6, 11.7.7, 11.9.7, 11.9.9, 11.10.1, 11.10.11, 11.10.13 and 11.10.7. All of these REs are listed as Least Concern under the VM Act, except RE 11.3.2 and 11.9.7 which are listed as Of Concern and RE 11.4.12 which is listed as Endangered under the VM Act.

Eucalypt woodlands in the Project area typically contain abundant small saplings amongst the grass layer, which act as reserves to replace dying trees. However, natural seed germination events of eucalypts are rare, occurring following the right timing and quantity of rainfall. Natural germination of some eucalypts occurs more often, such as in *Corymbia citriodora* (Spotted Gum), than in others such as *Eucalyptus crebra* (Narrow-leafed Ironbark). Therefore encouraging regrowth of previous eucalypt woodlands is more efficient than revegetating bare areas.

The seed of eucalypts fall from the capsules when mature, although seed is not always produced annually. Collect mature capsules before or as seed is released. Seed should be sown fresh with no pre-treatment necessary.

Various wattles (*Acacia* spp.) grow within eucalypt woodlands. These wattles require seeds to be soaked in hot water prior to sowing. Wattles should establish easily from direct seeding after soaking in hot water. However, it is important not to sow high densities of wattles, because they form wattle thickets that smother out the regeneration of other plants.

Other associated shrubs with fleshy fruits (e.g. *Geijera parviflora* and *Eremophila mitchellii*) will germinate at a higher rate if the flesh is removed from around the seed prior to sowing.

The structure and species composition of eucalypt woodlands is maintained through the use of moderately regular burning. Burning in eucalypt woodland sites that are adjacent to fire sensitive vegetation (e.g. Brigalow and SEVTs) provides protection from wildfires to those sensitive habitats. Fuel reduction burning should primarily occur within these eucalypt woodlands. Implement moderately regular burning under mild conditions to create a patchily burnt landscape. Fire killed shrubs (e.g. *Acacia decora*) and trees (e.g. Cypress Pine and Buloke) associated with these eucalypt woodlands require long fire intervals to regenerate to maturity. Limit active burning in these areas by burning under mild conditions.

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