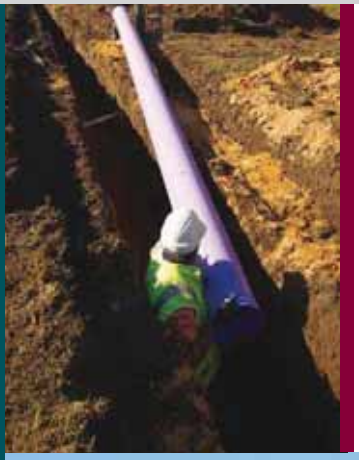
the australian PIPELINE industry association Ltd

CODE OF ENVIRONMENTAL PRACTICE

ONSHORE PIPELINES

MAY 2013



ENSURING THE FUTURE OF AUSTRALIA'S DYNAMIC PIPELINE INDUSTRY

Published by Australian Pipeline Industry Association Ltd

Original document prepared by Ecos Consulting (Aust) and updated by members of the APIA Working Group on the Environment.

First Published:
1998 “Part A” (Construction)
2000 “Part B” (Operations)
2005 “Part C” (Decommissioning)

Revised:
Revision 1 October 2005
Revision 2 March 2009
Revision 3 May 2013

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ACKNOWLEDGEMENTS

This revision of the Code of Environmental Practice (CoEP) has been prepared on behalf of the Australian Pipeline Industry Association (APIA) by CNC Project Management Pty Ltd, under the direction of APIA's HS&E Committee and the CoEP Working Group. APIA would like to thank CNC Project Management and staff, particularly Ian Spence, Mike Bugler, Daniel Craddock and Matt McDermot, for the contributions made to the Code. APIA also thanks the CoEP Working Group for their input and guidance during this third revision. Membership of the working group for this revision included Ross Calvert, Mick Cave, James Douglas, Jodi Gratton, Wendy Mathieson, Dan Morgan, Chandima Nawela, Tony Vervest and Kevin Wolfe. Special thanks to Justin Claridge and Richard Henderson for their expert advice on soil management and HDD respectively.

This third revision and update specifically focused on currency issues within the industry, particularly legislative and Australian Standards currency, standardising industry terminologies, practices and control measures, with recognition of water and other product transmission pipelines as adding to the adequacy of the above mentioned practice and process for pipeline industry.

The continued development of the Code is only possible thanks to the work of earlier contributions and APIA gratefully recognises the efforts made by all those who have participated in the Code's original development and revisions.

During the development of the original Code, membership of the APIA Environmental Affairs Committee included: Jim McDonald, Lindsay Goodwin, John Balint, Ken Berry, Craig Bonar, Ross Calvert, Megan Lawson, Tom Lyon, Julie Mitchell, Bruce Ride, Mike Sotak and Mark Watson.

APIA acknowledges the support and technical input of its members and the many individuals and Government agencies throughout Australia who have provided invaluable input to both the original and the first revision of the Code. In particular APIA would like to thank the following people: Susie Smith, Grant Bowley, Robert Coughlin, Bob Day, Sam Haddad, Kathy Hill, Colin Mason, Richard McDonough, Bob Otjen, Philip Toyne, Steve Tunstill, Westcoast Energy Australia, Jodi Bond, Allen Beasley, Ian Haddow, Leonie Chapman, Wendy Mathieson, Craig Bonar, Lloyd Nicholls-Goffey, Phil Morrell, Steve Milne, Zoë Bowen, Belinda Close and Terry Aust.

APIA acknowledges the further contributions made by the working group overseeing the Code's second revision. Membership of this working group included Dan Morgan, Kim Hardy, Garry Davis, Ada Cinaglia, Oleg Morozow, Stephen Milne, Lisa Carson and Jim Nikolareas. APIA also acknowledges the Code second revision's preliminary review participants, Kent Scott, Michael Quirk, Jasper Hennekens, Adam Pullen, Aidan Cresser and Andrew Groenwoldt.

PREFACE

The pipeline industry has a vital role in the economic and environmental wellbeing of Australia. Over many decades it has evolved techniques which now place it at the forefront of best practice in the construction, operation and decommissioning of pipelines. This enviable reputation is now recognised internationally and our experience is increasingly sought in many countries.

This Code is intended to encapsulate the best and most appropriate techniques and methods presently available to mitigate or eliminate the environmental impact of our activities and is based on the collective knowledge and experience of pipeline industry participants. APIA intends that the Code is viewed in the Australian pipeline industry as the minimum acceptable standard.

All pipeline construction is different and, consequently, it is not possible to set prescriptions on any particular course of action. Rather, we have assembled options for action, which, together, form a 'tool kit'. It is from these tool kits that the planners and the construction teams in the field will select the options best suited to their needs.

The Code demonstrates the industry's commitment to be leaders in the move to ecologically sustainable development and to be an active contributor to national goals for biodiversity protection and greenhouse mitigation.

The Code is a living, evolving document, and as such, will be reviewed frequently in light of new science, technology and regulation, to ensure that it reflects the most sensible, practical and effective practice of the time. By this continuing process of improvement, we believe our industry will maintain its position at the leading edge of environment protection in Australia.

This Code has been developed by APIA in consultation with its membership, the former Australian Gas Association, the Australian Petroleum Production and Exploration Association and pipeline regulating authorities in each Australian State and Territory. APIA Members are encouraged to adopt this Code and to provide feedback on its application. Community members are also invited to provide feedback to APIA on this initiative.

Comments may be forwarded to APIA at:

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1 INTRODUCTION

Supplying energy, water and mineral resources to communities and industry, pipelines play a vital role in Australia, directly contributing to national economic growth. Pipelines play an integral part in supplying critical commodities and energy sources to domestic and international markets. They play a major role in drought mitigation and support the development and commercialisation of primary industries throughout Australia. Pipelines are synonymous with the generation of a low carbon economy with efficiently transported commodities such as natural gas providing an important, low emission fuel with a long-term role in transitioning Australia to a low emission future. Pipelines are also providing the link between CO_2 source and sequestration sites to enable carbon capture and storage technologies and will move fuels of the future, such as hydrogen.

Pipelines continue to be the most energy efficient method of transportation for the commodities that they transfer and distribute throughout Australia.

In Australia, pipelines are used for a range of purposes including:

- domestic and industrial water supply
- sewage and waste water removal including recycled water
- gas transmission, storage and distribution
- petroleum and petrochemical liquids transmission
- slurry transportation
- powerline and cable conduits.

In 2012, the gas transmission pipelines that are APIA's core focus transported over 1,300 petajoules (P)J of the natural gas that is used in the Australian economy each year.
One PJ, or 278 gigawatt hours, is the heat energy content of about 43 000 tonnes of black coal or 29 million litres of petrol. 740PJ of natural gas are consumed directly for energy in Australia every year, and another 600PJ are used for electricity generation and in manufacturing processes where the gas is used as feedstock to create products such as fertilizers, explosives and other chemicals.

Is not often recognised that the 740 PJ of energy delivered directly by Australia's gas transmission and distribution pipelines is roughly equivalent to the entire energy output of the electricity sector, which in 2012 was 870 PJ or 242TWh. When the fact that 15% of the electricity was generated by natural gas-fired power stations is considered, it is apparent that natural gas supplies an equal amount of energy to the Australian economy as the electricity sector. Natural gas does this cleanly and efficiently and gas transportation by pipeline is the most efficient way to transport energy. In terms of transmission losses, an average of 1% of energy is used by a transmission pipeline to transport gas in comparison with an average loss in electricity networks of 7%.

The Australian pipeline industry is committed to ensuring that, as well as being a highly efficient mode of transport, pipelines have a low physical impact on the environments they pass through, and that they continue to do this throughout their lifespan, from construction through their operating life to decommissioning.

Pipelines constructed, operated and decommissioned in an appropriate manner have no lasting impact on the surrounding environment, and in almost all circumstances do not prevent the continued availability of any land they pass through for current or future uses.

1.1 ECOLOGICALLY-SUSTAINABLE DEVELOPMENT

Sustainability is a powerful global and national goal and is also a moral imperative influencing Australia's construction industry. With increasing community concern for the environment, over social impacts and climate change, as well as an increased focus on energy consumption in a carbon regulated world, the pipeline industry will need to take steps to ensure its facilities and operations are developed with ecological sustainability in mind.

While there is no universally accepted definition of ecologically sustainable development (ESD), in 1992 the Commonwealth Government suggested the following definition for ESD in Australia:

> *'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.*

Put more simply, ESD is development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. To do this, we need to develop ways of using those environmental resources which form the basis of our economy in a way which maintains, and where possible improves, their range, variety and quality. At the same time we need to apply those resources to develop industry and generate employment.

Embracing ESD principles within pipeline projects will contribute to achieving more economically sustainable projects and operations, while meeting community social and environmental objectives and being in accord with international agreements, national legislation, standards and codes of practice. On this basis, it can be said that the long-term future of the Australian pipeline industry is dependent on its members giving due consideration of ESD.

The pipeline industry is in a unique position within the infrastructure and energy sectors to do so. As pipelines are, in the vast majority of cases, buried infrastructure, the industry has the opportunity to minimise environmental and social impacts in ways not available to other forms of infrastructure. It is APIA's goal that Australia's pipeline industry is seen as national and global leaders in ESD.

1.1.1 PRINCIPLES FOR ESD IN AUSTRALIA'S PIPELINE INDUSTRY

Within the National Strategy for Ecologically Sustainable Development are seven guiding principles. APIA has adapted these for Australia's pipeline industry and encourages all pipeline proponents to recognise the following principles in their decision-making processes:

- Decision-making processes should effectively integrate both long- and short-term economic, environmental, social and equity considerations
- where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- the national dimension of the potential environmental impacts of actions and activities should be recognised and considered
- the pipeline industry should contribute to the development of a strong, growing and diversified economy which can enhance the capacity for environmental protection to be recognised
- the need to maintain and enhance competitiveness in an environmentally-sound manner should be recognised
- cost effective and flexible approaches should be adopted
- decisions and actions should provide for broad community involvement on issues which affect it

The effective adoption of these principles will enable Australia's pipeline industry to achieve APIA's goal of having Australia's pipeline industry recognised as national and global leaders in ESD.

1.2 PURPOSE AND SCOPE OF THIS CODE

This Code aims to assist the industry by establishing a minimum acceptable standard to be applied to the onshore pipeline construction, operation and decommissioning phases, encouraging the adoption and integration of sensible, practical and effective environmental management systems and procedures. It is APIA's view that the application of the standards in this Code will enable onshore pipeline proponents to exceed Commonwealth and State regulatory requirements, with the result that the consistent application of this Code across the pipeline industry will generate a lasting legacy of sustainability for existing projects and will help generate a positive reception for new pipeline projects.

Offshore pipelines outside State/Territory waters and within Commonwealth waters are regulated by Joint Authorities (consisting of the relevant State/Territory and Commonwealth ministers) under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and other legislation are not considered by this Code. Similarly, pipelines within state territorial seas are managed under legislation that generally mirrors the Commonwealth legislation referred to above, and is a specialised not covered by the Code.

In line with APIA's current core membership base, this Code has been written with high pressure gas transmission pipelines as its priority. It should however be noted that many of the

project activities and environmental guidelines outlined in the Code are readily adaptable to other transmission or distribution pipelines, including oil, water and slurry.

1.3 INTENDED USE OF THIS CODE

This Code provides guidance on the development and implementation of internationally-recognised Environmental Management System standards and provides comprehensive environmental management guidance for onshore pipeline construction, operation and decommissioning.

The Code applies to the Australian onshore pipeline industry (refer to Appendix 1); in particular, the planning, design, construction, operation and decommissioning. The Code is intended to complement the principles of Australian Standards that apply to pipelines and the environment.

The Code should be used as a minimum acceptable standard from which to develop environmental management plans and procedures for a variety of pipelines, as well as a resource for all stages of the pipeline design, planning, construction, operation (maintenance) and decommissioning phases.

The Code does not contain the full and final detail on any aspect of environmental management and, while it provides an excellent starting point, is not a substitute for a comprehensive environmental management plan. It is expected that pipeline proponents and operators use the Code as a guide, which they apply to their own specific circumstances to achieve sound outcomes for the environment using their in-house resources.

1.4 LAYOUT OF THIS CODE

This Code aims to provide guidance and direction in the management of the environmental aspects of pipeline planning, construction, operation and decommissioning.

Section 1 – Introduction outlines the purpose and intended use of the code.

Section 2 – **Legislative and Regulatory Governance** identifies and discusses the key elements of legislation and regulatory processes associated with pipeline planning, construction, operation and decommissioning.

Section 3 – **Environmental Management Systems** provides guidance on the development of Environmental Management Systems consistent with internationally-recognised standards such as *AS/NZS ISO 14001Environmental Management Systems – Requirements with guidance for use*.

Section 4 – Establishment and Evaluation of Risk provides guidance on environmental risk through all stage of the project lifecycle.

Section 5 – Pipeline Planning provides a description of the environmental considerations during pipeline planning and approvals process, from pipeline design and route selection to preparation of an environmental impact assessment.

Section 6 – Pipeline Construction provides a detailed description of the various activities undertaken as part of the pipeline construction phase.

Section 7 – Pipeline Operation and Easement Management describes the key environmental considerations associated with an operational pipeline, including management of facilities, safety and emergency response and pipeline failure response**.**

Section 8 - Decommissioning Process provides a detailed description the key environmental considerations associated with pipeline decommissioning. In this code 'Decommissioning' has the same definition as 'Abandonment' when used in applicable Standards and State legislation.

Section 9 – Environmental Guidelines: Impacts and Best Practice Management provides guidance on the management of potential environmental impacts associated with pipeline planning, construction, operation and decommissioning.

In order to maintain the Code as the primary reference point for the minimu acceptable industry standards, it will be reviewed and updated on a regular basis, with no more than three years between reviews. This will allow the timely incorporation of advances in technology, legislative changes and will help ensure the currency of listed environmental control measures.

1.4.1 PROJECT LIFECYCLE

This Code of Environmental Practice recognises four distinct phases in a pipeline's lifecycle; Planning, Construction, Operation and Decommissioning; these phases include the elements summarised below.

Planning: Pipeline and facilities design, route selection and facility siting, environmental impact assessment, stakeholder and community consultation and development of construction and operations environmental management plans (CEMP and OEMP respectively).

Construction: Continuous stakeholder engagement, implementation of CEMP, stakeholder and community consultation, creation of borrow pits, establish construction camps and work sites, clearing, grading, trenching, blasting, water course crossings, floating of machinery, construction of facilities, stringing, coating, welding, pipelaying, backfilling, pipe-testing and final coating, hydrostatic testing, pipeline purging final commissioning and disturbed area rehabilitation.

Operations: Implementation of OEMP, ongoing easement and facilities management, additional earthworks, safety and emergency planning, pipeline failure and incident response and ongoing stakeholder engagement.

Decommissioning: Implementation of decommissioning strategy.

Sections 5-8 of this code address industry best practice measures for managing pipeline activities at each stage of the project lifecycle. Each activity has the potential to create environmental impact,

Section 9 of this code identifies key environmental management aspects, their associated issues and outlines recommended management measures to address each one. Key environmental management requirements have been identified as:

- Flora Management
- Weed Management
- Fauna Management
- Biosecurity Management
- Heritage Management – Natural and Built Environments
- Soils Management
- Aboriginal Cultural Heritage Management
- Drainage, Erosion and Sediment Management
- Water Management
- Waste Management
- Noise Management
- Traffic Management
- Dust and other Air Emissions Management
- Fuel and Chemical Management
- Fire Prevention Management

1.4.2 CODE OF PRACTICE FOR STAKEHOLDER ENGAGEMENT

During 2013, APIA will be developing a stand-alone Code of Practice for Stakeholder Engagement to provide guidance to the pipeline industry on developing and managing relationships with the wide range of stakeholders that a pipeline project can affect. The management of these relationships is often closely related to the management of environmental issues and prior to this edition of the Code of Environmental Practice some of these stakeholder engagement practices were dealt with in this Code.

With the development of a stand-alone Code of Practice for Stakeholder Engagement, this Code will no longer specify particular stakeholder engagement techniques, but rather will contain timely reminders of the importance of effective stakeholder engagement practices..

2 LEGISLATIVE AND REGULATORY GOVERNANCE

2.1 REGULATORY CONTEXT

Regulatory authority for the construction, operation, maintenance and decommissioning of onshore pipelines in Australia is held by each State and Territory jurisdiction under the applicable pipeline or infrastructure legislation. Commonwealth approvals and legislative procedures may also be applicable, particularly the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and *Native Title Act 1993*. Smaller pipelines, including distribution pipelines or pipelines carrying non-petroleum products, may be subject to local government approval through the preparation and submission of a Development Application with supporting documentation. A list of relevant legislation, current as at the date of this edition is provided in Appendix 3. To ensure currency and consistency with existing legislation, APIA advises its members to undertake a review prior to commencement of planning each new project.

Due to varying requirements and the often complex nature of pipeline approvals processes, APIA advises its members to seek clarification on approvals processes from personnel with experience in these processes and from the relevant Commonwealth, State/ Territory or Local Government regulatory authorities.

A proposed pipeline which crosses more than one jurisdiction will require a coordinated approach to planning approvals. This involves an environmental assessment process that meets the statutory requirements of each jurisdiction. Commonwealth involvement in the review of proposed pipelines within the States or Territories may be initiated where the project will impact on Commonwealth land or if the project is likely to have significant impact on a listed Matter of National Environmental Significance[1]. If such impacts are likely, the proponent must refer the project to the Commonwealth Government for a decision on whether the activity is a "controlled action" and therefore requires approval under the Act. If there is any likelihood that EPBC approval will be required, it is recommended that engagement with Commonwealth and state or territory regulators is undertaken simultaneously, with the aim of allowing the Commonwealth to accept the relevant state or territory processes (as either a one off or under a bilateral agreement) as a suitable vehicle for

1 The seven Matters of National Environmental Significance under the EPBC Act 1999 are, World Heritage properties, National Heritage places, wetlands of international importance, listed threatened species and ecological communities, migratory species protected under international agreements, Commonwealth marine areas and nuclear actions (including uranium mines).

project assessment. This will avoid the possibility of being required to undertake a separate state and Commonwealth impact assessment processes, and will eliminate the possibility of Commonwealth intervention taking place after state approval has been granted.

All jurisdictions require that native vegetation clearance is quantified and minimised as far as possible, and most require some form of native vegetation offset (replacement of cleared vegetation with an equivalent or greater, securely protected substitute area) as part of project approval. The various state and Commonwealth offsetting requirements are summarised in Section 2.2.

Licensing for any onshore pipeline in Australia requires the proponent of the project to obtain planning approval, hold appropriate tenure and undertake detailed risk and environmental impact assessments for the proposed construction, operation and maintenance of the pipeline.

State / Territory and Commonwealth planning approval to construct a new pipeline will be conditional by nature. As part of any conditional planning approval, the regulating authorities may require the proponent to prepare additional management plans and obtain subsequent approvals and/or additional permits/licences. These may be required prior to the commencement of construction, during construction or upon completion of the work. Secondary regulatory approvals should be identified and obtained prior to commencement of construction activity. Some permitting conditions, such as permissions for watercourse crossings or hot works, may only be valid for a limited time or season, so must be applied for in a timely fashion to avoid interruption to the construction schedule.

When a pipeline is approved for construction, operation or decommissioning, the authority to construct, operate or decommission will be accompanied by State and/or Commonwealth regulatory conditions that must be met as part of the approval. These can require significant additional studies, further analysis or detailed plans to be compiled or completed prior to the commencement of work. Approval conditions will also outline the level of compliance required, and can often be extensive for larger or longer pipelines - so it is important that sufficient resourcing and timeframes are applied to be able to achieve compliance. Regulatory authorities themselves may be under pressure from external stakeholders to rigorously enforce approval conditions, so it is important for all parties that project proponents have effective compliance management systems in place.

Although a contractor may be designated regulatory responsibilities – such as obtaining day=-to-day approvals for crossing minor waterways - ultimate environmental responsibility lies with the proponent, and so the proponent's compliance management systems must include a system for checking contractor compliance performance.

An Environmental Management Plan (EMP) is the standard tool used to outline the expected environmental performance standards for the project to its contractor(s). The EMP should be reflective of any approval conditions and outline clear responsibilities for compliance with each approval condition. It is common for a proponent to include a draft EMP as part of its

project application documentation, and for the principal contractor to finalise this (producing either a Construction EMP (CEMP), or an Operations EMP (OEMP)) by including details of its own measures to ensure compliance with both the commitments of the draft EMP and also with approval conditions. CEMPs and OEMPs will need to document specific management measures that will be implemented at identified sites of sensitivity on individual projects.

Typically EMPs, both CEMP and OEMP, will contain a summary description of the project and legislative requirements, will define project roles and responsibilities, will detail guidelines for specific operational activities and will provide an outline of conditional requirements and how they will be mitigated, as well as defining monitoring, auditing and reporting provisions.

An Environmental Management System (EMS) is a tool which is used to enable an organisation to systematically manage its impact control mechanisms and thereby increase its operating efficiency. There are likely to be ongoing reporting requirements throughout pipeline construction and operation to ensure compliance with approval conditions. The EMS should describe requirements for auditing, training, documentation, communications, monitoring and continual improvement of the system; Section 3 outlines the key criteria for an EMS.

2.1.1 AUSTRALIAN STANDARDS FOR ONSHORE PIPELINES

The AS 2885 series of Australian Standards identifies best practice requirements for steel pipelines and associated piping components that are used to transmit single phase and multiphase hydrocarbon fluids. The basis of the series of Standards is to provide important principles, practices and practical guidelines for use by competent persons and organisations involved with high-pressure gas and petroleum pipelines. The Standards currently in this series are:

- AS 2885.0 Pipelines – Gas and liquid petroleum – General Requirements
- AS 2885.1 Pipelines – Gas and liquid petroleum – Design and construction
- AS 2885.2 Pipelines – Gas and liquid petroleum – Welding
- AS 2885.3 Pipelines – Gas and liquid petroleum – Operation and maintenance
- AS 2885.5 Pipelines – Gas and liquid petroleum – Field pressure testing

In 1994 all Australian Governments, through the Council of Australian Governments, adopted AS 2885 as the single national standard to guide the design, construction and operation of high pressure gas transmission pipelines in this country.

The AS/NZS 2566 *Buried Flexible Pipelines* series was prepared by the joint Standards Australia/Standards New Zealand committee; the objective of this series is to provide designers and installers with uniform procedures for the structural design of buried flexible pipelines. These standards apply to flexible pipes conveying low pressure gas, water, wastewater, stormwater or slurry for pressure or non-pressure applications, or for flexible pipes serving as conduits for the later installation of cables or pipes. The standards currently in this series are:

- AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design
- AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design – Commentary (Supplement to AS/NZS 2566.1:1998)
- AS/NZS 2566.2 Buried Flexible Pipelines – Part 2: Installation

It is intended that this Code is read (and applied) as a best practice adjunct to the generally more technical specifications of AS 2885 and AS/NZS 2566, rather than as a technical alternative or substitute.

For further guidance on where additional codes or guidelines may be apply, please refer to Appendix 4.

2.2 ENVIRONMENTAL OFFSETS

Pipeline projects are assessed in terms of their potential to cause environmental impacts to protected Matters of National Environmental Significance (MNES), as identified under the EPBC Act, and to native flora, fauna and biodiversity values under relevant State and Territory legislation. Projects with significant impacts on important native vegetation or biodiversity values - which cannot be readily mitigated through other mechanisms - are likely to be subject to environmental offsetting requirements.

This section outlines the Commonwealth environmental offset policy, sets out the fundamental differences between each states policies, reviews the principles, when it applies, and the key elements required in an offset plan.

Commonwealth

When negative environmental impacts (significant impact upon a protected matter) are unavoidable, a proposed development is determined a 'controlled action' and it is likely to subject to a requirement for an offset. This process is described in the Commonwealth's Biodiversity Offsets Policy, the *Environment Protection and Conservation Act 1999* Environmental Offsets Policy October 2012.

An environmental offset is a conservation management action whereby an area of the same or similar ecological equivalence to the area being impacted is protected or regenerated.

Proposed actions likely to cause unavoidable and significant environmental impact on any of the following matters can attract a requirement for an offset from the Commonwealth regulator;

- World heritage properties
- Wetlands of international importance (Ramsar)
- Listed threatened species and communities
- Listed migratory species
- Commonwealth marine environment
- The whole of environment on commonwealth land
- The whole of environment where it relates to actions carried out by a commonwealth agency
- The whole of environment where it relates to nuclear actions
- National heritage places
- Great Barrier Reef Marine Park

Offsets are not a carte blanche for proponents to develop proposals with otherwise unacceptable impacts, but are an effective mechanism for neutralising the remaining

environmental impact of a proposed action, once avoidance and minimisation principles have been applied.

The objective of environmental offsetting is to protect and improve conservation outcomes for the impacted matter, through direct or indirect conservation measures. The Environmental Offset Policy outlines two offset types.

Direct Offset

To improve the environmental value of the land through conservation management actions; the proposed offset must be land–based or monetary.

Indirect Offset

To improve the environmental value of the impacted protected matter through indirect means, such as contributing to relevant research or education programs, or reducing threats to a protected matter of equal concern that is not part of the direct offset.

For an offset to be accepted as compensation to the impact, the offset must have transparent governance arrangements. The offset must be quantifiable, monitored, auditable and enforced.

An acceptable offset can be quantified as;

- Being commensurate to the impact in both size and scale; and
- Delivering a positive conservation outcome.

and each 'controlled action' (impact) will have an offset equal to or greater than its value.

The Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) is currently devising a method of quantifying proposed actions and offsets, by assigning a scoring and point system. At the time of writing this code, the Commonwealth offset requirement is to source at least 75% of the total offset value from direct offsets with up to 25% being sourced from indirect offsets.

The performance of the direct and indirect offset conservation management action must be measured, reviewed and audited. Establishment costs, ongoing management of the offset, data collection and integration into Commonwealth departmental databases are the responsibility of the proponent for the term of the offset.

Integration of Commonwealth and State/Territory Offset Policies

While the EPBC Act concentrates on the protection of MNES, offsets at the State/Territory level are concentrated on the level of impact on a wider range of native vegetation and biodiversity values conserved under State/Territory legislation.

If a proposed pipeline project activates the 'controlled action' trigger under Commonwealth legislation, consultation with it is State/Territory and Commonwealth regulators is strongly recommended in order that their respective offset requirements can be coordinated and aligned.

State and Territory Policies

Appendix 8 provides a summary of the State/Territory policies, reviewing their respective principles, methods, application criteria and other key elements.

3 ENVIRONMENTAL MANAGEMENT SYSTEMS

APIA places a strong emphasis on effective environmental management through self-regulation and encourages its member companies to maintain a high standard of environmental performance. The development and implementation of an integrated Environmental Management System (EMS) is a key step towards achieving this goal through the control and management of environmental aspects and impacts.

An EMS is a tool that is used to provide a comprehensive and systematic approach to the environmental management of an organisation's activities, forming part of the overall business management process and covering all levels of operation. APIA encourages its member companies to develop and maintain an appropriate EMS which is tailored to suit their operations and is consistent with a recognised international standard (*AS/NZS ISO 14001 Environmental management systems – Requirements with guidance for use* is recommended).

3.1 EMS STRUCTURE AND OUTLINE

EMSs are generally structured into five key areas:

1. ***Environmental Policy***

- Implementation of an Environmental Policy signed off by the director

2. ***Planning***

The following are recommended:

- An environmental aspects register
- A legal register
- Environmental objectives and targets

3. ***Implementation and Operation***

The following are recommended:

- Appointment of an EMS representative
- Definition of roles, responsibilities and levels of decision-making delegation
- Identification of training needs related to tasks identified as having potential to impact on the environment
- Development and implementation of communications, documentation, control, operational and emergency procedures

4. ***Checking***

Implementation of auditing procedures to monitor and measure performance of key components of the EMS including:

- Compliance with legal requirements
- Dealing with actual and potential nonconformity(ies) and taking corrective and preventive action(s)

5. Management Review

The following are recommended:

- Provision for top management review, to ensure adequacy, suitability and effectiveness of EMS
- Capacity to demonstrate of Continual Improvement

The EMS should be used to form the organisational environmental management structure under which a pipeline project would be constructed and operated. The EMS allows for the development and implementation of policy, objectives and targets and facilitates a systematic approach to training, compliance, monitoring and auditing, amongst other measures. The organisational EMS should be a living document that is consistently referenced in project environmental management plans and regularly reviewed to maintain consistency and currency. Figure 1 presents the model outline for an EMS established under ISO 14001.

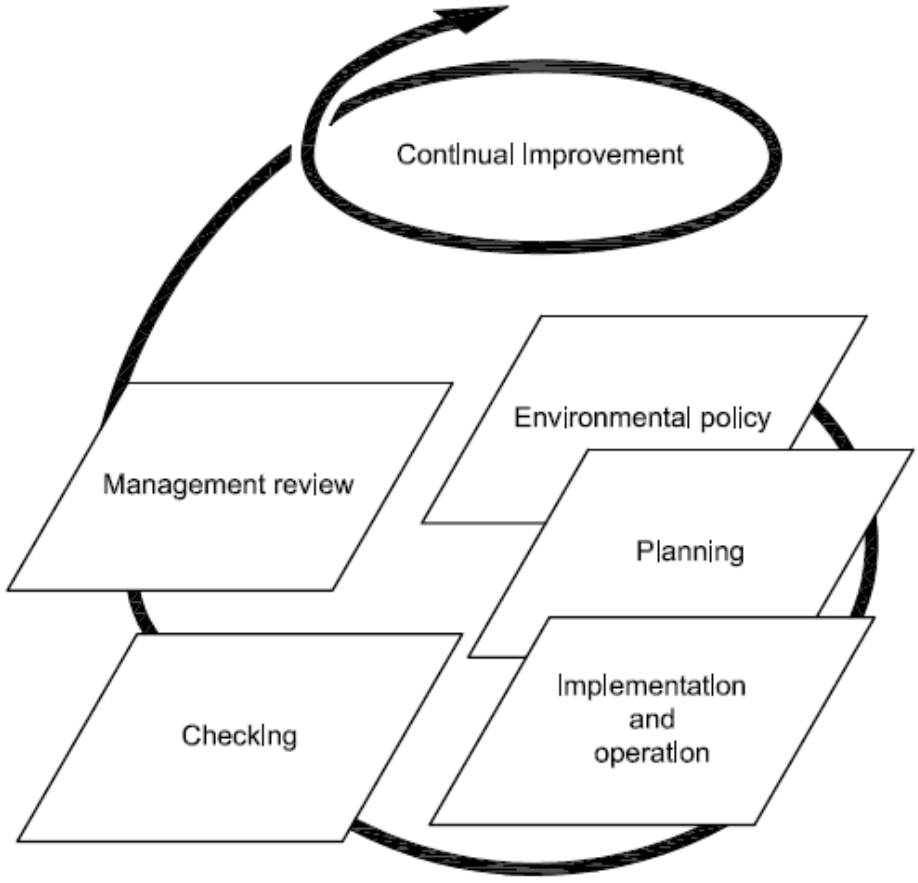


Figure 1: Environmental Management System outline (Sourced from ISO14001:2004)

Benefits of an effective EMS

An EMS that is appropriate to the nature of the business and the scale of its activities can deliver the following benefits:

- It provides a means for the organisation to control and improve its environmental performance, thereby assisting it to contribute to improvements in the quality of project and environmental performance
- It can facilitate improved time management , cost and quality control, through an improved understanding of process input requirements, greater process control and more efficient activity, product and service management
- It can reduce operating costs: In nearly every case, an EMS reduces operating costs through waste reduction, energy and time conservation, and other savings.
- It can reduce legal risk and potential liabilities: An EMS provides a structured framework for identifying and meeting regulatory requirements, resulting in the likelihood of fewer non-compliance findings and other regulatory complications
- It can deliver improved relations with stakeholders, including customers/clients, employees, service providers, shareholders, regulators, lenders and neighbours
- It can increase regulator and other stakeholder confidence that the project is being managed in a systematic and responsible manner

Integrated Management Systems

AS/NZS ISO 14001 Environmental management systems – Requirements with guidance for use has strong parallels with ISO 9001: Quality Management Systems and AS 4801: Occupational Health and Safety Management Systems standards.

An EMS can form part of an integrated management system (IMS) that can incorporate Quality Management and Occupational Health and Safety management. An effectively established IMS can provide a clear picture of all aspects of an organisation, how they affect each other and their inter-related risks. There is strong commonality between the principles of a QMS, OHS and EMS and by integrating the systems, proponents can ensure standardisation of approach to each system allowing more efficient and effective project control.

It should be noted that the similarity in approach between the ISO 9000 and ISO 14000 standards series has been recognised by the development of the ISO 19000 series, which describes auditing procedures applicable to both.

3.2 RELATED STANDARDS

ISO 14001 is part of a series of standards related to environmental management that exist to help an organisation minimise the negative effect of their operations on the environment, ensure compliance with applicable laws and regulations and facilitate continual improvement. The most prominent standards with the ISO14000 series include:

- ISO 14004 Environmental management systems—General guidelines on principles, systems and support techniques
- ISO 14015 Environmental assessment of sites and organizations
- ISO 14020 series (14020 to 14025) Environmental labels and declarations
- ISO 14030 Post production environmental assessment
- ISO 14031 Environmental performance evaluation—Guidelines
- ISO 14040 series (14040 to 14049), Life Cycle Assessment (LCA) discusses pre-production planning and environment goal setting
- ISO 14050 Terms and definitions
- ISO 14062 Improvements to environmental impact goals
- ISO 14063 Environmental communication—Guidelines and examples
- ISO 14064 Measuring, quantifying, and reducing Greenhouse Gas emissions
- ISO 19011 Audit protocol for both 14000 and 9000 series standards.

The ISO series of standards, whilst the most recognised, are not exclusive to EMS in Australia. Other systems exist that also form an acceptable basis from which to establish an effective EMS.

Related sections:
Section 3: Legislative and Regulatory Governance
Appendix 4: Relevant Codes and Standards

3.3 TRAINING

Training is essential to the successful implementation of an EMS and also as part of an individual pipeline construction project. It provides personnel with the necessary skills and knowledge to fulfil their environmental responsibilities and to meet the organisation's environmental objectives. Implementation of a training program leads to increased environmental awareness in the workforce and encourages continual improvement of the behaviour and performance of individual employees.

An effective environmental training program should be developed and implemented as part of the EMS, should cover the full range of environmental management issues relevant to an organisation's activities and should target all relevant personnel. The relevant portions of the training program should be referenced in Project Environmental Management Plans (EMP, CEMP or OEMP) or equivalent. Training program documentation should also describe the role and content of inductions and should include descriptions of job-specific training requirements for all members of the project team, including an outline of the content and schedules for necessary training refreshment.

Specific training requirements should be identified during the development of site procedures and training should be conducted on an 'as needs' basis. Training can be delivered by using internal or external resources, but attendance records and the issue of applicable certification or qualification should be documented to act as a record of organisational competency.

Environmental Professional Characteristics

Environmental practitioners typically work across all levels of an organisation or project to deliver effective environmental management and deliver positive environmental outcomes. Skills and training required will vary according to each environmental discipline.

Any environment professional working in the pipeline industry should be suitably qualified and should be able to demonstrate the following capabilities:

- Competency in understanding the organisation and its activities and the level to which environmental law and regulation applies
- Ability to apply effective environmental management systems and controls
- The demonstration of integrity towards environmental values
- The demonstration of competency within their specific environmental discipline

3.3.1 TRAINING MATRIX

Implementation of a training matrix clearly demonstrates the level(s) of training needs within a project or organisation against set criteria, tasks or roles. A training matrix can take the form of a table or chart that clearly shows what types of training is required for all members of the project team. This should include training requirements that are mandatory for the entire

project team, as well as task-specific training. The training matrix should include a schedule, including any dates where training currency expires and a forward forecast when these require renewal. A matrix should clearly show where training is required to fufill competency and compliance requirements, and should include the capability to show where such training has been completed.

3.3.2 ENVIRONMENTAL INDUCTION

Environmental inductions should be conducted for all site staff who will be actively involved with a pipeline project. Inductions must be undertaken prior to an individual's commencement on the work site and should include coverage of environmental management information including the following (recommended):

Organisational

- the organisation's environmental and related policies
- overview of the organisation's operations and its EMS
- the organisation's statutory, organisational, project and community commitments/ obligations
- the organisation's representatives with responsibilities, authority, resources to achieve environmental performance at all levels, throughout lifecycle

Site-based

- general background of the project, the area and its environment
- identification of site-specific environmental risks and proposed mitigation measures
- summary of relevant project regulatory requirements
- the individual's general work-related obligations and behavioural expectations
- project-specific performance requirements
- land access and landowner engagement requirements
- specific work procedures and project protocols relevant to the site or project (e.g. waste management, biosecurity, access to site, spill response)
- attention to incident reporting requirements and procedures.
- introduction to specific training and awareness tools (e.g. Project handbooks, EMS materials and forms, project alerts and project noticeboards)

Environmental inductions should be conducted as part of an organisation's overall induction program. It is recommended that the induction contains a questionnaire or similar to reinforce some key requirements and ensure that inductees can demonstrate that induction contents

have been understood at the time of induction. Completed questionnaires and records of attendance should be retained.

3.3.3 JOB-SPECIFIC TRAINING

Job-specific environmental training is designed to target particular personnel whose duties have a greater potential to result in environmental impacts, such as equipment operators, watercourse crossing crews, hydro-testing crews and rehabilitation crews.

Where appropriate, training should be conducted on-site, with sessions tailored to be task-oriented and addressing the environmental risks relevant to a particular trade or activity, including (recommended):

- erosion and sediment control
- clearing techniques and limits
- topsoil and soil management
- weed control requirements
- pest fauna management
- biosecurity measures
- spill kit and spill response
- sensitive site management
- incident and near-miss reporting
- rehabilitation techniques

It is recommended that where feasible, job-specific training is conducted by specialists, regulators (where appropriate) or nationally-accredited training providers. Training should also identify the required expectations for individuals who complete the training and the criteria against which their performance will be measured.

3.3.4 ENVIRONMENTAL AWARENESS

Environmental awareness programs maintain and enhance the environmental ethics of the organisation's corporate culture. Generally, programs will focus on topics relevant to the organisation, including:

- changing legislation
- current environmental issues relevant to the project / organisation, especially site-specific issues
- an understanding of how specific company activities impact on the environment
- the environmental expectations of stakeholders
- industry best practice or innovations

By participating in such programs, individuals may enhance their knowledge and learn new skills, which in turn enable them to better understand and address ongoing issues, to better align on-ground activities with organisational expectations and to contribute to the achievement of organisational / project environmental goals.

3.3.5 SITE-BASED TRAINING

Site-based training, or 'toolbox training', can be extremely valuable in reinforcing important environmental aspects on a pipeline construction site. This can be applied through specific toolbox talks that are dedicated to an aspect of environmental management, or as part of a daily pre-start meeting for construction crews and other site personnel to recap or reinforce site-specific environmental matters.

Site-based training is the best method of re-emphasising important elements of training inductions and specific regulatory requirements. Procedures can also be reiterated (spill response, weed hygiene, etc) to increase awareness and focus on important issues on site.

3.4 COMPLIANCE

The role of compliance as part of an EMS is to pro-actively establish and quantity the extent to which regulatory requirements, organisational commitments, targets and objectives or contractual commitments are being reached. The establishment of a compliance program should consist of a regular review of onsite activities and maintenance of records to gauge a measurement of performance against regulatory and management expectations.

3.4.1 INTERNAL MONITORING AND AUDITING

Internal monitoring and auditing forms an integral part of a company's EMS. Internal monitoring and auditing of pipeline activities on a regular basis provides ongoing assurance and timely insight into risk and compliance issues and assists in quantifying continual improvement.

Internal monitoring and auditing will identify areas where performance improvement would be appropriate. These areas should be assigned to a responsible person, who will have the task of overseeing the improvement and implementing a close out timeframe. Follow-up audits should be undertaken to ensure that recommendations for improvement have been implemented and that action items have been closed out inside designated timeframes. Records should be maintained for use in reporting and in demonstrating compliance during external audits.

Internal environmental auditing can take place against all or any of the following:

- Pipeline EMP, CEMP or OEMP commitments

- EMS standard or requirements
- Environmental legislation requirements
- Environmental licence conditions
- Environmental permit requirements
- Environmental conditions within construction contract
- Guidelines/ Code(s) of Practice

It is recommended that the guidance provided in the ISO 19000 standard series is used to design and conduct internal audits

3.4.2 EXTERNAL AUDITING

State and Commonwealth regulatory authorities have the authority to conduct compliance audits on pipeline projects to ensure adherence to approval conditions and applicable legislation. External audits can consist of a review of any on-site activities, as well as inspection of project records relating to approval conditions.

Non-compliance can give rise to a range of enforcement mechanisms, including the following:

- Remediation orders, notices or determinations to repair or mitigate environmental damage or improve environmental performance
- Enforceable undertakings to negate civil penalties and provide for future compliance
- Civil or criminal penalties that can apply to individuals and corporations that contravene the requirements for environmental approvals under the applicable legislation, including penalties that may relate to the provision of false or misleading information.

Any non-conformances or recommendations for improvement received as a result of an external audit should be addressed at the earliest opportunity.

4 ESTABLISHMENT AND EVALUATION OF RISK

Environmental risk deals with the probability of an event causing a potentially undesirable effect on the environment. AS/NZS ISO 31000 defines risk as 'the effect of uncertainty on objectives'. Uncertainties within a pipeline project can arise from:

- Pipeline construction and operational activities;
- Confidence in available technologies;
- Natural variability;
- Short and long term economic, health, social and commercial outcomes;
- The current political environment;
- Present and future values held by people and societies and factors that may cause them to change; or
- The effectiveness of control and planned risk treatments.

The Australian Standards Environment Management Handbook HB 203:2012 discusses how the standard can be used to help an organisation manage environment-related risk, which includes risks either to or from the environment, by understanding the relationship between principle, framework and process.

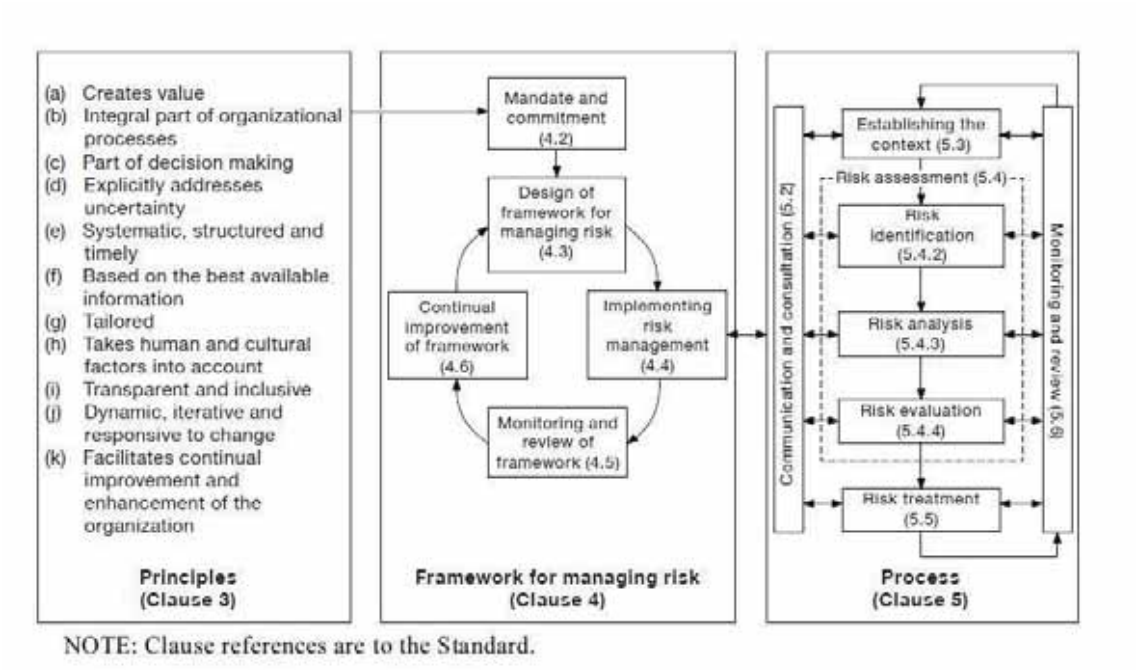


Figure 2. Relationships between risk management principles, risk management framework and risk management process (sourced from HB203:2012)

The Risk Management Process

The largest risk exists during the construction phase and this should be accurately reflected in any risk assessment. Appendix I of AS2885.1 outlines the process for managing environmental threats and should be consulted when undertaking pipeline environmental risk assessment.

The risk management process should be:

- an integral part of management (which facilitates all decision making); and
- tailored to the processes of the organization.

Parts of the risk management process are often carried out by multi-disciplinary teams, and would usually include contributions from a variety of experts, stakeholder organizations and other sources.

The steps of the generic risk management process are described below.

Communication and consultation

Consult the internal and external stakeholders over the risk management process as a whole, and as appropriate during each step.

Establishing the context

Determine the external and internal context of the organization and the particular application to which the risk management process is being applied. Establish the structure of the analysis and define the criteria against which risk will be evaluated. Identify stakeholders and define consultation mechanisms.

Risk identification

Identify, as the basis for further analysis, what can happen or what circumstances might change, when, where, why and how. This may include identifying hazards, environmental aspects and environmental impacts, and how uncertainty might affect decisions.

Risk analysis

Develop an understanding of the risks and the controls in place. Analyse risks in terms of the controls, the range of consequences in the context of those controls, and the likelihood of those consequences arising. Consequence/severity and likelihood/frequency may be combined to produce an estimated level of risk.

The Risk Matrix

Qualitative risk analysis is beneficial to pipeline projects where many risks have been identified. A risk matrix based on qualitative or adjudged measures of consequence and likelihood may be used as a means of combining consequence and likelihood to give a measure

of risk. This allows for screening of minor risks from major risks in order to prioritise risks so that resources can be applied to issues of higher importance. Adoption of a quantitative risk assessment tool will help apply a numerical identity to each risk, allowing a hierarchy to be established - which may aid response prioritisation

Risk evaluation

Compare the results of the analysis against the pre-established criteria. Decisions on whether to treat risk are based on this comparison and other factors identified when the context was established.

Risk treatment

Select options for treating risk and develop and implement a management plan, which should include consideration of funding and other resources, as well as response time frames and a schedule. Once treatment actions have been implemented, review the residual level of risk to see if they are now tolerable.

Monitoring and review

Regularly monitor and review the risks and controls, and any changes that may affect them.

Benefits of managing environment-related risk effectively

Using a structured, systematic and defendable approach to environmental risk management can prioritise project risk and ensure that focus and resources are applied to areas of greatest risk. The strength of this approach is that it focuses on reducing risk, applies available technical knowledge, takes into account the results of consultation with stakeholders and has ongoing monitoring and review built in, which provides a means of responding to any changes in internal and external circumstances. Furthermore, it is guided by clear principles, ensures there is an adequate supporting framework, and can provide a baseline from which to establish performance indicators. Organisational benefits of an inclusive risk management approach can include the following:

- improved environmental outcomes;
- improved profitability and efficiency;
- improved top management understanding of environmental risk and its mitigation
- reduced risk of production interference from environmental issues
- realistic stakeholders expectations about environment-related risk;
- enhanced reputation;
- demonstrable conformance with an accepted International Standard on the management of risk;
- enhanced consistency, transparency and accountability;
- compliance with legal obligations (including avoidance of liabilities through tort);
- obtaining or protecting regulatory approvals;
- greater flexibility;

- greater ability to attract external support or resourcing;
- lower risk financing costs;
- avoidance of disruption;
- avoidance of incidents and associated costs;
- more effective and safer incident control; and
- enhanced resilience.

4.1 RISK WITHIN THE PROJECT LIFECYCLE

Sound environmental risk management techniques should guide decision-making within a pipeline project through each stage of its lifecycle. Key project elements where risk should be considered include the following:

Planning:

- Scoping of a project
- Deciding stakeholder engagement techniques and strategies
- Pipeline and facility design, route and facility selection
- Deciding on constructability constraints and best option selection
- Deciding on alternative engineering options for impact mitigation and minimisation
- Deciding on relevant environmental performance indicators, requirements
- Allocation of management responsibility, programs and resources for risk management in pipeline lifecycle

Construction:

- Sites set-up
- Access through private property and along easement
- Clearing and earthworks, obtaining materials along selected route
- Determining construction methodology
- Determining watercourse crossing methodology
- Safety and emergency planning
- Soil management measures
- Drainage, erosion and sediment control measures
- Flora, fauna and biosecurity control measures
- Cultural Heritage control measures
- Traffic and socio-economic impact management measures
- Monitoring and auditing regime
- Emergency, incident / near miss, natural event response and investigation processes

Operation:

- Safety and emergency planning
- Inspection and management of easement and facilities
- Flora and fauna management measures
- Cultural Heritage management measures

- Drainage, erosion and sediment control measures
- Monitoring and auditing regime
- Emergency, incident / near miss response
- Natural event responses along and adjacent to the easement

Decommissioning:

- Determining suitability of pipeline removal or decommissioning techniques
- Access through private property and along easement
- Removal of above-ground infrastructure
- Monitoring and auditing regime

4.2 RISK MATRIX

Techniques for determining risk severity and frequency are outlined in Appendix F of AS2885.1; this system is recommended for adoption as the basis for preparing and undertaking onshore pipeline risk analyses.

5 PIPELINE PLANNING ACTIVITIES

Pipeline planning is a detailed process requiring diverse specialist resources, including engineers, surveyors, draftspersons, planners, marketers, environmental practitioners, legal advisers, land use advisers and community relations specialists; it also involves establishing a relationship with government and community stakeholders as part of the planning process.

This section discusses typical pipeline development planning processes, providing an outline of the regulatory, environmental, social and engineering considerations that should be applied during the planning phase of a new pipeline.

5.1 PIPELINE ROUTE SELECTION AND DESIGN

Physical characteristics of a pipeline corridor should be subjected to a constraints analysis (or similar), using route selection criteria to develop the most appropriate pipeline alignment. It is important to note that during the route selection phase other factors, such as political or community focussed issues, can form a major bearing of any alignment corridor and must be included alongside analysis of physical, environmental, heritage and regulatory constraints.

Sometimes common infrastructure corridors (CICs) may be utilised, where the proposed pipeline follows a proposed or existing energy, communications or other easement. CICs can pose a series of constraints which must be overcome including construction hazards associated with existing infrastructure (e.g. overhead power lines), the potential for third party interference with adjacent utilities (e.g. pipelines, fibre optic cable), incremental alienation of

freehold land through additional easements and potential impacts to environmentally sensitive areas within or adjacent to the corridor. Constructing a pipeline within a CIC can introduce ongoing hazards through the operational phase, such as cathodic protection interference, which must be considered as far as possible during the alignment selection phase.

Ultimately, a preferred pipeline route will be defined, based on consideration of the criteria outlined in Table 1 below. The selection of an appropriate pipeline route requires balancing these factors, whilst ensuring that the project's safety, economic, engineering and environmental objectives are fulfilled. Standard expectations of route selection are also detailed in S4.2.3 of AS2885.1

Table 1: Pipeline Route Selection Criteria

Aspect	▪ **Route Selection Criteria**
Regulatory	▪ identify applicable environmental legislation, regulatory policies and strategies ▪ establish location of protected lands ▪ establish permissibility within planning context ▪ identify, avoid and minimise impacts on regulatory planning constraints ▪ undertake review of regulatory timeframes against identified project time targets ▪ consider relevant commonwealth/state/territory offset policies
Strategic Justification	▪ establish the need for the pipeline ▪ review of impacts and cost/benefit
Environmental (including social aspects)	▪ acquire knowledge of the likely presence of listed species or ecosystems and avoid as far as possible ▪ generally conserve native terrestrial and aquatic flora and fauna ▪ minimise impacts on habitat and ecosystem integrity ▪ minimise impacts on surface and ground water quality ▪ conserve soils and protect land surface stability ▪ minimise impact on existing and future land use ▪ assess potential for successful rehabilitation ▪ quantify and minimise air and noise emissions ▪ avoid or ameliorate impacts on historical and indigenous cultural heritage values. ▪ assess and mitigate impacts on landowners, adjacent residents and existing/proposed infrastructure ▪ protect of landscape values

	▪ analysis of environmental threats
Safety	▪ review relevant safety standards ▪ assessment of safety risks ▪ design and plan implementation of risk reduction programs
Commercial Justification	▪ review current market requirements ▪ assess the ability to meet future consumer needs ▪ review construction and operating costs ▪ consider approval timing and requirements
Engineering	▪ review required engineering, construction and operation standards ▪ assess terrain, seismic and geotechnical constraints and hazards ▪ assess climate influences, such as cyclones, flood location and period, tidal and storm surges, etc ▪ assess engineering and construction options ▪ access requirements for construction and operation ▪ review of available construction methodologies to reduce construction risk

5.2 PROJECT PLANNING AND APPROVAL

Pipeline developments require government approval. The environmental impact assessment (EIA or similar) prepared by the project proponent will be considered by relevant government authorities prior to a decision being made on the licence application. For major projects, public exhibition of the EIA forms part of the planning assessment process, and allows regulatory authorities and members of the public to review and submit comments on the proposal. The regulator may require the proponent to prepare a supplementary EIA (or similar) to address issues that arise during the public comment period. The regulator will review the supplementary document and assess whether comments received have been adequately addressed prior to reaching a decision on the pipeline application.

5.3 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Detail of the EIA process for proposed pipelines varies between the Commonwealth, States and Territories, however some form of formal review of the project's potential environmental impacts is a common requirement. The pipeline approval process requires the proponent to identify and assess potential environmental impacts on the existing environment and to provide details of proposed management measures, customarily in the form of an Environmental Management Plan or similar, that will mitigate likely impacts to an acceptable level.

A proposed pipeline which crosses more than one jurisdiction requires a coordinated approvals process, involving satisfaction of the statutory requirements of each jurisdiction. Section 2 Legislative and Regulatory Governance contains further detail on such processes.

The basic elements of an EIA (or similar) consist of the following:

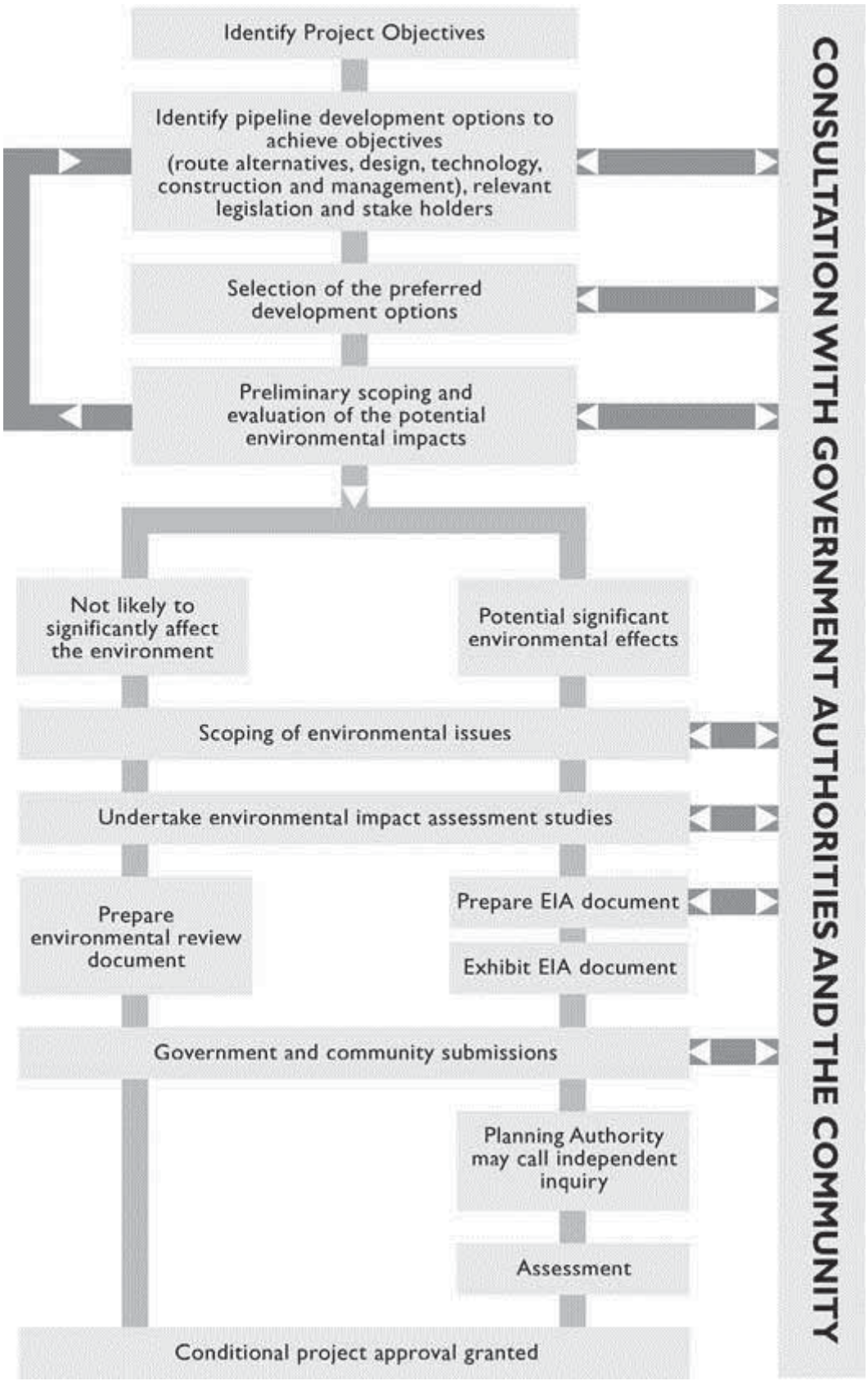
- a detailed project description
- project justification
- an evaluation of project alternatives
- an evaluation of the project against the principles of ecologically sustainable development
- a description of the existing environment
- identification and assessment of potential environmental impacts
- identification of environmental impact mitigation measures
- presentation of a draft environmental management plan, which includes the impact mitigation measures and commitments developed in the previous EIA sections.

The assessment process evaluates the environmental risk (and usually the social risk as well) that the proposal represents to the existing environment. Major points for consideration would usually include the following aspects:

- project justification
- flora, fauna and ecology, including biosecurity issues;
- soils, geology, terrain and seismic risk;
- risks to water resources;
- noise issues;
- impacts on air quality;
- social issues, including land use, economics, infrastructure, transport or social change;
- heritage (indigenous and European); and
- visual amenity.

Preliminary investigations during the project feasibility stage and consultation with all relevant stakeholders will assist in scoping the studies required for the assessment.

Figure 3 Key Stages in the environmental approval process.



5.4 CUMULATIVE IMPACT

Cumulative impact assessment in the context of a pipeline proposal can be described as an evaluation of the anticipated incremental impact caused by the proposed pipeline in consideration of the aggregate of past, present, and reasonably-foreseeable future actions on the existing environment..

This involves evaluation of the level of impact on resources, ecosystems and communities caused by existing and proposed land use activities in the wider landscape and contextualising the level to which the new proposal will contribute to this wider 'cumulative' impact.

Cumulative impact analysis of a new pipeline should be undertaken as part of the EIA for the project.

5.5 STAKEHOLDER AND COMMUNITY CONSULTATION

The pipeline industry recognises the growing need for effective stakeholder and community consultation as a key component of project planning and an important contributor to project acceptance by the regulators. Stakeholder and community consultation should continue throughout the life of a pipeline project, to ensure a proper understanding of the pipeline and its performance.

In response to growing community expectations and increased regulatory requirements, APIA has developed its own Code of Practice for Stakeholder and Community Engagement. This code of practice should be referenced for further detailed information on stakeholder and community engagement standards.

Typical pipeline construction corridor for a large transmission pipeline (>800 mm diameter). MacDow

Typical pipeline construction corridor for a large transmission pipeline (>800 mm diameter). MacDow

5.5.1 ENVIRONMENTAL MANAGEMENT PLANS

Most regulatory agencies require the preparation and approval of a Construction Environmental Management Plan (CEMP) prior to commencement of construction and of an Operational Environmental Management Plan (OEMP) prior to commencement of pipeline operations.

Usually, a draft EMP will be included in the project EIA, and would be used by the appointed Construction Contractor to develop the CEMP required as a pre-start approval condition. Although the contents may vary between jurisdictions, an EMP typically includes descriptions of legislative requirements, the environmental management system, project roles and responsibilities, detailed guidelines for specific construction activities, a list of impact mitigation commitments, a list of approval conditions and how they will be fulfilled, as well as monitoring, auditing and reporting provisions.

An EMP should be used by a project proponent to outline the expected environmental performance standards for the project to its contractor(s). The EMP should be reflective of any approval conditions and outline clear responsibilities for compliance with each condition.

It is common for a principal contractor to finalise the EMP into a Construction Environmental Management Plan (CEMP) to outline proposed measures and procedures that will be employed to ensure compliance with the requirements of the EMP and any other regulatory or contractual environmental responsibilities. CEMPs should be used to outline site-specific management measures that will be implemented at identified sites of sensitivity on individual projects. It is important to the regulator that undertakings and commitments presented in the EIA as part of the EMP are retained in the CEMP.

In the case of a commissioned pipeline, an OEMP must be approved prior to commencement of operation, and must be kept up to date throughout the life of the pipeline. The OEMP should contain a description of legislative requirements, define project roles and responsibilities, detail guidelines for specific operational activities, a list of impact mitigation commitments, a list of approval conditions and how they will be fulfilled, as well as monitoring, auditing and reporting provisions.

This Code does not contain the full and final detail on any aspect of environmental management and is not a substitute for a comprehensive environmental management plan, CEMP or OEMP. It is recommended that all pipeline proponents, construction contractors and pipeline operators seek appropriate expertise and advice to ensure they develop and implement environmental management documentation that is suitable to their activities and acceptable to regulators.

6 PIPELINE CONSTRUCTION ACTIVITIES

Onshore pipeline construction involves a range of specialist tasks, which are generally undertaken by pipeline construction companies and specialist service companies, in a defined construction corridor. This section addresses the many construction activities and environmental management issues that may be relevant to a particular pipeline project and presents a range of environmental management guidelines which represent good industry practice. The guidelines have been developed with the full range of project objectives in mind, including safety, environmental, engineering and economic factors. This section applies to both new pipelines and to the looping (or extensive replacement of) existing pipelines.

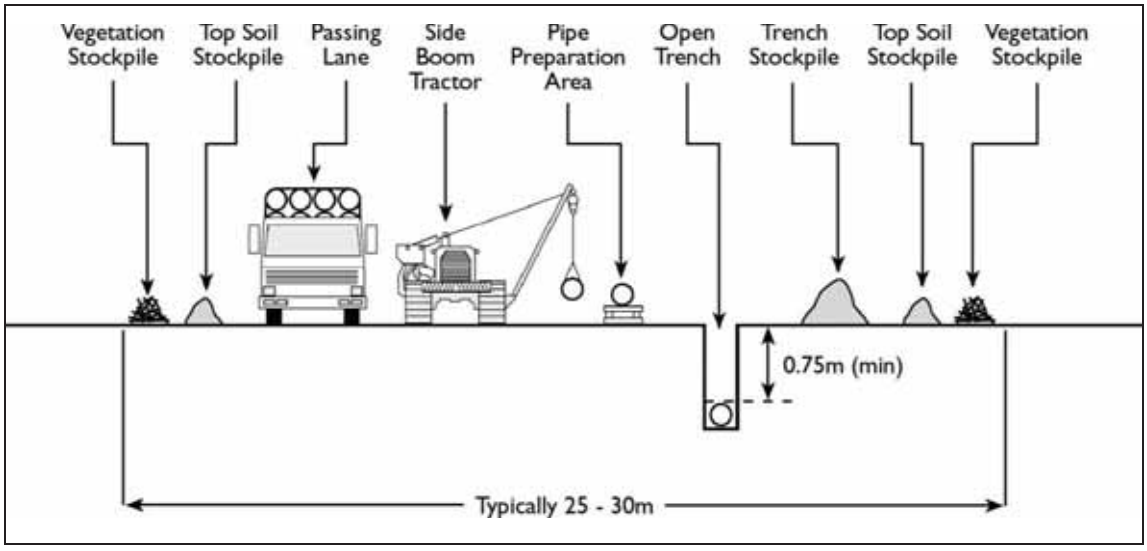


Figure 4: Typical construction corridor layout for small diameter pipeline construction

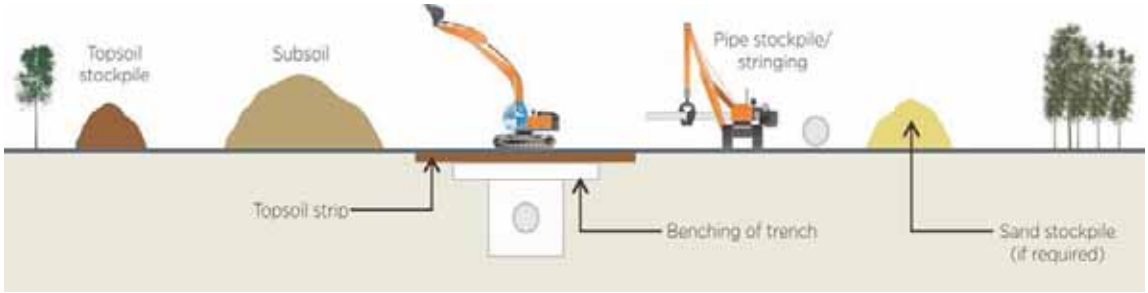


Figure 5: Typical construction corridor layout for large diameter pipeline construction

6.1 ACCESS TO SITE

During construction, access to project areas, such as pipeline easements, work and camp sites is required on a regular basis by transport, construction, proponent and regulatory personnel. Proponents may also find it useful to facilitate access to the construction areas for landowners, to encourage their understanding and acceptance of the construction process.

This section details the environmental management measures which need to be taken into account when obtaining access to the pipeline corridor - in addition to the safety requirements stipulated by legislation and in project Safety Management Plans.

For looping or replacement projects, it should also be remembered that the operation of an existing pipeline may mandate access to the pipeline easement for:

- pipeline surveillance and inspections to identify areas of erosion and subsidence, areas requiring vegetation management, check cathodic protection, identify possible leaks, monitoring third party activity and identifying any unacceptable risks to the pipeline;
- monitoring and auditing of environmental conditions;
- maintenance activities;
- construction of facilities or additional infrastructure; or
- emergency access.

The nature and frequency of access will vary according to site environmental conditions, maintenance program requirements and corresponding amount of repairs needed. A higher frequency of access to an operational pipeline may be required immediately following ground disturbance activities, to ensure that all environmental protection measures are functioning as intended. Access may be undertaken by vehicle or on foot and can include several pieces of equipment or machinery where access for ongoing maintenance or repair is required.

The following tables are checklists of issues to be considered when designing and building access for pipeline construction.

ACCESS TO SITE – KEY ENVIRONMENTAL ISSUES	Related Code Sections
Soil compaction, erosion and sediment release to land and water	Soil/Ground Stability and Land Disturbance Drainage, Erosion and Sediment Management
Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils	Soils Management
Potential modification to surface water flows (drainage lines and streams)	Water Management Drainage, Erosion and Sediment Management
Potential for site run-off into drainage lines and	Water Management

watercourses	Drainage, Erosion and Sediment Management
Disturbance of significant flora or wildlife habitat	Flora Management Fauna Management
Introduction of disease, weeds, vermin or destructive influences to the site	Biosecurity Management
Damage to agricultural production or other land uses	Soils Management Biosecurity Management
Temporary disruption to landowners (access, noise and dust)	Traffic Management Noise Management Dust & other Air Emissions Management
Degradation of existing road infrastructure	Traffic Management
Increased safety hazard resulting from increases in traffic volume	Traffic Management
Unauthorised access track proliferation	Soils Management Drainage, Erosion and Sediment Management

ACCESS TO SITE – ENVIRONMENTAL OBJECTIVES
1. To avoid location of site access points in sensitive areas
2. To minimise disturbance to ecosystems
3. To minimise direct impacts to flora and fauna
4. To minimise impacts on soil, drainage lines and watercourses
5. To minimise the spread of noxious weeds, pests and pathogens
6. To avoid adverse impacts on cultural and historic heritage sites
7. To minimise impacts on visual amenity when creating access points
8. To minimise disruption to landowners and third parties (sensitive receptors)
9. To ensure site access can be retained during operations of the completed pipeline
10. To achieve satisfactory road, track and site rehabilitation where required

	ACCESS TO SITE– ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning and Design	Access planning shall include: ▪ Documentation of proposed temporary and permanent access locations in environmental planning documentation. ▪ Documentation of the current status of existing infrastructure, such

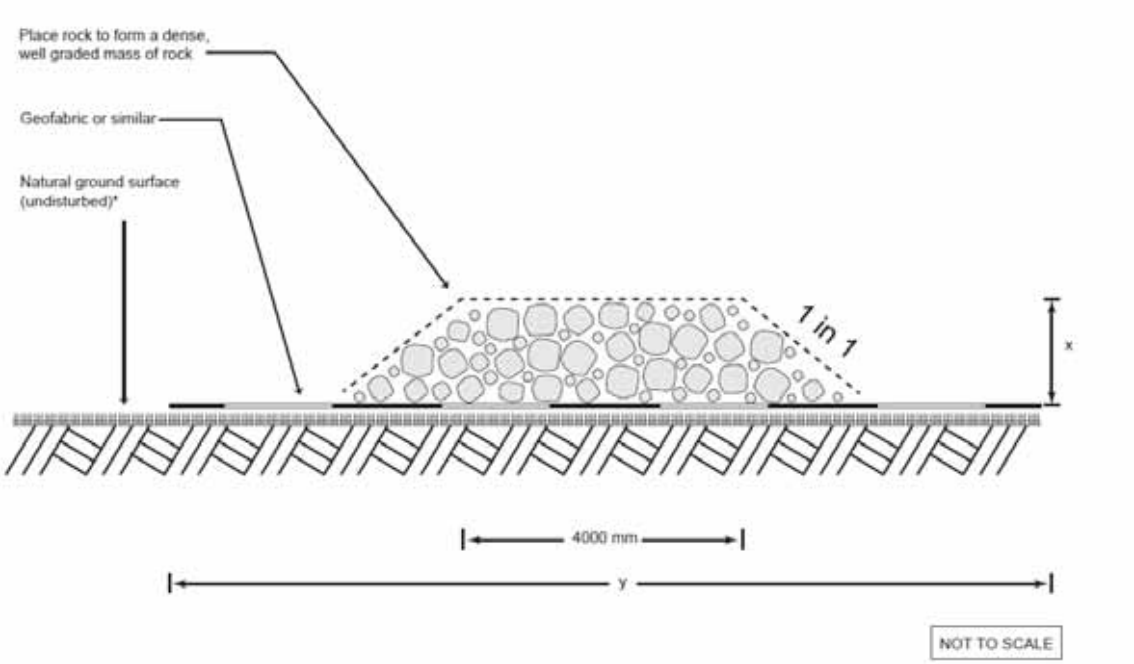
	as fences, tracks, gates, grids, etc ▪ Inclusion of temporary and permanent access locations in EIA field surveys – so that potential impacts and their mitigation can be included in environmental planning documentation. ▪ Use of existing roads, tracks and areas of disturbance where practicable. The location and design of new access tracks and roads should avoid or minimise impacts on high risk sites or sensitive receptors such as homesteads or residential areas. ▪ Application of relevant legislative and design requirements where appropriate. Pipeline access must be designed and maintained to accommodate the intended traffic volume. ▪ Consideration of scheduling, so that where practicable, pipeline construction activities minimise potential impacts on landowners. ▪ Scheduling so that, where practicable, the length of time between creation and rehabilitation of temporary access tracks is minimal. ▪ Identification of the permits required from local and state government authorities for access installation and of the construction standard required for access intersections and turning lanes from existing roads.
Construction Access	▪ The width of the access track shall be kept to the minimum practicable in order to enable safe vehicle movement (generally maximum of 4m). ▪ Access to and along the pipeline easement should be minimised during and immediately after periods of prolonged or heavy rainfall. ▪ In sensitive environmental areas, site-specific environmental management procedures shall be adopted to minimise environmental impacts caused by access to site. ▪ Consideration shall be given to employing access measures and controls which minimise impacts to landowners and to protect stock (such as the installation of temporary fencing, gates and cattle grids). ▪ Modified tracks, property fences or gates shall be reinstated to a condition equal or better than the pre-existing condition unless otherwise agreed with the landowner. ▪ As a general rule, gates shall be left as they are found or as sign posted or stated in the construction line list. If closed gates are required to be opened for extended periods (e.g. convoy passage) they shall not be left unattended unless otherwise agreed with the landowner. ▪ The width of the access track shall be kept to the minimum practicable in order to enable safe vehicle movement (generally

	maximum of 4m). ▪ During construction, access infrastructure shall be maintained to appropriate standards.
Reinstatement of Access	▪ Public and private tracks used during construction shall be reinstated to their pre-construction condition or as otherwise agreed with the relevant landowner or authority. ▪ Rehabilitation procedures shall include: ▪ Reinstatement of original land contour; ▪ Installation of appropriate sediment and erosion control measures; ▪ Installation of appropriate measures which discourage access to restored tracks such as signs, fences, earth mounds or ditches, or other physical barriers such as rocks or cleared vegetation. These may be temporary or permanent measures.
Operational Pipeline Access Track General Provisions	▪ The pipeline easement shall only be used as an access for activities essential to ensuring the continued safe operation of the pipeline and protection of the local environment. ▪ Access to the pipeline easement shall, as far as is practicable, be via existing tracks, and any access to the pipeline easement through private property shall only occur with individual landowner and/or occupier approval and in a manner consistent with pre-established access arrangements. ▪ Public access along the pipeline easement shall not be permitted unless that right already exists. Public access to the pipeline easement shall be restricted by physical barriers (e.g. gates, fences, other practical barriers) and by pipeline signs/ markers. ▪ Any use of internal farm tracks or private roads for pipeline surveillance must be by pre-established agreement with the landowner. Typically, he landowner should be notified at least 24 hours before access is required, or otherwise as agreed. Where regular/ ongoing access is required , acceptable terms should be pre-established, to the satisfaction of the landowner. ▪ In sensitive environments, vehicle access should be avoided if possible. Where there is no alternative, access should be restricted

as far as possible, with frequency of access minimised to an 'as required' basis.

- Access to and along the pipeline easement should be avoided where possible during and immediately following periods of prolonged or heavy rainfall.
- Access to the pipeline easement shall be conducted in a manner that adequately considers potential noise or vibration impacts (refer to section 9.10). In some areas, access may need to be restricted to specific times, as determined in consultation with local authorities or landowners.
- Seasonal land use activity and other local timing requirements relating to existing land use activities should be considered during the scheduling of operational access.
- Potential easement access impacts and their mitigation should be managed as part of an OEMP.

Figure 6 Temporary Access Track Construction.



TEMPORARY ACCESS TRACK: CONSTRUCTION

Lay geofabric or similar over undisturbed* ground

x – Depth, sizings and type of rock to be determined by suitably qualified person

y – Geofabric to extend minimum of 1500 mm beyond the width of the proposed track, to facilitate removal of track material once the track is no longer required

* In some cases topsoil can be removed: in such cases the stockpiled topsoil can be covered and used to prevent surface overland flow from reaching the temporary track itself

6.2 CLEARING

Clearing of the pipeline construction area involves trimming or removal of trees, shrubs, stumps and other obstacles, to provide unobstructed and safe construction access. Disturbance to native vegetation and wildlife habitat is avoided or minimised to the greatest extent practicable through careful route selection and the application of appropriate management procedures.

Trimming overhanging vegetation on a pipeline corridor as part of clearing activities. Ecos

The working space available for pipeline construction is generally reliant upon the width of easement specified in the planning approval conditions. The amount of working space needed is worked out during the planning phase by analysis of the following aspects:

- maintaining appropriate safety standards
- requirements for construction equipment and vehicle movement
- environmental sensitivities
- terrain and geotechnical constraints
- pipeline diameter and trench depth
- the number of pipelines being installed
- proximity to existing infrastructure such as roads
- maximising construction productivity
- minimising risk to adjacent land uses or users

The normal working width in Australia for a major pipeline is approximately 20-40 metres, however this may vary depending upon the particular project or site-specific considerations and should be minimised where practical. It is a common requirement to reduce working width through areas of sensitivity – and this can require an adjustment in construction methodology. Reduced working width should be considered on a case-by-case basis, based on a risk assessment of the environmental sensitivities and associated construction constraints.

CLEARING – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion	Soils Management Drainage, Erosion and Sediment Management
Sediment release to land or water	Water Management Soils Management Drainage, Erosion and Sediment Management

Removal of significant flora and wildlife habitat	Flora Management Fauna Management
Fragmentation of wildlife habitat and dislocation of wildlife corridors	Flora Management Fauna Management
Increased potential for feral animal movement along new corridors	Biosecurity Management
Increased potential for weed species introduction	Biosecurity Management
Disturbance to heritage sites	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Potential impacts to visual amenity	Visual Amenity Management
Unauthorised third party access to previously inaccessible areas	Traffic Management
Rehabilitation of cleared areas	Flora Management Fauna Management Reinstatement and Rehabilitation

	CLEARING – ENVIRONMENTAL OBJECTIVES
	1. To minimise disturbance to flora 2. To minimise impacts on fauna 3. To minimise impacts on soil and water 4. To minimise impacts on visual amenity 5. To minimise impacts on sites of cultural and historic heritage significance 6. To optimise rehabilitation success
	CLEARING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning	▪ Significant ecosystem patches or individual trees that are identified as having significant natural, heritage or visual amenity values should be avoided by the alignment during the planning phase. ▪ The pipeline proponent shall specify the pipeline construction working width for the entire length of the pipeline. This may vary at different locations. Note: while the main clearing area is 20 - 40m, turn-around and working areas (especially near watercourses) may need to be wider in certain locations. ▪ Clearing boundaries shall be delineated on project drawings and in

	the field to define the extent of authorised clearing. These boundaries will widen at locations where additional spoil will be generated (e.g. bell holes, corners, deep crossings). ▪ Relevant stakeholders and landowners shall be consulted in relation to the level of clearing required during the planning phase - to assist in minimising impacts on property land use and management and loss of amenity. ▪ Areas should be identified where additional workspace is required early in the planning process (lay down areas, vehicle turn around areas). These should be located in pre-disturbed areas of low or no vegetative value where possible, and their locations must be negotiated with the relevant landowner. ▪ Where a pipeline passes through sensitive environmental areas, site-specific environmental management procedures should be adopted to minimise environmental impacts. ▪ Measures shall be employed which identify, make safe and protect other third party infrastructure in the vicinity of the clearing works ▪ Necessary permits and clearances are to be obtained prior to commencement of clearing activities. A copy should be carried on site with clearing crews where possible.
Construction	▪ Vegetation clearance should be minimised as far as practical, particularly at watercourses. Retention of vegetation, avoidance of native grasses and trees and selective trimming are preferable to clearing. ▪ Wildlife habitat fragmentation effects can be minimised by retaining tree canopy connectivity where practicable, particularly at watercourses and where there are roadside ecosystem remnants. ▪ Consideration should be given to retention of significant ecosystem patches or individual trees within the approved corridor, where they have significant natural, heritage or visual amenity values. ▪ In the case of protected or retained vegetation within (or adjacent to) the pipeline construction area, where there is significant natural, heritage or visual amenity values to protect, the vegetation shall be marked with flagging or marker tape to indicate that it should be avoided. Marker paint should not be used. ▪ Flagging or marker tape used to identify sites shall be standardised throughout the project. The roles of flagging or marker tape shall be explained during project inductions. ▪ Clearing shall aim to retain roots in riparian zones and other sensitive areas where possible, to retain stability. Slashing may be undertaken as a means of vegetation clearing, particularly in sown

pastures or at water courses.

6.3 GRADING

Grading involves the removal of topsoil and, in some instances, sub-soil from the pipeline construction area and associated work and camp sites. Topsoil, also referred to as the A horizon, is the surface soil horizon rich in organic and mineral matter. Topsoil has a high value as it contains nutrients and the majority of seed stock that can quickly germinate and contribute to effective rehabilitation following reinstatement of the pipeline corridor.

Grading of pipeline corridors. W. Mathieson/Ecos

Grading is required where:

- construction is likely to unduly damage topsoil and inhibit rehabilitation or primary production activities
- the topography does not permit safe and practical access to the pipeline construction area or work sites
- the soil conditions cannot accommodate construction activities

Generally, topsoil is removed to the next soil horizon (i.e. sub-soil). The extent and depth of topsoil removal from the pipeline construction area (e.g. full stripping or partial stripping) shall be determined on the basis of best practice for the specific site, in consultation with landowners, the project CEMP and relevant regulatory authorities, as appropriate.

Removal of topsoil from the entire pipeline construction area is the general industry standard. In some instances, topsoil stripping shall be restricted to the trench line, so as not to expose highly acidic/ erodible subsoils.

Depending on the soil condition, some soil types are more erodible than others. Light soils for example can be more prone to wind erosion, and in such instances, the length of time between initial grading and reinstatement should be minimised.

Topsoil stripping measures commonly applied in pipeline construction are listed in **Error! Reference source not found.**. Prior to the commencement of grading activities, appropriate topsoil management techniques shall be determined in consultation with the Proponent/Asset

owner, affected landowners and relevant regulatory authorities, as required. It may be necessary to vary application of the techniques listed below on a site-by-site basis.

Table 2: Common Topsoil Stripping Measures

Topsoil Management Technique	Description
Trench line	Topsoil is graded to a blade width over the trench line only and the soil stockpiled in windrows adjacent to the pipeline construction area.
Trench And Work Side	Topsoil is graded over the trench and work side only.
Trench And Spoil Side	Topsoil is graded over the trench and spoil side only.
Full Stripping	Topsoil is graded over the full width of the pipeline construction area
No Stripping	Direct trench excavation or plough-in with no topsoil stripping

GRADING – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion and sediment release to land or water	Water Management Soils Management Drainage, Erosion and Sediment Management
Degradation of soil structure through soil mixing, compaction and topsoil loss	Soils Management Drainage, Erosion and Sediment Management
Disturbance of problematic soils such as Acid Sulphate Soil, dispersive soil or contaminated soil and consequent release of acid or contaminated leachate	Soils Management
Removal of wildlife habitat	Flora Management Fauna Management
Disturbance to Cultural Heritage	Heritage – Natural and Built Environments Aboriginal Cultural Heritage Management
Increased potential for the spread of weeds and pathogens	Biosecurity Management
Potential impacts to visual amenity	Visual Amenity Management
Unauthorised third party access to previously	Traffic Management

inaccessible areas	
Potential temporary disruption to existing land uses	Stakeholder Code of Practice
	GRADING – ENVIRONMENTAL OBJECTIVES
	1. To minimise soil profile damage 2. To minimise sedimentation and acidification of land and water 3. To minimise disturbance to native flora 4. To minimise impacts on fauna and fauna habitat values 5. To minimise impacts on sites of cultural and historic heritage significance 6. To minimise impacts on visual amenity 7. To minimise disruption of landowners and third parties 8. To optimise rehabilitation success 9. To minimise the time between clearing and restoration of pre-clearing land use
	GRADING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning	▪ Soil analysis prior to construction should be undertaken to determine the pre-existing soil profile and structure and allow effective soil conservation measures to be determined. A Soil Assessment and Management Plan (or equivalent) should be produced. ▪ Activities should be scheduled to minimise the length of time between ground disturbance and reinstatement. ▪ Where topsoil is predicted to be removed for longer than one month, striped topsoil should be covered with a stabiliser such as geotextile material, temporary seed cover or equivalent, to retain the topsoil for use when reinstatement occurs. ▪ Planting a cover crop over topsoil stockpiles not expected to be re-used for longer periods of time (a year or more) should be considered.
Construction	▪ Topsoil should be graded and stockpiled separately to subsoil and should not be compacted or otherwise impacted during construction. ▪ Weather conditions should be considered in terms of soil management prior to and during construction. ▪ Graded soil shall not be stockpiled where it has the potential to

	result in sedimentation or acidification of land or surface water (e.g. on slopes which drain immediately to a watercourse). ▪ Topsoil containment measures (e.g. berms and sediment fencing) shall be used as necessary. Grading and stockpiling of soil shall not, as far as practicable, impede surface drainage or water flows. ▪ Grading of watercourse beds and banks shall be minimised - leaving an undisturbed organic mat within the riparian zone - or delayed until construction of the crossing is imminent, thus minimising risk associated with sediment release into watercourses - refer section 6.11 Watercourse Crossings for detail.

6.4 STRINGING, COATING AND JOINTING

Following clearing and grading activities, pipe materials are delivered to site. The term pipe-stringing is used to describe laying lengths of pipe alongside the prepared trench in preparation for welding into continuous lengths. Polyethylene (PE) pipe may be delivered to site in lengths or in rolled spools, while polyvinyl chloride (PVC) piping is delivered in a similar fashion to steel (rigid pre-determined lengths). The length of stringing along the alignment should be assessed on a case-by-case basis and should include provisions for gaps at crossing points.

Pipe stringing. Ecos

PE pipe can be joined by heat fusion or with mechanical fittings. Thermal Heat Fusion methods include; butt fusion, saddle fusion, socket fusion and electrofusion. The principal of heat fusion is to heat two surfaces to a designated temperature, then by application of a sufficient force cause the melted materials to fuse together. This fusion, when done in accordance with the manufacturer's specifications, results in a joint that is as strong as or stronger than the pipe itself. The newly-joined pipe can be handled as soon as it has cooled to near ambient temperature. Prior to attempting heat fusion, the operator must confirm that the fusion equipment selected is designed to operate with the pipe in question.

Mechanical joining methods for PE/PVC piping include mechanical compression couplings and stab type mechanical fittings.

PVC piping is joined by using solvents. Pipe ends are cut evenly, the ends are then cleaned and a primer applied before using a solvent to join two pipe ends together with the aid of a connector. The process is essentially one of chemical fusion.

For steel or ductile iron, pipe joins are welded. Once completed, each weld is inspected visually and using x-ray or ultrasonic equipment. The surface at the joint is then cleaned by grit-blasting or wire brushing, and a corrosion inhibitor - a tape wrapping, plastic sleeve or protective coating - is applied.

Coating is the primary means of corrosion protection for steel and ductile iron pipelines. Any internal lining or external coating should be fit-for-purpose and applied to the individual pipes prior to their arrival on site.

Waste products generated by pipe stringing, coating and welding activities can include PE and PVC end caps and offcuts, mild steel offcuts and defective pipe, metal filings, timber skids and sandbags, chemical containers (such as epoxy coating cans), abrasive blasting residue and welding residue (such as welding rod scraps, welding stubs, electrode butts, radiography

chemicals and packaging). Recycling opportunities and the appropriate methodologies for the gathering and disposal of generated waste, including hazardous materials, should be described in the EMP/CEMP/OEMP prior to the commencement of works.

STRINGING, COATING AND JOINTING – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Dust and noise emissions resulting from pipe transport	Noise Management Traffic Management Dust & other Air Emissions Management
Temporary obstruction of other land uses	Stakeholder Code of Practice
Damage to existing road networks and infrastructure	Traffic Management
Potential fire hazard associated with construction welding and grinding	Fire Prevention Management
Appropriate management of waste materials	Waste Management
Pipe stringing impeding emergency vehicles, landowner access or fauna movements including stock	Fauna Management Traffic Management
Hazardous waste generation from abrasive blasting	Fuel and Chemical Management Waste Management
Waste from spent rods, spray paint etc	Fuel and Chemical Management Waste Management

	STRINGING, COATING AND JOINTING – ENVIRONMENTAL OBJECTIVES
	1. To minimise disruption to landowners and third parties 2. To minimise the risk of bushfire 3. To minimise waste generation/ littering 4. To effectively manage wastes, including maximising recycle / reuse opportunities 5. 6. To avoid damage to existing road networks from pipe trucks and other vehicular traffic

	STRINGING, COATING AND JOINTING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning	▪ Consultation shall be undertaken with relevant landowners and regulatory authorities with regard to locating pipe storage laydown and worksites - refer to Section 6.10 Construction Camps and Worksites.

	▪ Need for and location of access gaps in the pipeline strings should be pre-determined in consultation with stakeholders (fire authority, landowners).
Pipe Stringing	▪ Pipe strings should avoid areas of native vegetation and should be strung on to areas of the RoW where clearing and grading is complete, unless otherwise agreed.
Pipe Jointing	▪ Epoxy containers or other hazardous containers or materials to be collected and disposed of in an appropriate manner, that is described in the EMP/CEMP/OEMP.
Abrasive Blasting	▪ Abrasive blasting shall be conducted in accordance with applicable codes of practice and regulatory conditions.
Pipe Welding	▪ All welding, welding procedures, welder qualifications, the use of welding consumables, and the removal of weld defects shall conform to relevant Australian Standards, particularly AS2885.2. ▪ Ferrous and non-ferrous materials generated from pipe welding and cutting process should be recycled as far as possible. ▪ PE/PVC pipe solvents and waste materials generated from welding, joining and cutting activities should be recycled or disposed of in an appropriate manner that is described in the EMP/CEMP/OEMP. ▪ Abrasive blasting shall be conducted in accordance with the applicable national standards, with blasting wastes handled in a manner appropriate to the medium used.

Pipe welding. Ecos

Joint coating. Ecos

6.5 TRENCHING

Trenching may be undertaken either prior to, during or after pipe stringing, depending upon project schedules, terrain and other logistical factors. Trench excavation depth may vary depending on:

- the product being transported (e.g. gas, petroleum liquids, water)
- the maximum operating pressure of the pipeline
- the nature of the terrain (e.g. rock, open pasture, rivers)
- the proximity to infrastructure and buried utilities (e.g. roads, railways, other pipelines, fibre optic cable)
- land use and the potential risk of third party interference (e.g. rupture during deep-ripping or excavation)

Trenching machine in action Ecos

General trench depth parameters are specified in Australian Standards, while site-specific requirements will be obtained from infrastructure owners (i.e. road and rail authorities, etc).

TRENCHING – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion and sedimentation of land and water (including discharge waters)	Water Management Soils Management Drainage, Erosion and Sediment Management
Problematic soils (Acid Sulphate Soil) or contaminated soil disturbance	Soils Management
Potential for stock and wildlife entering the open trench	Fauna Management
Disturbance to sub-surface artefacts, heritage sites or skeletal remains	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Disturbance to root structures of mature vegetation	Flora Management Soils Management
Temporary obstruction of other land uses	Stakeholder Code of Practice

Potential impact to water sources (groundwater and surface water)	Water Management Drainage, Erosion and Sediment Management Fuel and Chemical Management

	TRENCHING – ENVIRONMENTAL OBJECTIVES
	1. To minimise adverse impacts on soil, particularly impacts to the soil profile through topsoil mixing or burial 2. To minimise adverse impacts on water 3. To minimise adverse impacts on stock or wildlife 4. To minimise impacts on sites of cultural and historic heritage significance 5. To minimise disruption of landowners and third parties or to their activities 6. To minimise environmental risk associated with third party interference

	TRENCHING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning	▪ Third party infrastructure, including pipelines, fibre optic cables and private infrastructure shall be identified and relevant impact management measures applied prior to commencement of trenching activities.
Construction	▪ The open trench shall be checked regularly for fauna, with their removal being managed in accordance with Section 9.5.
Alternative techniques	▪ Boring or HDD should be used as required where the pipeline crosses sensitive areas, major watercourses or significant built infrastructure.

6.6 BLASTING

In ground where the use of conventional excavation or ripping equipment is not feasible, it may be necessary to use controlled blasting. The handling, storage and use of explosives is governed by prescriptive State and Territory legislation and Australian Standards.

BLASTING – KEY ENVIRONMENTAL ISSUES	Related Sections
Impacts on terrestrial and aquatic fauna	Fauna Management Drainage, Erosion and Sediment Management
Noise disturbance	Noise Management
Vibration disturbance	Noise Management
Dust generation	Dust & other Air Emissions Management
Appropriate management of debris	Waste Management
Infrastructure damage	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management

	BLASTING – ENVIRONMENTAL OBJECTIVES
	1. To minimise adverse impacts on fauna and significant habitat areas 2. To minimise associated noise impacts 3. To minimise associated vibration impacts 4. To minimise associated dust generation 5. To safely contain blast debris 6. To avoid damage to adjacent infrastructure, cultural material or third party assets

	BLASTING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning and Design	▪ Alignment selection shall minimise encounters with areas of rock that require blasting. ▪ A Blasting Operations Management Plan shall be prepared, detailing the proposed method of blasting, including safety, drill pattern, charges, explosives, detonation methods, debris control, climactic conditions etc. ▪ Prior notice shall be given to adjacent residents, nearby work crews

	and other potentially affected parties (e.g. adjacent utility operators) in accordance with applicable standards and regulatory requirements. ▪ Risk assessment to identify threats to environment, adjacent landowners and infrastructure/assets should be undertaken to ensure scale of blasting is appropriate.
Blasting Operations	▪ Blasting procedures shall be conducted in strict compliance with relevant State or Territory legislation and Australian Standards. ▪ Measures such as appropriate blast design, blanketing and collaring, shall be employed as required on a site-by-site basis to prevent possible damage to nearby structures, utilities and sensitive habitat/fauna. ▪ Avoid blasting in sensitive fauna/flora/groundwater /wetlands/river crossing areas.

6.7 TRENCHLESS TECHNOLOGY

Trenchless technology is a viable alternative where there are significant surface constraints which limit or exclude standard trenching as a construction methodology. Trenchless technology is a collective term that includes techniques such as tunnelling, thrust boring, Horizontal Directional Drilling (HDD) and the plough-in method. These methods of construction cause minimal disruption to the surface environment, making them ideal for areas where there are environmental sensitivity, heritage constraints, social complexities or where existing infrastructure cannot be passed by trenching; the main drawbacks to trenchless technologies are increased unit cost and risk, and the risk of failure must be considered when considering use of a trenchless technology.

The planning and phasing of trenchless activities during construction requires an understanding of where these methods would be most feasible. A thorough risk assessment for the proposed technology, including consideration of environment and technical issues, cost and the area/s zoned for trenchless methodologies should be conducted during the initial design and planning stages. Geotechnological (geotech) analysis will be required, to inform this risk assessment, and to confirm the appropriateness of the trenchless technology proposed.

For further guidance on trenchless technology, it is recommended the website of the Australian Society for Trenchless Technology (ASTT) is consulted (refer to http://www.astt.com.au/trenchless_technology/guidelines/astt_guidelines/).

6.7.1 MICROTUNNELING (CLOSED-FACE BORING)

Overview of the technique

Microtunneling, sometimes called “closed-face” boring, is a form of trenchless construction that uses a remotely-operated microtunneling machine which is guided between two pits or shafts. Once the microtunneling machine is in place and starts to create a microtunnel, pipe is pushed in behind the machine using a pipe jack, with the advance of the machine controlled by the speed with which the pipe is fed in. Microtunnelling is typically used in situations where a pipeline needs to cross under rail, road or other sensitive features and the geology is un-cohesive, granular and/or water charged.

The potential benefits/where the method can be applied

Microtunneling can avoid surface disturbance across road and rail corridors and at other sensitive locations. It allows deep installation under existing utilities (fibre optic, gas pipelines, water pipelines) and is able to penetrate groundwater tables without a requirement for dewatering. Microtunneling can also be used through contaminated soils and can be a cost effective option in such instances.

Limitations

Microtunneling can only take place on a relatively flat and constant grade surface, and it requires the sinking of pits or shafts, which can be expensive; the technique cannot be used to negotiate tight vertical or horizontal curves. It is also a technically elaborate process and is relatively slow. All of the factors listed above contribute to cost, and the microtunelling technique can be relatively expensive.

Potential Risk

The main risk when undertaking microtunneling is surface settlement caused by disturbance to the subsurface geology following installation of the pipe. Other environmental issues can arise from mismanagement of excavated topsoil and spoil from each service shaft or pit, from fauna entrapment, from ineffective control of waste and from the risk posed by a significant rainfall event.

Risk Management

Undertake careful examination of geology and hydrogeology at defined locations during the initial planning stages to determine the sub-surface characteristics. This will inform a decision on whether microtunneling is the most suitable method of construction.

If sensitive structures are present on site (i.e. railway line), settlement monitoring should be undertaken during the works. A contingency plan for resolving potential settlement issues should be prepared by suitably-credentialed specialists and approved by the project proponent and relevant stakeholders/regulators prior to commencement of microtunneling works.

Stockpile areas should be located away from sensitive locations and managed in accordance with 9.7.

Spoil and topsoil stockpiles shall be managed in accordance with Section 9.6 Soils Management whilst waste management and management of drilling muds should be undertaken in accordance with provisions in Section 9.9 Waste Management). Dewatering of bellholes should be managed in accordance with provisions of Section 9.8 Water Management.

6.7.2 THRUST BORING

Overview of the technique

Thrust boring is a low impact technique involving drilling short distances to join two enlarged trenches, or bellholes, located within the pipeline construction area (see figure 7). A bellhole is required on each side of the proposed crossing (road or railway or watercourse), one will be the entry bellhole (containing the thrust bore rig) whilst the other is used as the receiver. The entry bellhole is typically 25m or more long and 4-5m wide to allow it to hold the rig and a full length of pipe. The receiving bell hole is typically 4-5m long and 3m wide.

The potential benefits/where the method can be applied

The technique of thrust boring is commonly applied to install pipelines beneath infrastructure such as roads, railways, buried utilities (e.g. fibreoptic cable) and, in some circumstances, for watercourse crossings. Thrust boring can be used in areas of high environmental, heritage and social significance where surface impact is not acceptable.

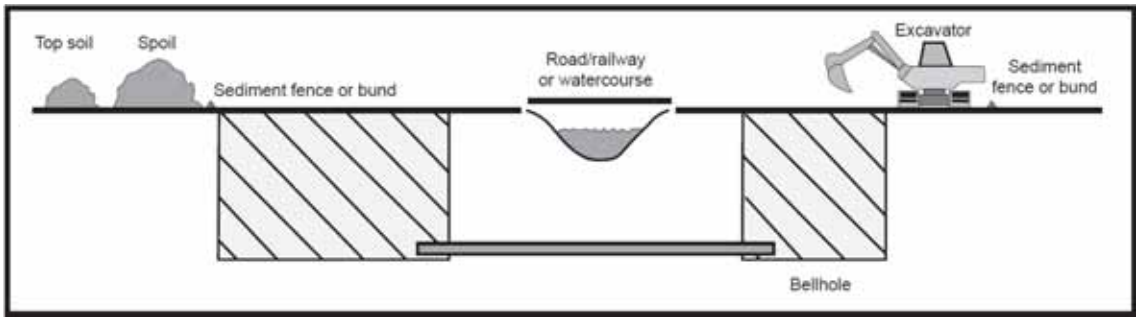


Figure 7: Schematic profile of a bored crossing

Limitations Use of a thrust bore is limited by site conditions, including geology, landform, soil type, soil depth and width of the required bore. Thrust boring works best in soils that are above the water table, with special dewatering measures needed when groundwater is encountered. The thrust bore is not suitable over long distances due to increased cost and risk of failure, and over longer distances where surface disturbance is not desired, permitted or possible, crossing methodologies such as HDD technology and microtunneling have become more suitable options. Thrust boring is also limited to construction on one plain of direction which can also limit its suitability..

Potential Risk

Environmental risks include potential mis-management of excavated topsoil and spoil from each bellhole, fauna/livestock entrapment, ineffective control of waste and risk of a significant rainfall event filling the bellholes leading to runoff with an unacceptable sediment level.

Risk Management

Evaluation of geology and/or hydrogeology and analysis of alternative construction techniques should be undertaken in the initial planning stages to determine if thrust boring is the most suitable method of construction.

Stockpile areas should be located outside of sensitive lands and managed in accordance with 9.7 Drainage, Erosion and Sediment Control provisions. Fauna management should be undertaken in accordance with Section 9.2.

Spoil and topsoil stockpiles shall be managed in accordance with Section 9.6 Soils Management whilst waste management and management of drilling muds should be undertaken in

accordance with provisions in Section 9.9 Waste Management). Dewatering of bellholes should be managed in accordance with provisions of Section 9.8 Water Management.

6.7.3 DIRECTIONAL DRILLING

Overview

The installation of the pipeline by Horizontal Directional Drilling (HDD) involves drilling a hole at a shallow angle beneath the surface, then pulling the welded pipe string back through the drill hole. Drilling is conducted by a specially designed drill rig, operated by a specialist contractor. A variety of associated equipment and infrastructure is required, and a cuttings settlement pit and drilling mud containment pit at the drill entry and exit points are needed.

The size of the HDD rig and its associated footprint depends upon the size of the pipe, the nature of the subsurface geology and the length of the drill. Smaller, self-contained rigs (e.g. on the back of a semi-trailer) are often used for applications such as road crossings, while larger HDDs require more sizeable equipment and static drill rigs.

Potential Benefits/where the method can be applied

The use of HDD decreases the risk of impact to areas where surface disturbance must be avoided as far as possible. HDD is generally used to cross major watercourses (refer to section 6.11 Watercourse Crossings) or at sites where standard open cut methods are not feasible or appropriate. It may also be used to negotiate or introduce subsurface curves or bends – in 3 dimensions - for road or railway crossings or to facilitate coastal crossings where a pipeline crosses beneath the intertidal or shoreline region (i.e. 'land to water' crossings).

Limitations

The feasibility of using HDD is strongly limited by site conditions such as soil stability, slope, access, available workspace and the nature of subsurface rock. Directional drilling is also relatively costly in comparison to conventional trenching, but may be more economical in certain conditions.

Risks

While directional drilling can reduce aboveground impacts, it is still important to apply effective drill site sediment control and waste management processes.

Failure of the HDD, resulting in the release of drilling muds and/or collapse of the pilot drill hole, is a risk which increases where the geology is un-cohesive, granular and/or water charged. Failure of an HDD, or 'frack out', generally requires either a secondary HDD or replacement by a more intrusive construction technique.

Pullback operations are a major source of risk in HDD, where the product pipestring sticks during pullback leading to partial hole collapse and other complications.

Issues such as noise and increased duration of construction and workforce numbers also need to be managed, and are considered in in Section 6.10 Construction Camps and Worksites, Section 9.9 Waste Management and Section 9.10 Noise Management.

Risk Management

As part of determining if HDD is the most suitable method of construction, geotechnical analysis should be undertaken, together with a review of the limitations of the HDD technology for the areas where it is proposed for use.

A HDD failure scenario should be included in the risk management analysis during the planning stages and should include emergency management and response, as well as remediation measures.

Site specific environmental management procedures should be prepared for all HDD sites prior to drilling; these should deal with identified risks and specify mitigation and management measures.

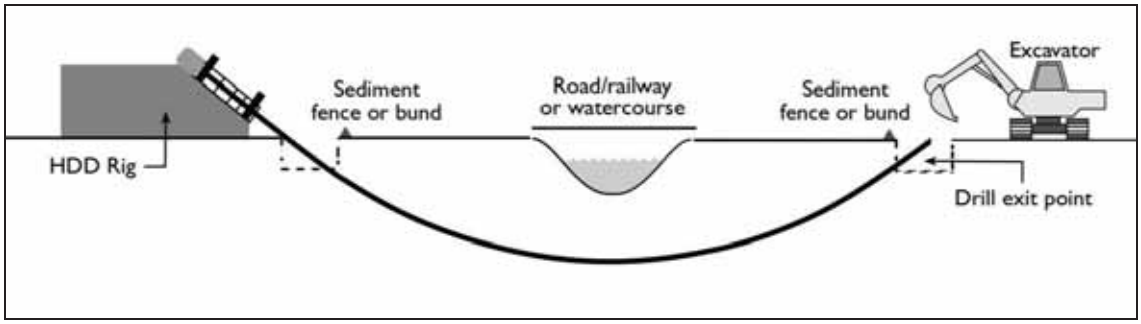


Figure 8 Schematic profile of Horizontal Directional Drilling

Small horizontal directional drilling rig. Ecos

Large horizontal directional drilling rig on pad. MacDow

6.7.4 PLOUGH-IN METHOD

Overview

Plough-in construction is an emerging technique predominantly applied to the installation of small diameter gas and water pipelines. The method employs a deep ripper and heavy duty keel which contains a chute. The keel slices through the soil leaving the pipe extruded from the chute outlet in its trailing edge. Depth and direction can be controlled by the guidance system. The keel can adopt a vibratory capacity to ease soil citting. Bellholes are required at regular intervals to join spools of pipeline together, with their spacing dependent on the length of PE rolls being installed.

Potential Benefits/where can it be applied

Plough-in methodology can prove to be a lower cost, lower impact and faster form of installation when the construction circumstances allow. It can be applied to areas of better agricultural soils where trenching would be more disruptive, can negotiate curves and has the fastest recovery time. It does not require topsoil stripping in advance, and in some situations the pipe spool can be mounted on the plough-in rig, negating any requirement for a pipe-stringing area.

Limitations

Plough-in construction is not suitable for terrain containing a lot of sub-surface rock; in addition, there are technical limits to the diameter of pipeline that is suitable for plough-in and it is only suitable for PE pipelines. Set-up costs mean that plough-in may not be cost-effective for applications requiring only short pipe lengths.

Risks

Too much rock present in the subsoil can damage both the equipment and the PE pipe itself. Other associated environmental risks are associated with the necessary bellholes, including potential for soil mismanagement, risk of fauna/livestock entrapment, ineffective control of waste and potential impacts from a significant rainfall event.

Risk Management

Geotechnical analysis should be undertaken during project planning to determine if plough-in is a suitable construction methodology.

Spoil and topsoil stockpiles shall be managed in accordance with Section 9.6 Soils Management. Fauna management should be undertaken in accordance with Section 9.2 Fauna Management whilst waste management and management of drilling muds should be undertaken in accordance with provisions in Section 9.9 Waste Management. Dewatering of bellholes should be managed in accordance with provisions of Section 9.8 Water Management.

6.8 PIPELAYING AND BACKFILLING

In a conventional trenched installation, the joined pipe string is lowered into place using side-boom tractors or excavators. Prior to pipelaying, it may be necessary to dewater the trench if rain water or groundwater has accumulated and to inspect it for any entrapped fauna.

Pipe being lowered into the trench Ecos

Padding machines may be used as an alternative to imported bedding materials, to sift the excavated subsoil and provide fine material to pad beneath, beside and above the buried pipe - to protect the pipe coating. In some instances, such as very rocky soils, imported sand or foam pillows may be used for padding to protect the pipeline and its coating.

The trench is generally backfilled using previously excavated material, and then compaction is an important key to minimising settlement or slumping following construction.

PIPELAYING AND BACKFILLING – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Soil erosion and sedimentation of land and water	Water Management Soils Management Drainage, Erosion and Sediment Management
Management of potentially contaminated trench water discharge	Water Management Drainage, Erosion and Sediment Management Soils Management
Entrapment of stock and wildlife in the open trench	Fauna Management
Temporary obstruction of other land uses	Stakeholder code of practice
Backfilling problem areas and soils (acid soils, salinity, settlement, surface water or high groundwater table)	Soils Management
PIPELAYING AND BACKFILLING – ENVIRONMENTAL OBJECTIVES	
1. To minimise adverse impacts on soil and water	

	2. To minimise adverse impacts on stock and wildlife 3. To prevent erosion and slumping following backfill 4. To minimise disruption of and to landowners and third parties
	PIPELAYING AND BACKFILLING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning	▪ Where backfill is required in contaminated soils (e.g. hazardous chemical disposal sites, potential or known acid sulphate soil areas), appropriate site specific management guidelines shall be developed in consultation with relevant regulatory authorities. ▪ Where pipeline is planned through problematic soils, temporary and permanent impact management methodologies should be developed.
Pipelaying	▪ Appropriate measures shall be taken to protect the pipe coating from damage when in the trench, such as the use of suitable bedding and padding material (e.g. sand, or screened trench soil, placed around the pipe), the use of protective fabrics or the application of concrete sleeves over the pipe's corrosion prevention coating.
Backfilling	▪ The period of time between trenching and backfilling shall be minimised as far as possible to prevent erosion of exposed soils, to minimise the likelihood of trench collapse, to minimise risk of heavy rainfall affecting the open trench, to minimise the likelihood of fauna falling in and to minimise inconvenience to third parties such as landowners. ▪ The open trench shall be checked for fauna prior to backfill and any trapped animals must be safely removed. ▪ Subsurface water flows and erosion along the backfilled trench shall be prevented by appropriate means such as trench blocks (i.e. trench/sack breakers) and / or by compaction of backfilled soils. ▪ Backfill soils shall be compacted to a level consistent with surrounding soils, with the aim of preventing trench subsidence. During final re-profiling of the pipeline construction area, a low crown of soil mounded over the trench may be necessary to compensate for potential future subsidence. ▪ Appropriate measures shall be adopted for managing problem soils, e.g. saline or acid sulphate soils. ▪ If fill has to be imported from off-site, it should be certified, where possible, or inspected to ensure it is free of weeds. Wherever possible and appropriate, fill should be sourced from as close to the trench as possible.

- As a precaution in order to prevent damage during future excavation, plastic warning tape, used to alert third parties to the presence of a buried pipeline may be laid within the trench above the pipeline. Where non-metallic materials are used, the plastic warning tape should have a metallic strip embedded into it to facilitate its future detection.

Padding machine returning spoil to the trench. Ecos

6.9 BORROW PITS

Borrow pits, or small quarry sites, may be required during pipeline construction as a source of the following:

- soft earth or sand for pipeline padding during trench backfilling
- road base material for constructing or upgrading roads and access tracks
- rubble material for the construction of above-ground pipeline infrastructure, e.g. hard stands and lined fuel/chemical storage bunding
- rip-rap for stream bank stabilisation

Where practicable, borrow material will be sourced from existing sites. Larger borrow pits are likely to require additional approvals under State legislation, suggesting that a better alternative may be for borrow to be sourced from existing licenced quarries.

In the event that new source pits are required, they shall be located, operated and restored in accordance with the management measures detailed below.

BORROW PITS – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Soil erosion, sediment release to land and water	Soils Management Drainage, Erosion and Sediment Management
Removal of significant flora and wildlife habitat	Flora Management Fauna Management
Disturbance to heritage sites	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Dust and noise emissions resulting from borrow material excavation and transport	Noise Management Dust & other Air Emissions Management
Potential impacts on visual amenity	Visual Amenity Management
Temporary obstruction of other land uses	Stakeholder code of practice
Proliferation of borrow sites	Drainage, Erosion and Sediment Management
Site rehabilitation	Reinstatement and Rehabilitation
BORROW PITS – ENVIRONMENTAL OBJECTIVES	
1. To minimise clearing or other disturbance of flora 2. To minimise impacts on fauna 3. To minimise adverse impacts on soil and water	

	4. To minimise impacts on cultural and historical heritage 5. To minimise impacts on visual amenity 6. To achieve satisfactory rehabilitation 7. To minimise disruption of and to landowners and third parties
	BORROW PITS – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Borrow Pit Planning	▪ Borrow pit sites shall be selected in consultation with relevant regulatory authorities and landowners, and the necessary regulatory approvals obtained prior to site work commencing. ▪ Borrow pit number and location should be provided in planning documentation, together with an estimate of the anticipated volume of material required and a rehabilitation plan for each new pit. ▪ Site management plans identifying topsoil, vegetation and spoil storage areas, dimensions of borrow removal area and the locations of access tracks and excavation boundaries shall be prepared prior to commencement of borrow pit operations.
Borrow Pit Operation	▪ Borrow pit operations shall comply with the requirements of relevant licensing and approvals. ▪ Site access shall be designed, constructed, operated and restored in accordance with the guidelines detailed in section 6.1 Access to Site. ▪ Where significant quantities of padding or rubble material are required from a single borrow pit, a progressive shallow strip mining technique should be adopted. ▪ Where any wastes are proposed to be deposited in borrow pits, establish procedures for their selection, treatment and separation, including identification of any additional permits or approval to do so.
Borrow Pit Rehabilitation	▪ Site rehabilitation shall be undertaken as soon as possible following completion of extraction. Subject to approval from the relevant statutory authorities and at the request of landowners, borrow pits may be left in a condition suitable for appropriate alternative uses, such as water storage dams. ▪ Where strip mining techniques are applied or large pits opened, they shall be progressively restored during extraction operations. ▪ Where required, borrow pits will be suitably remediated in agreement with the landowner and the regulator, with care taken to ensure they do not become waterlogged or filled with extraneous materials.

6.10 CONSTRUCTION CAMPS AND WORKSITES

Pipeline construction involves a wide range of skills and personnel, such as project managers, welders, machinery operators, safety and paramedical staff, supervisors and inspectors, environmental advisors, catering staff, surveyors, field engineers and so on.

Temporary storage of fuel and oils at a yard/campsite. Ecos

The size of a construction workforce varies according to:

- the size of the pipeline project (e.g. a short infield flowline versus a major cross country transmission line divided into several 'construction spreads')
- the nature of the environment traversed (e.g. complexity)
- project timeframe and resourcing
- the required construction techniques (e.g. trenching, trenchless crossings).

Construction workforces on pipeline projects in Australia have ranged in size from about 50 to 1,000 personnel, with 250 personnel being typical for a single spread, medium length pipeline of around 300km. This workforce may be accommodated in hotels, motels and caravan parks in the vicinity of the pipeline route, or alternatively, in temporary construction camps.

Campsites become a preferred option for housing the construction workforce when the project is in an isolated location or where accommodation pressures in the area are high. Positive outcomes derived from installation of construction camps can include the following:

- Reduction in driver fatigue (reduced travel time to and from site)
- Reduction in traffic levels on and impacts to public roads
- Reduced greenhouse gas emissions from commuting work force
- Reduction in occupancy pressure on other local accommodation options (ie, motels caravan parks, etc)
- Reduction of noise disturbance to residences and sensitive receptors in townships
- Socio-economic benefits from increased demand on local services such as food and fuel
- Economic benefit to landowners on whose land camps are located

Construction worksites, such as site offices, directional drilling sites, pipe storage areas and machinery and equipment lay down yards will also be required. These sites are generally treated in a manner similar to campsites and are therefore also addressed in this section. The procedures for the planning, design, cultural heritage clearance, site preparation, operation and rehabilitation of construction camps, worksites and pipe-yards are considered in the following table.

Construction camps and worksites would be established after obtaining all required approvals - including landowner consent, cultural heritage survey and clearing permits. It is important to establish during the planning process whether camps, site buildings or other off-easement development are considered to be 'miscellaneous activity' under the local planning procedures – and therefore requiring their own approval - or if they are included under an umbrella project planning approval.

CONSTRUCTION CAMPS AND WORKSITES – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Soil erosion, sediment release to land and water	Soils Management Drainage, Erosion and Sediment Management
Removal of significant flora and wildlife habitat	Flora Management Fauna Management
Dust and noise emissions	Noise Management Dust & other Air Emissions Management
Potential impacts on visual amenity	Visual Amenity Management
Temporary obstruction of other land uses	Stakeholder code of practice
Site rehabilitation	Rehabilitation and Reinstatement
Waste Management and disposal	Fuel and Chemical Management Waste Management
Increased traffic volumes entering and leaving site	Traffic Management

CONSTRUCTION CAMPS AND WORKSITES – ENVIRONMENTAL OBJECTIVES
1. To minimise clearing or other disturbance to flora
2. To minimise impacts on fauna
3. To minimise adverse impacts on soil and water
4. To minimise impacts on cultural and historical heritage
5. To minimise impacts on visual amenity
6. To minimise disruption to landowners and third parties
7. To minimise the area of disturbance

	CONSTRUCTION CAMPS AND WORKSITES – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Site Planning and Design	▪ The necessary planning and other statutory approvals shall be obtained prior to establishing construction camps, laydown areas, pipe-yards or other worksites ▪ Where practicable, sites shall be located close to the pipeline easement and adjacent to pre-existing access tracks or roads, or at existing construction sites (e.g. local work areas) ▪ Sites shall be located so as to avoid disturbance to features of natural, scientific, indigenous or historical heritage significance or to significant agricultural land ▪ Sustainability of operations (inclusion in EMS or other) should be considered, and related to the scale or anticipated lifespan of the camp ▪ Sediment, erosion and drainage controls suitable to the size and scale of the operation shall be implemented
Site Construction	▪ Site access shall be designed, constructed, operated and restored in accordance with the guidelines detailed in Section 6.1 Access to site. ▪ The extent of a site shall be clearly defined on project plans and at the site. ▪ Topsoil should be stockpiled separately during camp construction, and should then be sufficiently protected and conserved so it retains its functioning capability for reuse during eventual camp site rehabilitation.
Site Management	▪ Servicing of machinery and equipment shall be undertaken at a facility that is able to correctly manage waste oils and filters. ▪ Wherever practical, site management should cater for waste stream separation and for waste recycling.
Site Reinstatement and rehabilitation	▪ Requirements for the restoration of campsites, worksites, laydown areas and pipe-yards shall be determined in consultation with relevant regulatory authorities and landowners. In some instances, landowners and/or regulatory authorities may choose to retain the site in its cleared state for future uses, in which case, partial site rehabilitation may be acceptable.

6.11 WATERCOURSE CROSSINGS

A range of pipeline construction methods are available to facilitate river, stream and other watercourse or drainage line crossings. These include above-ground or aerial options, where the pipeline is suspended across the waterway by existing or purpose-built piles or bridges; by below-ground options achieved through either standard trenching, watercourse flow diversion or the adoption of a suitable trenchless technology.

Temporary vehicle crossing across watercourse. Ecos

The preferred crossing technique should be identified by conducting a comprehensive risk assessment, considering the environmental, social and financial benefits and impacts. Site-specific factors for determining crossing methodology can include safety requirements, hydrology, watercourse substrate and geology, hydrogeology, environmental sensitivities, engineering feasibility, availability of land for suitable pipe launch and retrieval sites and cost.

An important factor in consideration of construction methodology is the efficiency of construction, and often the least environmental impact during the construction of minor watercourse crossings is achieved by open cut trenching techniques - as they can often be completed in a shorter time frame when compared to alternatives.

Some typical crossing methodologies are considered below.

Aerial Crossings are applied intermittently on water pipelines and have been successfully used for hydrocarbon pipelines. This involves strapping the pipeline to existing or purpose built pilings or bridge infrastructure. A key engineering and environmental consideration is the risk associated with the pipeline being exposed to potential floodwaters. Where the risk is unacceptable, other crossing options are considered.

Standard 'Open Cut' Trenching involves in-stream excavation of a trench in the standard manner. Excavators or backhoes are generally used for this technique, enabling trench spoil to be stockpiled away from the stream bed. The prefabricated pipe is placed across the waterway, lowered in and the trench backfilled immediately. This method is often applied in dry or shallow low flow watercourses, but may also be applied in sensitive watercourses where rapid construction is considered the best means of minimising environmental impacts.

Watercourse Flow Diversion techniques involve construction of temporary dams upstream and downstream of the crossing and the diversion of water around the site, thus creating a dry construction area between the dams. Water flow is maintained by pumping the water around the dammed crossing site (i.e. 'dam and pump') or by diverting the water flow through a flume

pipe installed between the dams (i.e. 'fluming'). Both methods have limitations depending upon site-specific factors such as flow volume, velocity and rate, watercourse profile and substrate permeability. This method is generally applied at crossings where water flow is required to be maintained for ecological, social or engineering reasons.

Horizontal Directional Drilling involves drilling a hole at a shallow angle under the watercourse through which the pipeline is threaded. Directional drilling is a costly technique, which may be used for major river crossings; however it can be limited by geotechnical or physical constraints and its adoption can introduce additional environmental considerations such as management of drilling muds and the positioning and management of drilling pads.

Microtunneling is similar to HDD but can be utilised for much larger pipelines and can be used on longer crossings (please refer to Section 6.7 for more detailed descriptions of trenchless technologies).

WATER COURSE CROSSINGS – KEY ENVIRONMENTAL ISSUES	**Related Section(s)**
Soil erosion and sedimentation of land and water	Soils Management Drainage, Erosion and Sediment Management
Bank degradation	Soils Management Drainage, Erosion and Sediment Management
Flood events	Water Management Drainage, Erosion and Sediment Management
Impacts on riparian and aquatic flora and fauna	Water Management Drainage, Erosion and Sediment Management
Disturbance to heritage sites	Heritage Management– Natural and Built Environments Aboriginal Cultural Heritage Management
Temporary obstruction of other land users	Stakeholder code of practice
WATERCOURSE CROSSINGS – ENVIRONMENTAL OBJECTIVES	
1. To minimise impacts on riparian, aquatic and water-dependent flora and fauna 2. To minimise impacts on the bed and banks of the watercourse 3. To minimise erosion and sedimentation impacts 4. To maintain water quality and water flow requirements	

	5. To minimise impacts on heritage sites 6. To minimise the impacts from significant rainfall events during crossing construction 7. To maximise rehabilitation success and restore long term site stability
	WATERCOURSE CROSSINGS – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning and Design	▪ Pipeline alignments shall be selected so as to minimise, where practicable, the number of watercourse crossings. ▪ Open cut crossing locations should take advantage of existing areas of cleared riparian vegetation and should be located away from active erosion channels or bends as far as possible. ▪ Site-specific watercourse crossing techniques shall be determined by the pipeline proponent/contractor in consultation with relevant regulatory authorities and landowners; technology decisions shall be informed by a comprehensive risk assessment that has considered environmental and social impacts and the relative costs of technical alternatives. ▪ For major crossings, hydrological and hydraulic modelling should be undertaken during the initial planning and design stages to determine watercourse characteristics and to inform consideration of technology alternatives. ▪ Hydrology data captured in the planning and design stage, (flow rates, catchment size) shall be used to develop a post-crossing reinstatement plan (rock size, type of erosion control matting, etc). ▪ Where open cut methodology is proposed, survey details of the original contours of water crossings should be incorporated into the "As-Built" documentation to assist in rehabilitation of site. As-built documentation may include details such as top and toe, invert, over bends, sags, bank slopes, watercourse substrata and position of the pipe. ▪ The necessary approvals or permits must be determined during the planning stage, and must be obtained from relevant authorities prior to the commencement of crossing construction. ▪ The need for additional area for sediment and erosion control structures at water crossings should be considered at the planning stage. ▪ Understand surface and groundwater hydraulics to ensure that design will be appropriately robust to account for future flooding events.

	▪ Where appropriate, monitoring programs - designed and conducted by suitably-qualified personnel - should be implemented, to quantify any effects on riparian, aquatic and water-dependant flora and fauna. ▪ Crossings shall be completed as quickly as is reasonably practical in order to minimise impacts. ▪ Crossing planners shall remain vigilant regarding seasonality and rainfall events, receiving daily weather reports, evaluating long range forecasts and subscribing to flood warning services where relevant. Planners should also ensure landowners are consulted over the historic behaviour of the waterway in question, and should consider any advice received as a high quality source of information. ▪ The storage of fuels, chemicals and lubricants should be as far away as is reasonably practical from any waterway, to reduce the risk of contamination in the event of an accidental spill. ▪ All equipment required for the crossing shall be on-site and in good working order prior to work commencing on the crossing. ▪ The refuelling or maintenance of equipment, machinery and vehicles should be conducted as far away as is reasonably practical from any waterway, to reduce the risk of contamination in the event of accidental spil.l

Vehicle Access	▪ Access tracks/roads shall, where practicable, avoid crossing waterways. Where necessary, watercourse crossings shall be:
	  ▪ via existing crossings where possible
	  ▪ through the stream bed within the pipeline construction area corridor in accordance with Figure 9. Access shall be limited, where practicable, to vehicles and equipment essential to construction at the site, or
	  ▪ via culvert causeways, bridges or other such crossing structures.

Clearing at Watercourses	In addition to the guidelines detailed in Section 6.2 Clearing, the following measures shall be applied: ▪ Mature vegetation shall be trimmed in preference to felling where possible. ▪ Additional workspace may be required adjacent to watercourse crossings for materials laydown, for sediment basins, for stringing of pipe or stockpiling excavated spoil or topsoil. This extra area should be located outside of the riparian zone and in previously cleared or disturbed areas where possible. ▪ Installation of Erosion and Sediment Control measures as per Section 9.7 Drainage, Erosions and Sediment Control.

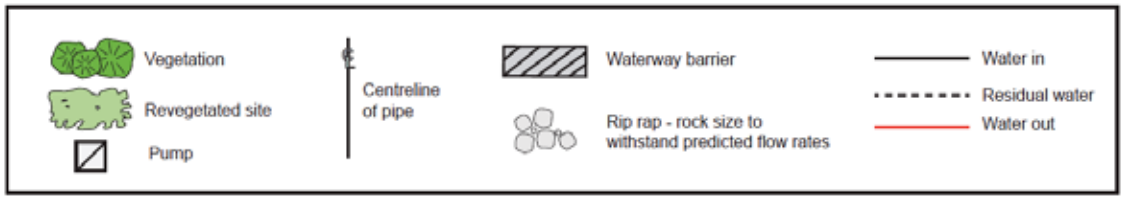
	▪ Where the stream bed consists of rocks, pebbles or coarse gravel overlaying finer material, this material shall be removed and stockpiled separately and replaced as part of crodding reinstatement.
Pipelaying in Watercourses	▪ The pipe section designated for the crossing shall be fabricated prior to trenching or directional drill completion, to enable rapid installation. ▪ Appropriate measures, such as concrete coated pipe or bolt-on weights, shall be employed to anchor the pipeline in the trench as necessary.
Rehabilitation and Revegetation	In addition to the guidelines in Section 6.13, the following measures shall be applied: ▪ Ensure bed and banks of watercourse are reinstated to pre-existing conditions to facilitate safe passage of fish and other aquatic species. ▪ Banks shall be revegetated to minimise fragmentation of vegetation corridors and to avoid interrupting the movement of fauna. Appropriate species selection is required for the exclusion zone above the buried pipe. • Appropriate stabilisation measures will be required on both the banks and bed of watercourses. Such measures shall be determined on a site-specific basis during the planning stage, and following consideration of site-specific factors such as stream hydrology, soil type, rainfall, vegetation regeneration potential, land use, etc. • Stabilisation measures shall be applied based on site-specific requirements, and are likely to include a selection of the following: ○ restoring watercourse banks to their original profiles. ○ respreading topsoil over the area from which it was removed and seeding areas of disturbance. ○ replacing or introducing a surface layer of cobbles, coarse gravel or rock over disturbed areas as rip-rap. Particular care shall be taken to ensure that the material is replaced on the river bed to a depth equivalent to the original conditions and so that it is not likely to act as a barrier to the passage of aquatic fauna. ○ spreading light, stockpiled timber from pipeline construction clearing activities randomly over the pipeline construction area leading down to the watercourse crossing. ○ applying sandbag, gabion or other means of scour protection to conform with existing natural contours, as appropriate, with topsoil then respread over the sandbags or gabions

- preventing access to sites, through the appropriate deployment of fencing or barriers, to assist site recovery.

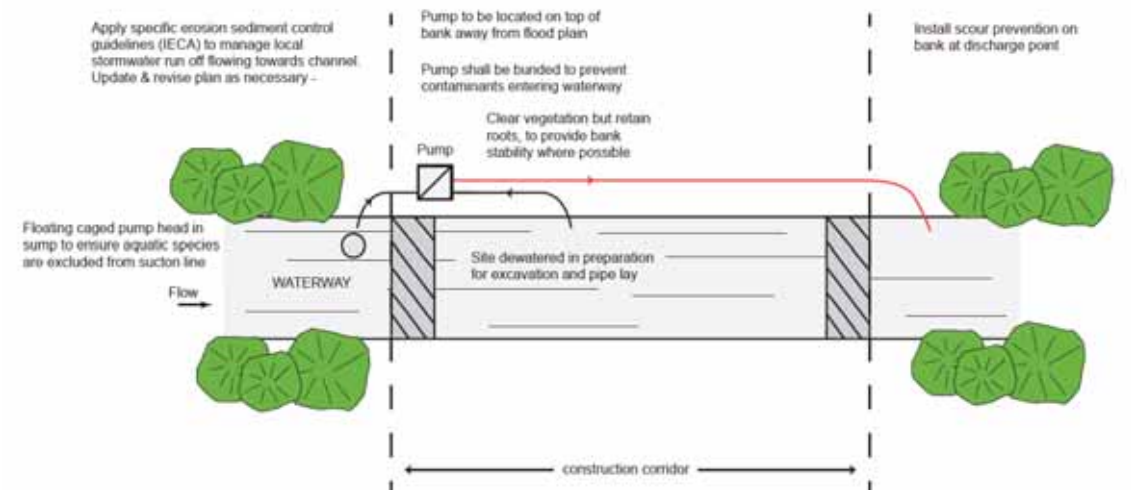
- Additional, site-specific reinstatement measures may include:
  - the installation of terracing and surface water diversion berms along the top and at intermediate points down the bank slope. Run-off from disturbed areas shall be diverted to stable (e.g. vegetated) areas or to settling basins and should not be allowed to flow directly into the watercourse
  - the installation of silt and sediment fences on slopes to filter surface run-off water
  - the reseeding or replanting of disturbed banks
  - the application of stabilising materials such as hydromulch, jute or coir matting or other suitable geotextile materials
  - avoiding vehicle access to rehabilitation areas.

FIGURE 9 DIAGRMATIC REPRESENTATION OF A TYPICAL OPEN CUT WATER CROSSING

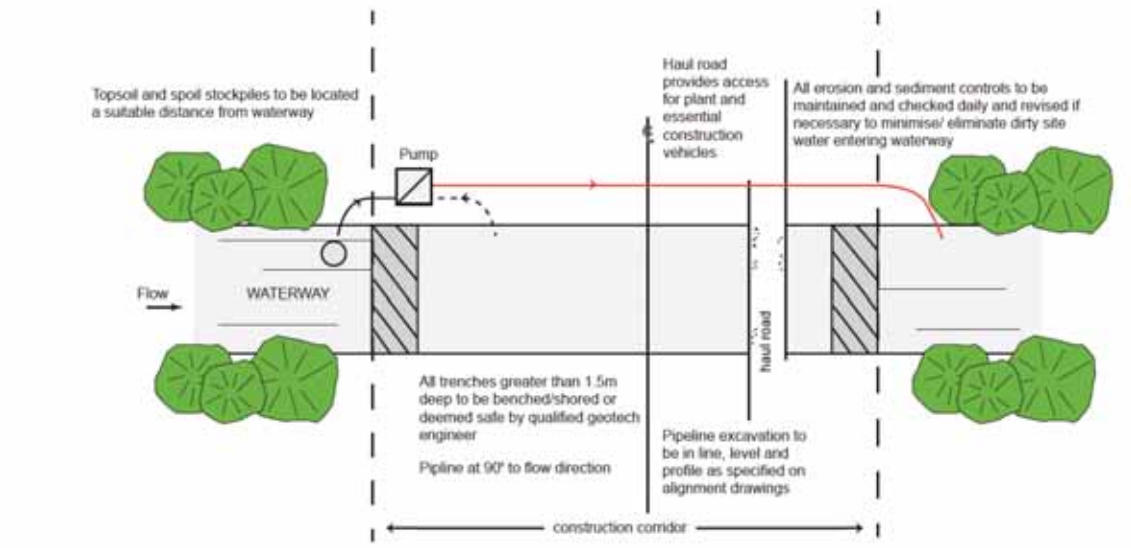
LEGEND



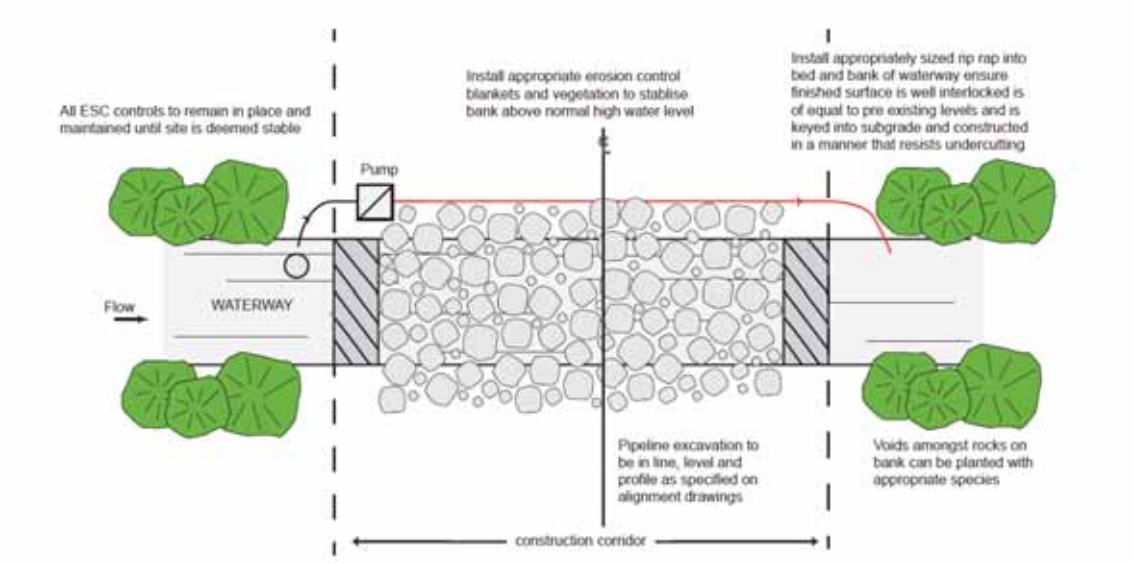
STEP 1



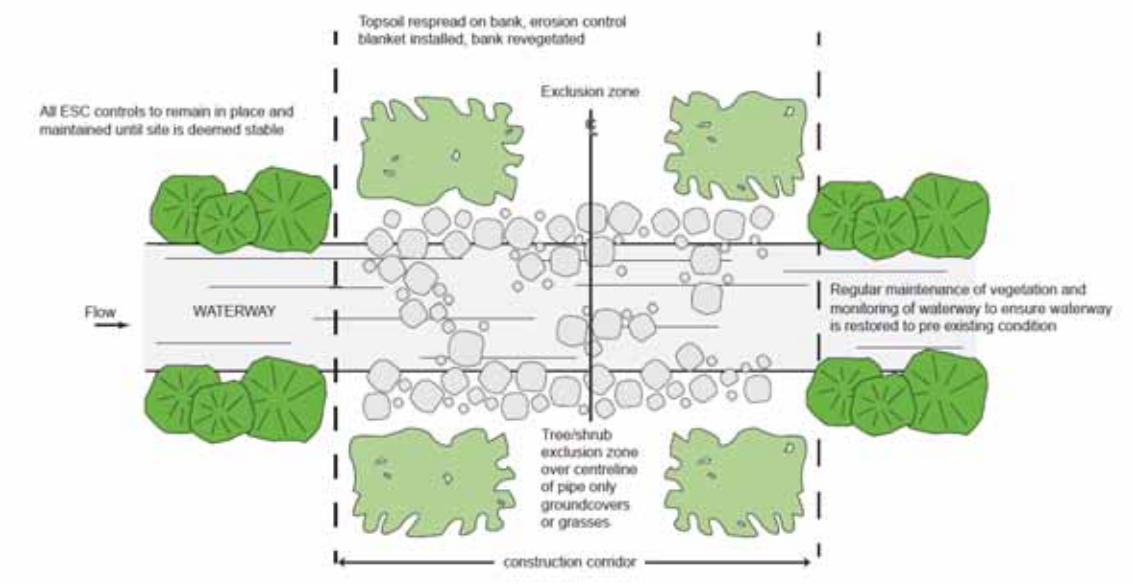
STEP 2



STEP 3


All ESC controls to remain in place and maintained until site is deemed stable
Install appropriate erosion control blankets and vegetation to stablise bank above normal high water level
Install appropriately sized rip rap into bed and bank of waterway ensure finished surface is well interlocked is of equal to pre existing levels and is keyed into subgrade and constructed in a manner that resists undercutting
Pump
Flow
WATERWAY
Pipeline excavation to be in line, level and profile as specified on alignment drawings
Voids amongst rocks on bank can be planted with appropriate species
construction corridor

STEP 4


Topsoil respread on bank, erosion control blanket installed, bank revegetated
All ESC controls to remain in place and maintained until site is deemed stable
Exclusion zone
Flow
WATERWAY
Regular maintenance of vegetation and monitoring of waterway to ensure waterway is restored to pre existing condition
Tree/shrub exclusion zone over centreline of pipe only groundcovers or grasses
construction corridor

The potential impacts, advantages and disadvantages of Open cut trenching across a watercourse and Horizontal Directional Drilling under a watercourse are set out in Table 3.

Table 3: Construction potential impacts, advantages and disadvantages for large diameter pipelines

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
Minor Crossings				
Open Cut - Low Banks and Mostly Dry	Soils integrity Sedimentation and erosion Riparian ecosystem integrity	Completed by Mainline crew with shorter timeframe before rehabilitation Economical use of resource Less Noise and Air emissions than HDD alternative Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian veg	Bulldozer Excavators, Side booms ,Padding machine, Welding Machines, Rockbreaker, Drill and Blast if required. Compressor and Sandblasting pot, Pumps(for possible ground water)
Minor Water Course Crossings with no Water Flow	Soils integrity Sedimentation and erosion Riparian ecosystem integrity	Completed by Mainline crew with shorter timeframe before rehabilitation Economical use of resource Less Noise and Air emissions than HDD alternative Maintain access through	Have equipment working in the crossing May require some clearing of riparian veg	

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
		crossing		
Minor Water Course Crossings with water Flow to be constructed by Crossing crew	Soils integrity Sedimentation and erosion Riparian ecosystem integrity Aquatic ecosystem integrity Water quality	Specialist crew for more difficult crossings(depth of feature and amount of earthworks) Economical use of resource Less Noise and Air emissions than HDD alternative Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian veg Having to divert and or dam water flow and maintain water quality and ecosystems. (Flume or Pump methodologies)	2xD8 Bulldozers,4-6 Excavators, Welding Machines, Padding machine, Articulated dump trucks, Front-end Loaders, Rock drills and Blasting as required, Excavation with R/Breaker, Compressor and S/Blasting pot
Major Watercourse Crossings				
open cut Methodology	Soils integrity Sedimentation and erosion Riparian ecosystem integrity in watercourse. Impact on Sedimentation and erosion Impact on aquatic	More economical than HDD Less Equipment and resource required than for HDD. Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian veg. Having to divert or dam water flow and maintain water quality and ecosystems.	As Above with additional Pumps and Compressors for Pre-test

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
	ecosystems Water quality			
Pipe installation by Floating Method (probably will not be used for APLNG)	Soils integrity Sedimentation and erosion Riparian ecosystem integrity Aquatic ecosystem integrity Water quality	Can use where flow through wide feature low. Minimises equipment required for lowering in. Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian veg. Having to divert or dam water flow and maintain water quality and ecosystems.	As above
Pipe Installation by Bottom Pull Method (Probably will not be used for APLNG)	Soils integrity Sedimentation and erosion Riparian ecosystem integrity Aquatic ecosystem integrity Water quality	Can use where significant flow through wide feature Minimises equipment required for lowering in Maintain access through crossing	Having to divert or dam water flow and maintain water quality and ecosystems.	As above
Horizontal Directional Drilling (Large diameter pipes)	Soils integrity Sedimentation and erosion Aquatic ecosystem integrity(Frac-	Can avoid riparian veg and features, cultural heritage Minimum disturbance to	Significant extra clearing required for pipe string. Time frame 3-4 weeks plus to complete. Additional access	Power packs for Directional Drill, Mud recycling pumps and screens, Mobile crane, Excavators,

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
	outs) Water quality Drill site sediment control, Waste management, Noise	watercourse if successful Can use for large water flows or volumes	requirements both sides of crossing, More equipment required to achieve result. Risk of failure of HDD to complete, uncertain outcomes. Possibility of Frac-out and polluting watercourse with Bentonite(difficult to determine in turbid water). Possible coating and pipe damage going unnoticed due to process. Extra earthworks for pipe stringing area Managing treatment and disposal of drilling chemicals Very expensive - particularly in consideration of large diameter pipelines compared to other methodologies.	Generators, Pumps, Vibro hammer for installation of sheet piles, Side booms for welding of pipe string, Compressor and blasting pot, Side booms for pipe installation, Pumps and Compressor for Pre-test.

6.12 PIPELINE TESTING AND COMMISSIONING

Hydrostatic testing is normally undertaken on pipelines at the completion of backfill operations. Water pipelines also require completion of air and scour valves (high point drains and low point drains) for the defined test sections.

Pipeline commissioning can take place after the pipeline has undergone a series of safety and operational tests. Appropriate notification and licencing by the relevant regulatory authority is required prior to a pipeline being commissioned and declared operational.

Hydrostatic testing a section of pipeline. Ecos

6.12.1 HYDROSTATIC TESTING

Hydrostatic testing (hydrotesting) involves pressure testing pipelines with water or another suitable test medium, to verify pipeline strength and detect leaks. For gas pipelines, the process involves the temporary installation of test manifolds in sections of the newly constructed pipeline and filling the pipeline with the testing medium; the pipe section is then pressurised, allowing detection of any leaks and weak spots in the test section.

Following hydrostatic testing, the pipeline will require final cleaning, gauging and drying, particularly in the case of hydrocarbon pipelines. This is achieved using air pressure to push cleaning and drying Pipeline Inspection Gauges (PIGs) through the pipeline to remove residual water, welding slag and sediment.

HYDROSTATIC TESTING – KEY ENVIRONMENTAL ISSUES	Related Sections
Potential impacts on aquatic fauna from discharged hydrotest medium	Fauna Management
Modification of water quality	Water Management Drainage, Erosion and Sediment Management
Third party deprivation of water resources	Water Management
Use of chemical additives (e.g. test medium corrosion inhibitors, biocides)	Fuel and Chemical Management Water Management
Test medium disposal	Water Management Waste Management

Soil contamination, erosion and sedimentation from hydrotest medium discharge	Drainage, Erosion and Sediment Management Soils Management
	HYDROSTATIC TESTING – ENVIRONMENTAL OBJECTIVES
	1. To minimise water use 2. To minimise impacts on flora and fauna 3. To maintain water quality in adjacent groundwater or surface waterbodies 4. To minimise impacts on soil 5. To minimise disruption to landowners and third parties
	HYDROSTATIC TESTING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**

Planning and Design	▪ Hydrotesting operations shall conform to the requirements of relevant legislation and AS/NZS 2885.5[2].
	▪ Prior to the commencement of hydrotesting activities, a hydrostatic testing plan shall be prepared, describing at least the following aspects:
	  ▪ The procedure to be used
	  ▪ Personnel roles and responsibilities
	  ▪ Permits and approvals required
	  ▪ Environmental and social objectives and their fulfilment
	  ▪ Hydrotest medium, its source and quantities required
	  ▪ Any hydrotest medium additives and their management, with applicable MSDS
	  ▪ Hydrotest timing and scheduling
	  ▪ Hydrotest medium disposal
	  ▪ Reporting
	▪ Consultation with landowners and/or relevant regulatory authorities shall be conducted to determine an acceptable water sourcing and disposal methodology.

[2] AS/NZS 2885.5: 2012 *Pipelines – Gas and Liquid Petroleum – Field Pressure Testing*.

Hydrostatic Testing	▪ Holding dams, if required, shall be located, constructed and restored in accordance with the principles outlined for construction work sites - refer to Section 6.10 Construction Camps and Worksites. ▪ Measures which prevent hydrotest water discharge resulting in soil erosion or sedimentation of land and water shall be adopted - refer to Section 9.7 Drainage, Erosion and Sediment Management. ▪ Potential impacts on other users of the water resource shall be avoided or minimised by maintaining adequate flow rates and water levels or by coordinating water usage to minimise potential interference. ▪ The use of environmentally harmful chemical additives in the hydrotest water, such as some corrosion inhibitors and biocides, shall be minimised. ▪ Hydrotest water discharge or recycling for secondary uses, such as pasture irrigation or livestock watering, shall only be undertaken in accordance with applicable water quality guidelines. ▪ Where practicable test water shall be used for multiple test sections.

6.12.2 PIPELINE PURGING

PIPELINE PURGING (GAS)

At the commissioning stage of a gas pipeline, it is necessary to purge the pipeline of air to ensure safe operation and that the initial gas flwo can meet the required market specifications. To achieve this, a ‘slug’ of inert gas such as nitrogen may be pushed through the pipeline by low pressure natural gas.

The air and nitrogen mix is purged out of the system through valve-controlled outlet pipes. This process may result in gas being vented from the pipeline as air is purged,, however such gas releases are minimised as far as possible for both environmental and economic reasons.

PIPELINE PURGING (WATER, SLURRY)

To ensure the efficient operation of a water pipeline, air release valves are installed at every high point and scour valves are installed at low points. Air valves can release air from the pipeline during commissioning or allow air in to prevent pipe collapse if a leak or other release from a section of pipe is causing a vacuum. Scour valves are used to allow water to drain from a section of the pipe ahead of repair or for cleaning.

PIPELINE PURGING AND GAS VENTING – KEY ENVIRONMENTAL ISSUES	Related Section(s)
Creation of a safety hazard by venting gas	Dust & other Air Emissions Management
Potential release of greenhouse gases	Dust & other Air Emissions Control
Noise associated with gas release	Noise Control

	PIPELINE PURGING AND GAS VENTING – ENVIRONMENTAL OBJECTIVES
	1. To minimise the creation of safety hazards 2. To minimise atmospheric emissions 3. To minimise noise disturbance 4. To minimise water pollution 5. To minimise waste and air or water contamination by the products of pipeline purging operations
	PIPELINE PURGING AND GAS VENTING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning - Gas	▪ Gas vents shall be located at an appropriate distance from residential areas and infrastructure, in accordance with relevant regulatory requirements ▪ Purging or venting shall be minimised by using methods that prevent or reduce the mixing of air, inert gas and product gas (e.g. use of a PIG) ▪ Purging or venting gas from the pipeline shall be conducted under meteorological conditions that facilitate rapid atmospheric dispersal of the gas ▪ Adjacent residents shall be advised of the venting operation prior to undertaking the activity
Planning – Non-water / slurry liquid pipelines (	▪ See Purging principles and practice (further guidance in Appendix 4).
Planning – Water Slurry	▪ Where possible, air valves and scour valves shall be located in areas where disturbance to existing land or land use is minimised ▪ Effective and suitably-sized scour protection must be in place when actively releasing water from scour valves. .

6.13 REINSTATEMENT AND REHABILITATION

Reinstatement and rehabilitation are the final major stages in pipeline construction. This section details the standard environmental management considerations for pipeline construction area rehabilitation.

Rehabilitation is the combination of reinstatement and revegetation. Reinstatement is the process of reinstalling or replacing infrastructure and re-establishing pre-construction landforms, while revegetation is the process of replacing vegetation, consistent in species composition and density with the pre-construction state. Revegetation is limited directly over the top of the pipe in order to maintain access and line of sight along the easement, although groundcovers and shrubs should be used. Progressive rehabilitation is standard following pipeline construction, generally commencing as soon as all pipeline infrastructure is in place and continuous access along the easement is no longer required.

Rehabilitated pipeline corridor co-located in a HVTL easement CNC Project Management

REINSTATEMENT AND REHABILITATION – KEY ENVIRONMENTAL ISSUES	Related Sections
Erosion and sediment control	Soils Management Drainage, Erosion and Sediment Management
Reinstatement of habitat components (rocks logs and debris)	Fauna Management

Reinstatement of infrastructure (fences, gates, culverts)	Stakeholder Code of Practice
Revegetation & rehabilitation of construction areas/sites/facilities	Stakeholder Code of Practice Biosecurity Management

	REINSTATEMENT AND REHABILITATION – ENVIRONMENTAL OBJECTIVES
	1. To minimise soil erosion potential and maximise area stability 2. To reinstate pre-construction landforms 3. To restore, repair or otherwise replace fence lines, gateways and other infrastructure disturbed during construction to their pre-existing condition (unless negotiated otherwise with the relevant landowner) 4. To minimise the potential for sedimentation or acidification of land and water 5. To minimise modification to drainage patterns 6. To minimise introduction of weeds, vermin or pathogens 7. To reinstate and enhance the environment, including wildlife habitat where practical 8. To minimise negative visual impact and enhance visual amenity 9. To minimise adverse impacts on land use 10. To create a pipeline line of sight and provide maintenance access to the pipeline corridor where required.

	REINSTATEMENT AND REHABILITATION – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Planning	▪ Pre-construction environmental assessments including photographs and GPS references should be undertaken as required - for use as pre-construction baseline information or to identify analogue sites for comparison, post rehabilitation ▪ Rehabilitation plans shall be developed, considering the application of vegetation regeneration and/or revegetation techniques as appropriate ▪ Rehabilitation plans should consider creating a positive visual aesthetic as far as is possible ▪ Site-specific rehabilitation plans should be prepared, in consultation with the landowner, and referring to pre-existing condition and outlining proposed rehabilitation methodology and monitoring regimes

Earthworks	▪ Compaction relief shall be undertaken, as required, by ripping or scarifying soils along the contours ▪ As necessary, the pipeline corridor shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features ▪ Where topsoil has been removed, it shall be respread, or clean topsoil imported where there are insufficient stockpiles. Biosecurity measures shall be applied to imported topsoil ▪ Erosion and sediment control measures shall be installed as necessary to manage the disturbed area whilst revegetation occurs.
Reinstatement	▪ Third party, stock and wildlife access to newly reinstated areas should be excluded where possible, to allow for establishment of seed and plant stock sufficient for area stabilisation ▪ Third party, stock and wildlife access to above-ground infrastructure, such as valves or scraper stations, shall be controlled by installing barriers (e.g. fencing) ▪ Unauthorised easement access shall be discouraged by installing signs, fences, earth mounds or ditches, or by placing rock piles or previously cleared vegetation as barriers ▪ Flagging used to identify sensitive environmental features (e.g. natural and cultural heritage), shall be removed and disposed of at the completion of construction in order to avoid drawing attention to sites ▪ For gas pipelines, permanent pipeline location markers shall be erected along the easement in accordance with AS/NZS 2885.3 Operation and Maintenance
Rehabilitation	▪ Where practicable, and in consultation with the landowner, rehabilitated areas should be fenced, in order to prevent access until site stability is established ▪ Seed stock should be respread or sown in accordance with the rehabilitation plan to assist natural regeneration. Surface roughness is encouraged when spreading topsoil in order to trap water and seeds ▪ Pipeline construction rehabilitation shall use native species that are typical of the surrounding vegetative community for revegetation where appropriate. Advantages of this approach include value in creating wildlife corridors, reduction of ecosystem fragmentation, creation of natural habitat and also farm management benefits (e.g. windbreaks, drought resistant shade trees and weed species

suppression)

- Line of sight and access shall be maintained along the easement in accordance with AS/NZS 2885.3 Operation and Maintenance
- Temporary sediment and erosion control measures should be removed from site once sufficient rehabilitation has been established to ensure site stability

Rehabilitation on a Large Diameter Pipeline RoW – CNC Project Management

7 PIPELINE OPERATION AND EASEMENT MANAGEMENT

The operation of onshore pipelines involves a range of activities generally undertaken by operations staff and specialist service companies. Common activities include surveillance of the pipeline easement; maintenance of the pipeline, pipeline easement and associated facilities (such as valves, compressor stations, pressure reduction stations and cathodic protection equipment); pigging of the pipeline for cleaning or inspection; and the use and handling of odorants.

Pipelines are widely accepted as a safe and environmentally responsible means for transporting gas and liquids. If pipeline operations are appropriately managed, few environmental issues are likely and those that do eventuate are typically localised and small-scale. Potential impacts that may require preventative action or mitigation measures include:

- soil erosion, sedimentation and subsidence
- disturbance to flora and fauna species and their habitat
- the introduction or spread of weeds and disease
- disruption to access or land use
- altered surface water flow or drainage
- contamination of soil or water
- the production, handling and disposal of wastes
- ignition and spread of fire
- degradation of air quality (dust, odour)
- reduction to amenity (visual and noise)

An operational pipeline corridor.
Ecos

This section provides guidance for the application of minimum acceptable standard environmental management measures to those aspects and activities that are particular to the operation and maintenance of existing pipelines.

In particular, this section aims to assist pipeline operators to achieve the following key environmental objectives:

1. To operate and maintain the pipeline in a safe manner.
2. To manage and maintain the pipeline easement in a manner that minimises potential impacts on the environment, land use and third parties.
3. To conduct maintenance and repair activities in a manner consistent with the minimum acceptable standard for pipeline construction contained in this Code.

7.1 EARTHWORKS

Earthworks may be required for maintenance or construction of additional facilities within the pipeline easement. Minor earthworks may be required in order to maintain access tracks and drainage controls, or to stabilise areas of erosion, and are generally of relatively short duration and minimal depth of excavation. Excavations to expose the pipeline for coating and corrosion repairs, or to protect the pipeline from land subsidence, will result in a greater level of environmental disturbance. Such works are considered to be construction and should be conducted in accordance with Section 6 Environmental Guidelines - Construction.

EARTHWORKS – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Soil erosion and sediment release	Soils Management Drainage, Erosion and Sediment Management
Interruption to natural surface and groundwater flows	Water Management Drainage, Erosion and Sediment Management
Disturbance to native vegetation and wildlife	Flora Management Fauna Management
Damage to agricultural production or other land uses	Biosecurity Management Stakeholder Code of Practice
Temporary disruption to residents, landowners and third parties	Stakeholder Code of Practice
Introduction of weed species	Biosecurity Management
	EARTHWORKS – ENVIRONMENTAL OBJECTIVES
	1. To minimise impacts on soil and water and environmental flows 2. To minimise disturbance to native flora and fauna 3. To minimise disruption to residents, landowners and third parties
	EARTHWORKS – ENVIRONMENTAL MANAGEMENT
	Management Measures
General	▪ Earthworks shall be undertaken in accordance with the principles and guidelines outlined in Section 9. ▪ Prior to commencing earthworks, adequate notification shall be given to the regulator, adjacent landowners and nearby sensitive receptors. ▪ During earthworks, topsoil should be stockpiled separately from subsoil, and respread over the disturbed area at completion of works in order to aid regeneration.

- During earthworks, erosion and sediment controls should be installed in accordance with IECA best practice sediment and erosion control and should be routinely checked to ensure they are in good condition, are stable and are effective. Repair works should be undertaken as required.
- Should earthworks occur in an area with known or potential acid sulphate soils, a scheme needs to be applied to ensure low pH run-off is not generated; as an example, a pH neutralising agent (such as agricultural lime) can be used to neutralise soil during stockpiling or backfilling. It is recommended that an issue-specific management plan, outlining ASS management methodology is developed, approved and implemented prior to undertaking the activity.
- Only clean fill shall be used if additional material is required[3]. Fill material should preferably be sourced locally and be compatible with the surrounding area.

[3] See *Australian Standard AS2885.3* section 3.2.4.5.

7.2 LAND USE

Pipeline easements generally pass through freehold or leasehold land that is mainly used for other activities. In these situations, agreements have been negotiated with landowners, allowing the landowner continued use of their land whilst the pipeline operator retains a right of access to the pipeline easement to operate and maintain the pipeline and its associated easement in accordance with the provisions of tenure and the pipeline licence.

LAND USE – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Disruption of existing land uses	Stakeholder Code of Practice
Disturbance to residents, landowners and third parties	Stakeholder Code of Practice Traffic Management Noise Management Dust & other Air Emissions Management
LAND USE – ENVIRONMENTAL OBJECTIVES	
1. To minimise disruption to existing land uses 2. To minimise disturbance to residents, landowners and third parties 3. To maintain appropriate consultation with all relevant landowners	
LAND USE – ENVIRONMENTAL MANAGEMENT	
Management Measures	
▪ Consultation with relevant landowners and regulatory authorities should be undertaken. The APIA Code of Practice for Stakeholder Engagement will provide advice on this activity. ▪ Where practicable, operations and maintenance activities should be conducted during appropriate periods, with the landowner consulted over the schedule and with consideration given to land use activities, including livestock and crops, in order to reduce potential adverse effects.	

7.3 MANAGEMENT OF PIPELINE FACILITIES

Pipelines are managed above ground through the installation of facilities. Aboveground facilities associated with pipeline operations can include compressor stations, pressure reduction stations, mainline valves, delivery facilities, scraper stations and instrumentation. Permanent buildings may be constructed at major facilities, such as compressor stations, but the majority of facilities are controlled remotely. The high-pressure equipment located within aboveground facilities may create issues associated with noise, gas leaks, security, visual impacts and fire risk. Operational activities, maintenance and surveillance related to aboveground facilities should be detailed in the Safety and Operating Plan[4], OEMP or equivalent approved plan.

A mainline valve. W. Mathieson

Aboveground facilities associated with water and slurry pipeline operations include balance tanks, storages, pump stations and water treatment plant. Balance tanks are large permanent structures located on high ground. Larger water storages are often contained within lined reservoirs adjacent to pump stations; pump stations and water treatment equipment are generally housed within permanent buildings.

PIPELINE FACILITIES – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Safety hazards resulting from increased traffic	Traffic Management
Bushfire and internal fire risk	Fire Prevention Management
Noise disturbance to sensitive receptors, other land users, stock and wildlife	Noise Management
Reduction of visual amenity	Visual Amenity Management
	PIPELINE FACILITIES – ENVIRONMENTAL OBJECTIVES
	1. To eliminate unacceptable safety hazards 2. To minimise the risk of bushfire 3. To minimise the impact of noise, visibility, odour and traffic on the local community
	PIPELINE FACILITIES – ENVIRONMENTAL MANAGEMENT
	Management Measures
Planning	▪ Where practicable, pipeline facility sites shall be located remote

[4] See *Australian Standard AS2885.3* section 3.3.

	from populated areas and sensitive receptors. Relevant landowners are to be consulted regarding the location of aboveground facilities. Visual impact mitigations from pipeline facilities outlined in Section 9.12 Visual Amenity Management should be considered and adopted where necessary. ▪ Facility sites should be securely fenced and locked to prevent entry by unauthorised persons.
Operational Management	▪ Potential odour issues should be managed in accordance with Section 9.11 Dust and other Air Emissions Management and compliant with applicable legislation, conditions and standards. ▪ Fire prevention methods outlined in Section 9.15 Fire Prevention Management should be implemented in accordance with a site-specific risk assessment and in compliance with legislation, conditions and standards. ▪ Pipeline facilities will be maintained in a clean and tidy condition. This includes maintenance of any screening around pipeline facilities. ▪ Noise emissions from pipeline facilities should be managed in accordance with Section 0 Noise Management and compliant with applicable legislation, conditions and standards.

7.4 SAFETY AND EMERGENCY PLANNING

Safety and emergency response have both social and environmental implications and for this reason they are often considered during the approvals process. AS 2885 and AS/NZS ISO 31000 provide guidance on the conduct of a safety risk assessment and subsequent development of a Safety Management Plan (SMP); AS 2885 is particularly focused on high pressure gas and liquid petroleum pipelines but can still be referred to for use in water and other high pressure pipelines, while AS/NZS 31000 is applicable to all pipelines.

SMPs should be developed for pipeline construction and operation; they should incorporate the findings of an AS 2885-based risk assessment process, and need to be in place prior to the commencement of the respective construction or operation. The SMPs should address all relevant safety issues, outlining appropriate incident prevention and response measures. A key component of the SMPs will be steps to be taken in response to emergencies, such as a spill or fire, giving consideration to both safety and environmental issues.

In addition to predictable construction and operational risks, the risk assessments for SMPs should include consideration of 'low likelihood / high consequence' risks, such as sabotage or terrorism and the risk of disruption to supply where a region relies on the production or supply of oil or gas, or the supply of basic human needs such as water.

7.5 PIPEINE SURVEILLANCE

Pipeline surveillance is an essential activity in the operation of every pipeline, and is covered in AS2885.3. Any surveillance activity requiring land access must be undertaken in consultation with the landowner, and with due attention to appropriate biosecurity procedures. Pipeline surveillance activities are likely to involve the following tasks:

- looking for any 3rd party activity on, or immediately adjacent to, the easement ;
- checking infrastructure condition and identifying maintenance requirements (access tracks, easement signage, fencing, gates);
- checking for evidence of erosion, washouts or land subsidence;
- identifying any areas of pipeline exposure (after significant rainfall/flooding event or similar);
- assessment of vegetation cover on the easement (establishing the requirement for easement maintenance or checking rehabilitation of sites);
- monitoring for weed infestation;
- monitoring the condition of watercourse crossings;
- monitoring for disturbance to protected ecological or heritage sites;
- monitoring for indications of leaks or spills; and
- monitoring for the presence of refuse or litter.

7.6 PIPELINE FAILURE AND RESPONSE

Pipelines carrying liquids such as oil, condensate or chemicals have the potential to impact on public safety and the environment in the event of pipeline failure. Pipelines are designed and operated in accordance with AS2885 to minimise the chance of such failures. Operational activities on any pipeline (gas or liquid) can lead to spills such as fuels and oils from plant and equipment, spills of chemicals in storage compounds or spills of contaminated water (such as from water bath heaters). Spill Prevention and Response Plans should be prepared as part of the SMPs for all pipelines. This section deals with general operational procedures that must be in place to minimise the risk and consequence of a liquid spill.

SPILL PREVENTION AND RESPONSE – KEY ENVIRONMENTAL ISSUES	**Related Sections**
Safety hazards to the workforce and the public	Traffic Management
Contamination of soil and water including groundwater	Fuel and Chemical Management Water Management Drainage, Erosion and Sediment Management Soils Management
Damage to or death of flora and fauna	Flora Management Fauna Management
	SPILL PREVENTION AND RESPONSE – ENVIRONMENTAL OBJECTIVES
	1. To reduce the risk of a spill to as low as is reasonably practical 2. To prevent contamination of soil and water 3. To prevent the direct and indirect impacts on vegetation communities, fauna and fauna habitats
	SPILL PREVENTION AND RESPONSE – ENVIRONMENTAL MANAGEMENT MEASURES
	Management Measures
Planning	▪ Pipelines shall be designed and operated in accordance with AS 2885 and this Code ▪ Pipelines shall be designed to limit the volume of material released in the case of a spill, particularly in sensitive areas. ▪ Detailed Spill Prevention and Response Plans shall be developed as part of the emergency response planning for all operational pipelines. ▪ Spill Prevention and Response Plans shall address: ▪ monitoring and detection systems ▪ notification and reporting procedures (both internal and external)

- call-out procedures; contact lists and incident investigation procedures
- operator response actions required to halt the spill (i.e. control of pumps, valves, etc.)
- spill containment and materials recovery procedures
- reinstatement and rehabilitation procedures
- requirements for safe and legal disposal of contaminated soil, clean up material, etc.
- environmental impact assessment
- personnel responsibilities
- traffic management
- equipment requirements, location, storage, maintenance and transport
- communications and logistics
- incident reporting and plan review / revision (recommended every two years)

- Spill response procedures shall comply with all relevant regulatory requirements.
- Workforce training shall be conducted in spill response and recovery procedures. Spill response drills shall be regularly conducted for operational pipelines.

8 DECOMMISSIONING ACTIVITIES

Decommissioning of pipelines requires careful assessment of the economic, risk, social and environmental situation and close communication with regulators and other stakeholders.

This section provides guidance on the minimum acceptable environmental management standard to be adopted once the decision to decommission has been taken, .

This section can be used as a reference when preparing pipeline Safety and Operating Plans, Operations Manuals or Environmental Management Plans. .

Reference should be made to *AS 2885 Pipelines – Gas and liquid petroleum*, in particular AS 2885.3, for specific guidance on abandonment of pipelines.

8.1 DECOMMISSIONING PREPARATION

The decommissioning program should be supported by a suitable study which addresses any potential effect on the environment and other uses / users of the easement. The process of risk assessment should be carried out in accordance with Section 4 of this code. The methodology applied to pipeline decommissioning should be considered on a case-by-case basis.

The following aspects should be considered when considering decommissioning methodology:

- the potential reuse options;
- age and length of the pipeline;
- the nature of the environment in which the pipeline is located; and
- any other issues relevant to the particular pipeline.

Early planning for decommissioning is essential in order to determine regulatory requirements for each case. Planning will also involve setting out the strategy, philosophy, goals and objectives for the decommissioning process. It is recognised that commercial considerations, such as whether there is any future use for the pipeline or the cost of removal versus the cost of abandonment, can be a key determining factor in planning a decommissioning strategy, but planning in fact involves consideration of five assessment criteria:

- regulatory requirements
- technical feasibility;
- environment and social factors;
- safety; and
- cost.

DECOMMISSIONING PREPARATION – KEY ENVIRONMENTAL ISSUES	Related Section(s)
Impact on flora and fauna	Flora Management Fauna Management
Impact on soil and water quality	Water Management Drainage, Erosion and Sediment Management
Waste management and disposal	Waste Management
Impact on landowners and other stakeholders	Traffic Management Noise Management Dust & other Air Emissions Management Stakeholder Code of Practice
	PREPARATION – ENVIRONMENTAL OBJECTIVES
	1. To undertake pipeline decommissioning works in a manner that is consistent with AS 2885 2. To comply with obligations under the operational pipeline licence and any other regulatory conditions 3. To decommission the pipeline in a manner that minimises potential impacts on the environment, land use and third parties 4. To include detailed assessment of the environmental and social aspects of decommissioning in the decommissioning planning process 5. To develop and implement a safety management plan for the pipeline decommissioning, that includes measures to minimise the risk to the environment, stakeholders and decommissioning personnel 6. To include assessment of the environmental, safety and social impacts of all options prior to determining the disposal strategy for product, pipe waste and facility components 7. To consider all feasible recycling alternatives when disposing of a facility 8. To clarify issues of residual environmental liability as part of the decommissioning strategy development process and before licence relinquishment
	PREPARATION – ENVIRONMENTAL MANAGEMENT
	Management Measures
Strategy Option	▪ The decommissioning strategy must be identified.

	▪ Decommissioning objectives shall be set and procedures identified. ▪ A planning assessment shall be conducted. ▪ Social/community implications shall be considered when decommissioning.
Technical	▪ Planning shall include a description of the pipeline and associated equipment to be decommissioned, including lengths, diameters and type of construction. ▪ Planning will incorporate technical and engineering aspects of the decommissioning process, including opportunities for re-use and recycling and documentation of the potential impacts associated with cleaning, or removing chemicals from the pipeline. ▪ Planning shall involve assessment of the timing of the decommissioning. ▪ Planning shall involve assessment of safety considerations associated with capping, removal and disposal of aboveground infrastructure. ▪ Planning shall involve identification of critical areas where subsidence of an abandoned pipeline cannot be tolerated (e.g. crossings). ▪ Technical consideration shall be given to pipeline structural integrity and structural condition, the state of the easement, and the establishment of the sequence of dismantling.
Existing Easement Condition	▪ Assessment will be made during planning on the current condition and status of the pipeline, including the extent of burial, trenching and details of any materials used to cover the pipeline, in order to determine potential environmental impacts associated with decommissioning. ▪ Operational and monitoring data and history shall be reviewed.
Environment and Stakeholders	▪ Impacts on the environment and landowners, including exposure of the environment to pipeline-related contaminants, shall be assessed in the development of the decommissioning strategy. ▪ The risk and nature of impacts on other environmental aspects, including emissions to the atmosphere, leaching to groundwater, discharges to surface water and effects on the soil, shall be reviewed. ▪ Consumption of natural resources and energy associated with re-use or recycling shall be reviewed. ▪ Impacts on amenities, future land use options, the activities of the surrounding community and on the environment shall be assessed.

8.2 PRODUCT REMOVAL AND PIPE CLEANING

Onsite decommissioning commences with product removal and pipeline cleaning. Decommissioning water pipelines requires the pipe or section of pipe to be hydrostatically tested in accordance with the test requirements detailed in the WSAA Water Supply Code of Australia and other relevant state supplementary documentation. Decommissioning gas pipelines requires that the hydrocarbon product is purged from the line and the pipe cleaned using the most appropriate method over a series of stages. Likely stages include injecting inert substance such as nitrogen, flushing with water, and use of foam or brush PIGs to clean the pipeline.

PRODUCT REMOVAL AND PIPE CLEANING – KEY ENVIRONMENTAL ISSUES	**Related Section(s)**
Potential impact on surface and ground water quality	Water Management
Potential soil contamination	Soils Management
Potential impact on flora and fauna	Flora Management Fauna Management
Release of air pollutants	Dust and Other Air Emissions Management
Waste management and disposal	Waste Management
Temporary disruption to landowners and third parties	Stakeholder Code of Practice

	PRODUCT REMOVAL AND PIPE CLEANING – ENVIRONMENTAL OBJECTIVES
	1. To prevent impact on surface and ground water 2. To prevent soil contamination 3. To minimise impact on flora and fauna 4. To minimise waste and dispose of appropriately 5. To minimise disruptions to landowners and third parties
	PRODUCT REMOVAL AND PIPE CLEANING – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
	▪ Site preparation and management requirements shall be implemented in accordance with developed and approved Decommissioning Strategy. ▪ If the pipeline is to be abandoned, an abandonment plan, development in accordance with AS 2885 (s.8.10) shall be developed ▪ The equipment must be made safe by removing or making safe harmful substances.

Planning	▪ Hydrocarbon gases shall typically be disposed to fuel gas or flare systems.
Depressurising	▪ As systems become depressurised, the pipeline may then be isolated by valving and subsequent blanking.
Venting	▪ Where flammable or other harmful materials are to be vented, the point(s) for release should be located in order to preclude any likelihood of ignition, under suitable meteorological conditions and away from residential and environmentally-sensitive areas. ▪ Prolonged or significant venting activities should be undertaken in consultation with the appropriate regulatory agencies.
Draining	▪ Prior to equipment being isolated, it is essential that facilities are drained as much as possible via fitted drain points. ▪ Adequately sized drain lines should be installed at the lowest points and sized in accordance with operating engineering practices. ▪ All equipment must be cleaned and purged before connections can be cut ready for disconnection and/or removal. ▪ The extent of the cleaning activity depends upon the state of the equipment and the type of contaminants present.

Purging and Flushing	▪ Pipe-work can be flushed or purged using steam, water or inert gas. For many applications, water is used as the primary pipe cleaning method. ▪ Pipelines can be cleaned using a process called progressive pigging, where a series of cleaning PIGs is pushed through the pipeline with chemical cleaning agents and flush water to remove all hydrocarbons and other contaminants. ▪ If water is used for cleaning, water supply and disposal will be undertaken in accordance with regulations and managed in accordance with the procedures in the approved Decommissioning Strategy. ▪ Management of waste water shall be in accordance with Section 9 Environmental Guidelines: Issues and Best Practice Management. ▪ No water will be returned directly to watercourses without appropriate approvals. ▪ Water shall be tested for hydrocarbon and chemical residue prior to disposal. ▪ Where contaminant level exceeds release conditions, flushed water shall be disposed of at an approved waste facility or otherwise re-treated to meet acceptable levels. ▪ Discharging water into the environment shall be undertaken in a manner that prevents localised effects, including erosion and sediment transport, and in consultation with any affected landowners.
Rehabilitation and Monitoring	▪ All pipelines which are partially or wholly left in situ should be inspected and thoroughly cleaned internally to ensure that all contaminants are removed. ▪ Consideration should be given to filling the pipeline with cement slurry or other appropriate material to prevent the pipeline acting as a water conduit, or collapsing to cause surface subsidence. ▪ Consideration should be given to maintenance or upgrade of the cathodic protection system in order to prevent pipeline collapse. ▪ In the event that cathodic protection is maintained, the responsibility for ownership is to remain with the pipeline operator and appropriate records kept. ▪ At the completion of the post-abandonment monitoring period, all signage associated with the pipeline should be removed ▪ At completion of the abandonment process, location drawings, noting the pipeline status and complying with AS 100.401 shall be prepared and made available to the regulator and to affected

	landowners

8.3 REMOVAL OF PIPELINE

Abandoning buried pipelines *in situ* is environmentally preferable to pipeline removal as a decommissioning strategy, due mainly to the disturbance associated with the excavation and removal of the pipeline.

REMOVAL OF PIPELINE – KEY ENVIRONMENTAL ISSUES	**Related Section(s)**
Potential impact on surface and ground water quality	Water Management
Potential soil contamination	Soils Management
Potential soil erosion	Soils Management
Potential impact on flora and fauna	Flora Management Fauna Management
Potential impact on heritage	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Waste management and disposal	Waste Management
Temporary disruption to landowners and third parties	Stakeholder Code of Practice

	REMOVAL OF PIPELINE – ENVIRONMENTAL OBJECTIVES
	1. To undertake pipeline corridor remediation works in a manner that is consistent with AS 2885 2. To prevent impact on surface and ground water 3. To prevent soil contamination 4. To prevent soil erosion 5. To minimise impact on flora and fauna 6. To minimise waste and to dispose of waste appropriately 7. To minimise disruptions to landowners and third parties 8. To minimise visual impact of the easement, site locations and access tracks by undertaking appropriate rehabilitation 9. To decommission the pipeline corridor in a manner that minimises potential impacts on the environment, land use and third parties

	REMOVAL OF PIPELINE – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Excavation	▪ The width of vegetation clearance shall be minimised to the safest practical width.

	▪ Cleared vegetation shall be stockpiled for respreading during rehabilitation. ▪ Topsoil shall be stripped and stockpiled for respreading during rehabilitation. ▪ Trench subsoil and pipeline padding material shall be stockpiled separately from vegetation and topsoil.
Removal of Pipe	▪ The recovered pipe will be dismantled and segments either salvaged for reuse or disposed of as scrap, depending on its condition, relative costs, demand, etc.

8.4 REMOVAL OF ABOVEGROUND INFRASTRUCTURE

The overall objective is to leave the easement in a condition that is as near as practical to pre-existing environmental conditions and decommission the pipeline in a manner that minimises potential impacts to the environment, land use and third parties. All aboveground pipe and supports along the pipeline should be cut-off at a minimum depth of 750mm below the natural surface, or at pipeline depth as determined by AS 2885.3, removed and blanked off below the surface. All aboveground signs and markers above the pipeline should be removed. If the cathodic protection system is being abandoned, all aboveground elements should be removed, and anode and earthing beds are to be disconnected at 600mm below the natural surface level (refer to AS 2885.3 and Section 7.3).

REMOVAL OF ABOVEGROUND INFRASTRUCTURE – KEY ENVIRONMENTAL ISSUE	**Related Section(s)**
Potential impact on surface and ground water quality	Water Management
Potential soil contamination	Soils Management
Potential impact on flora and fauna	Flora Management Fauna Management
Waste management and disposal	Waste Management
Temporary disruption to landowners and third parties	Stakeholder Code of Practice
Visual amenity	Visual Amenity Management

	REMOVAL OF ABOVEGROUND INFRASTRUCTURE – ENVIRONMENTAL OBJECTIVES
	1. To undertake pipeline corridor remediation works in a manner that is consistent with AS 2885 2. To prevent impacts to surface and ground water

	3. To prevent soil contamination 4. To prevent soil erosion 5. To minimise impacts to flora and fauna 6. To minimise waste and dispose appropriately 7. To minimise disruptions to landowners and third parties 8. To minimise the remaining visual impact of the easement, site locations and access tracks, by undertaking appropriate rehabilitation
	REMOVAL OF ABOVEGROUND INFRASTRUCTURE – ENVIRONMENTAL MANAGEMENT
Activity	**Management Measures**
Well Head Pipework	▪ Well manifolds shall be abandoned using methods that will protect groundwater resources. ▪ Wells shall be permanently plugged or abandoned, or may be re-configured for other purposes, such as for groundwater monitoring, all in accordance with the applicable regulatory requirements and in consultation with the affected landowner. ▪ Well pads shall be removed and any hydrocarbon-contaminated soil disposed of in accordance with regulatory requirements.
Other Infrastructure	▪ Re-use of buildings in good condition shall be considered. ▪ Where buildings are to be demolished, this shall be undertaken in accordance with regulatory requirements. ▪ The power plants, generators, compressor station equipment, mainline valves and other ancillary infrastructure that is part of the pipeline designed under AS 2885 recovered pipe will be dismantled and either salvaged for reuse or disposed of as scrap, depending on its condition, relative costs, demand, etc.

9 ENVIRONMENTAL GUIDELINES – KEY ENVIRONMENTAL ASPECTS, ISSUES AND MINIMUM STANDARD OF MANAGEMENT

Environmental Management of onshore pipeline construction, operation and decommissioning involves a range of specialist tasks, which are generally undertaken by pipeline construction companies and specialist service companies, and occur in a defined corridor.

This section outlines the key environmental aspects associated with construction, maintenance and decommissioning of onshore pipelines in Australia. For each key aspect, associated activities and issues have been defined and the minimum standard of management identified. These management standards have been developed after consideration of current practice, the applicable national codes and standards and safety, environmental, engineering and economic objectives.

These minimum standards may be directly applied to a company's operations, or as a basis for the development of project-specific or company-specific environmental procedures. Additional site-specific guidelines may be required to address issues unique to a particular pipeline or location. Site-specific guidelines may be captured in an environmental "line list", which identifies sites with specific environmental management requirements by position along the pipeline.

No matter what aspects of design, construction, operation or decommissioning have been contracted to other parties, ultimate environmental responsibility lies with the pipeline licensee. **It is therefore imperative that the licensee has a sufficiently resourced management system in place which ensures performance and compliance with licence obligations**.

Section 9 is divided into the following Key Aspects:

- Flora Management
- Fauna Management
- Biosecurity Management
- Heritage Management
- Aboriginal Cultural Heritage Management
- Soils Management
- Drainage, Erosion and Sedimentation Management
- Water Management
- Waste Management
- Noise Management
- Dust and Air Emissions Management
- Traffic Management
- Fuel and Chemical Management
- Fire Prevention Management

For the purposes of this section, the principle focus is on the management of Key Aspects during the Planning, Construction and Operational phases of the pipeline lifecycle. It is assumed that the Decommissioning phase of any onshore pipeline will be subject to its own planning process which should be consistent with the guidance and provisions presented in this section, Section 8 and with relevant aspects of AS 2885.3.

9.1 FLORA MANAGEMENT

An essential part of the environmental management of onshore pipeline is gaining a detailed understanding of flora species and communities affected by the project.

Prior to commencement of any ground disturbance activity, It is recommended that to facilitate adequate flora management, the following tasks are undertaken as a minimum:

- Review of available literature and databases
- Field investigations to assess presence, location and condition of flora species and communities, with an emphasis on the presence of listed species, but also noting weed or invasive species
- Impact assessment to determine the likely effects of a project on terrestrial and aquatic vegetation
- Implementation of appropriate management principles and measures, including those listed in this section.

FLORA MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Reduced vegetation cover leading to:
  - erosion and sedimentation
  - loss of agricultural productivity
  - disruption of native fauna movement of migratory pathways
  - loss of visual amenity
- Disturbance to existing vegetation, especially listed species
- Excessive vegetation regrowth
- Establishment of weed and invasive species

FLORA MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To minimise threat to native flora, particularly listed species, assemblages or ecosystems
2. To prevent the introduction or spread of pest species.
3. To prevent the introduction or spread of invasive weed species
4. To promote and maintain stable vegetation cover
5. To avoid loss of agricultural production or soil productivity
6. To minimise soil erosion and sedimentation

FLORA MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.		
Phase	**Activity**	**Management Measure**
Planning	Pipeline Easement Management and Access	• Use existing roads, tracks and areas of disturbance as the first option. New access tracks and roads should be designed and constructed to avoid or minimise impacts on flora.
	Clearing vegetation	• Pruning or removal of protected vegetation must only occur in accordance with the requirements of the relevant state legislation. • Necessary pruning / clearing approvals must be in place to the commencement of clearing activities. • Prior to clearing and subject to regulatory permitting and seasonality, a program of local native seed collection for use in rehabilitation of the RoW is strongly encouraged). • Prior to clearing and subject to regulatory permitting and seasonality, a program of translocation of vegetation potentially suitable for use in RoW rehabilitation should be considered. • Management of cleared vegetation shall be undertaken in a manner approved by the regulator and in accordance with land owners' requirements. • Clearing activities shall be scheduled so that the time between initial clearing and rehabilitation is minimal.
	Reinstatement and Rehabilitation	• Rehabilitation planning should be site- and/or property-specific, and undertaken in consultation with the regulator and the affected landowner. • Appropriate rehabilitation measures should be planned (e.g species selection, erosion/ sediment control devices, re-use of cleared / translocated species) to optimise potential for regrowth and stabilisation success. •
	Borrow Pits	• Proposed borrow pit sites shall be assessed for potential environmental impacts relative to flora, fauna, landform and heritage.
	Construction	• Vegetation clearance should be minimised as far as

	camps and worksites	practicable, with cleared vegetation being stockpiled separately if required for respreading during reinstatement. • Trees and tall shrubs should be retained on site, where practicable, and infrastructure arranged to avoid them, in accordance with AS 4970.
Construction	Pipeline Easement Management and Access	• Utilise provisions in Section 6.1. • Vehicle parking shall be restricted to the pipeline construction corridor, easement or other specifically designated areas agreed in advance with the landowner. • Parking under trees can damage their roots through soil compaction and can impair water infiltration into the soil, and should be discouraged. • Upon completion of pipeline construction, temporary access tracks shall be closed and rehabilitated to a condition compatible with the surrounding land use, and as pre-agreed with the affected landowner. • Pre-existing tracks used for access during construction shall be reinstated to their pre-construction condition, or as otherwise agreed with the relevant landowner.
	Clearing	• The removal or disturbance of vegetation outside the access tracks, agreed / approved additional work areas and pipeline RoW is not permitted unless additional regulatory and landowner approvals are obtained. • Avoid disturbing roots or compacting soil in the drip zone of vegetation to be retained. • A record should be maintained of vegetation cleared for the project (including for operations and maintenance) as part of the associated offsetting program, as appropriate. • Cleared vegetation shall be stockpiled separately in a manner which: o facilitates respreading or salvaging - refer to Section 6.13 Reinstatement and Rehabilitation o avoids damage to adjacent live vegetation

		(e.g. trees shall be felled onto the easement away from standing timber). • Cleared vegetation shall be stockpiled in windrows adjacent to temporary access, for respreading during reinstatement, or managed in accordance with measures detailed in Section 6.13 Reinstatement and Rehabilitation. • Cleared vegetation management options include (but are not limited to): ○ distribution over the pipeline construction area during rehabilitation to recycle nutrients and to provide surface protection from erosion or access barriers. ○ salvage in consultation with the relevant land management agency (e.g. timber, pulp wood or firewood) ○ stockpiling for use at other rehabilitation sites if suitable ○ retention on site as habitat.
	Reinstatement and Rehabilitation	• Rehabilitation should be monitored regularly with any maintenance being undertaken in accordance with Section 6.13 Reinstatement and Rehabilitation. • Flagging or marking tape used to identify sensitive environmental or cultural heritage features, shall be removed and correctly disposed of at the completion of construction. • A watering regime should be determined for newly reinstated areas, to facilitate optimum germination of seed stock in the absence of rain. • In sensitive areas, supplementary planting of native vegetation that is consistent with the surrounding vegetation class/regional ecosystem should be considered as a stabilisation measure and to facilitate rehabilitation. Seed collected off the RoW pre-clearing should be used in preference to imported seed. • Respreading stockpiled vegetation over the pipeline construction area and other disturbed areas enhances regeneration potential. • Consideration should be given on a site-specific basis

		to the use of mulch - which can improve soil nutrients; provide fauna habitat, improved soil structure and improved conservation of water; can, reduce erosion potential, trap water and seeds, provide weed control and reduce visual impacts. • Where seeding is adopted to facilitate prompt revegetation and soil stabilisation, the following principles shall be considered: o seed mixtures shall be formulated with consideration of the vegetation composition of the areas adjacent to the pipeline construction area o where approved, practicable and seasonal, native seed should be collected or sourced in the local area o sterile seed stock may be used in problem areas, to provide environmentally-acceptable, short term surface stability to stockpiles or areas that may be prone to erosion. o where applied, seed shall be evenly dispersed over the disturbed area o seeding shall take place as soon as practicable after reinstatement of the soil profile. Reapplication of seed may be required in some areas. o fertilisers and soil supplements may be necessary to aid germination, but shall only be applied with approval from regulators and in consultation with landowners, as their application could encourage faster-growing weed species.
	Watercourse Crossings	▪ At ecologically-sensitive watercourse crossings, mechanical slashers shall be considered for use in clearing activities, to retain as much ground cover and root stock as possible. ▪ Cleared vegetation shall be stockpiled away from watercourses and, wherever practicable, shall not be stored or felled so as to land in watercourses.
	Borrow Pits	▪ Where present, topsoil and vegetation shall be removed

		from the excavation site and stockpiled separately in an adjacent area (in accordance with Section 6.9 Borrow Pits) for use in rehabilitation. ▪ Borrow pit rehabilitation shall include: ▪ managing cleared vegetation in accordance with measures outlined in Section 6.13 Reinstatement and Rehabilitation. Respreading cleared vegetation over the site is the preferred option, particularly covering the pit slopes. ▪ implementing appropriate regeneration/revegetation measures in accordance with Section 6.13 Reinstatement and Rehabilitation, taking into consideration site specific characteristics which may affect regrowth and stabilisation success. Seeding and the use of geotextile materials may be appropriate ▪ reinstatement of access tracks in accordance with the guidelines in Section 6.1 Access to Site.
Operation	Pipeline Easement Management and Access	• Regrowth vegetation on the pipeline easement shall be maintained to ensure root systems do not create a safety risk to the pipeline[5] . The width of vegetation removal for easement maintenance purposes (i.e. the distance cleared on either side of the pipeline centreline) should be the minimum extent reasonably necessary to ensure the access to the RoW and safe operation of the pipeline. • If erosion is occurring due to inadequate vegetation cover on the easement, consideration should be given to promoting additional growth or installing erosion control structures. Such work should be conducted with prior consultation with the landowner. • When undertaking vegetation maintenance, maximum heights for vegetation along the easement should be determined by considering requirements for line-of-sight and access. Vegetation type, land use sensitivity and topography should also be taken into consideration. Minimum ground clearance for most equipment used for maintenance is usually between 150 and 300mm.

[5] Also refer to *Australian Standard AS2885.3*

	Watercourse Crossings	• A buffer of riparian vegetation should be maintained for watercourses. If regrowth trees within this buffer require removal, it should be done using hand-held equipment.
	Reinstatement and Rehabilitation	• Where appropriate, trees may be permitted to regrow on the pipeline construction area outside the pre-determined buffer zone of the pipeline. Each pipeline operator should determine its own requirements and it is common for various segments of the same pipeline to have different buffer zone widths. • The following guideline for zone widths should be considered: **Clearance Zone –** strip of land 3m wide located directly above centreline of pipe **Zone A -** strip of land no closer than 1.5m from centreline of pipe – perennials and annuals only. **Zone B -** strip of land no closer than 3m from centreline of pipe and suitable for small woody shrubs **Zone C** - strip of land no closer than 5m from centreline of pipe and suitable for woody shrubs and small trees. • Where necessary and practicable, rehabilitated areas may need to be fenced in order to prevent access until site stability is established. • In consultation with the landowner, third party, stock and wildlife access to newly-reinstated areas should be excluded where possible, until there is sufficient establishment of seed and plant stock. • As a general consideration, areas that have been recently rehabilitated should be avoided by ground, vehicular or machinery movement for a long as possible.
Related Sections Fauna Management Drainage, Erosion and Sedimentation Management Biosecurity Management Environmental Offsets		

9.2 FAUNA MANAGEMENT

Australia is home to a unique and diverse range of terrestrial and aquatic fauna species. Pipeline construction has the potential to significantly impact on individuals, species and communities.

An essential part of the environmental assessment process is gaining a detailed understating of fauna species and communities affected by a pipeline project, as proponents will be required to work within the regulatory frameworks listed in Section 2 to protect fauna values.

The following tasks may be undertaken to provide adequate fauna management:

- Review of available literature and databases to determine the likely presence/absence of species – especially listed fauna species
- Field investigations to confirm presence / absence of species in the project area
- Impact assessment to determine the likely effects of the project on terrestrial and aquatic fauna
- Development and implementation of appropriate management and impact mitigation measures, including those listed in this section.

Successful planning and implementation of appropriate fauna impact management controls is essential to limit potential impacts during the construction and operational phases of a pipeline.

FAUNA MANAGEMENT– KEY ENVIRONMENTAL ISSUES
▪ Removal of key habitat such as mature trees, hollow-bearing trees and fallen trees which are used for nesting, shelter and foraging ▪ Fragmentation of habitat ▪ Disturbance to fauna movement corridors ▪ Introduction of invasive species that can destroy natural fauna habitat or displace natural food plants ▪ Impacts of noise and increased human activity on natural behaviour ▪ Potential for fauna to become trapped in the open trench ▪ Increased bushfire threat during construction

FAUNA MANAGEMENT– ENVIRONMENTAL OBJECTIVES
1. To minimise impacts on native fauna, particularly listed species, or their habitat
2. To prevent the spread or transfer of pest or weed species.

FAUNA MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Pipeline Easement Management and Access	• Use of existing roads, tracks and areas of disturbance wherever feasible. New access tracks and roads should be designed and constructed to avoid or minimise impacts on fauna or their habitat. • Wherever possible, construction planning shall consider opportunities to time activities in a way that minimises impact on sensitive fauna lifecycle periods (e.g. breeding, nesting, migration).
	Clearing	• Careful planning of RoW location and clearing can minimise some wildlife habitat fragmentation effects – for example, by maintaining tree canopy connectivity where practicable, particularly at watercourses and roadside remnants. •
	Hydrostatic Testing	• Measures which minimise potential impacts on aquatic fauna shall be adopted, such as avoiding significant aquatic habitat areas, maintaining adequate flow rates and water levels or the use of alternative water resources. • Proponents should not plan to dispose of hydrotest media to waterways, unless the media can be suitably treated and the regulator indicates such disposal can be acceptable. • Planning is also required to ensure that the hydrotest process does not transfer pest species of fish or other aquatic fauna from one catchment to another.
	Borrow Pits	• Proposed borrow pit sites shall be assessed for potential environmental impacts to fauna and their habitat.
	Watercourse Crossings	• Where practicable, trenched watercourse crossings shall be scheduled during dry or low flow periods and shall avoid periods of fauna sensitivity (e.g fish migration periods). • Consideration should also be given to potential

		effects from upstream works on downstream estuarine / tidal waters.
	Reinstatement and Rehabilitation	• Site-specific or property-specific rehabilitation plans may be necessary, depending upon site conditions or legal requirements (e.g. problematic soils, significant habitat or species and regulatory permit conditions, easement negotiations). These plans should include discussion of the proposed inspection regime and anticipated ongoing maintenance measures, particularly as these apply to fauna impact management.
Construction	Clearing	• Fauna spotter/catchers should be on site during clearing to advise on clearing techniques that will minimise fauna impact and to undertake fauna handling, if required. • Records of all fauna interactions should be created, listing the species concerned, the nature of the interaction and its GPS coordinates. • Cleared vegetation shall be stockpiled separately in a manner which does not impede stock or wildlife. • Prior to clearing, habitat trees/hollows and habitat for other conservation significant species should be identified and flagged, with a view to re-using such trees/hollows/habitat as part of RoW reinstatement. • Consideration shall be given to the control of feral animal movements along newly cleared corridors that facilitate movement or provide new access to sensitive environments.
	Pipe Stringing and Welding	• Individual pipes and joined pipe sections (pipe strings) shall not impede vehicle, stock or wildlife passage. Gaps which coincide with gaps in the topsoil and vegetation stockpiles, with crossing points for designated access tracks/roads and fence lines shall be left in the strings, with their location, and the location of any additional gaps needed for site or emergency access, shall be located in consultation with relevant landowners. • Welded pipe sections should have temporary end caps installed when the site is not attended, to prevent ingress of fauna.

	Trenching	▪ Measures shall be adopted to prevent fauna entrapment within the pipeline trench, such as: ▪ minimising the period of time the trench is open, particularly in fauna habitat areas ▪ constructing trench plugs with slopes less than 45^{o} to provide exit ramps for fauna ▪ installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas) ▪ use of branches, ropes, hessian sacks, ramped gangplanks or similar to create 'ladders' to enable fauna to exit the trench ▪ engagement of appropriately-certified personnel to undertake monitoring of the open trench and remove trapped fauna as required.
	Blasting	• In addition to standard regulatory requirements, blasting in ecologically-sensitive areas shall incorporate appropriate precautions to protect ecological resources. For example, ○ where possible, blasting should be scheduled to avoid sensitive lifecycle periods of fauna species (e.g. breeding, nesting, migration). ○ Smaller and/or staggered charges shall be used where practicable. • Rock that is not required for other purposes may be retrieved and used for wildlife habitat creation where possible
	Pipe laying and Backfilling	▪ A suitably accredited fauna spotter/catcher should survey the trench prior to the commencement of pipe laying and backfill activities and relocate any trapped fauna as required.
	Reinstatement and Rehabilitation	▪ Native groundcover consistent with adjacent vegetation shall be encouraged to regenerate over the entire pipeline construction area, particularly in sensitive areas, to minimise negative habitat barrier effects. ▪ Where appropriate, habitat structural elements, such as timber and rocks, shall be replaced on the pipeline construction area. ▪ Respreading stockpiled vegetation, either whole or mulched, can provide valuable fauna habitat.

		▪ On private land, the reinstatement plan should be agreed with each landowner and tailored to the specific challenges and opportunities of that property.
Operation	Pipeline Easement Management and Access	▪ The corporate body of knowledge about a particular pipeline should include awareness of the types of fauna found on or adjacent to the pipeline easement and of the possibility that other fauna, especially listed fauna, might also be present from time to time. ▪ Fauna habitat should be considered when planning for easement management, especially for general mowing, slashing or line of sight maintenance activities, with any valuable habitat to be managed in accordance with licence conditions or the approved maintenance plan / arrangements. ▪ A fauna survey should be undertaken when proposing to undertake maintenance excavations in sensitive areas or in areas containing potential habitat values. ▪ Consideration shall be given to the control of feral animal movements along pipeline easement corridors that provide access to sensitive environments.
	Reinstatement and Rehabilitation	▪ Where appropriate, native groundcover and shrubs shall be encouraged to regenerate over the entire pipeline construction area, in order to minimise negative habitat barrier effects. ▪ If vegetation has remained in a stockpiled state at the side of the RoW for a lengthy duration, suitably qualified fauna spotter/catchers should catch and relocate fauna from it, prior to re-spreading.
Related Sections Flora Management Biosecurity Management		

9.3 BIOSECURITY MANAGEMENT

Biosecurity is defined as the protection of environment, economy and public health from negative impacts associated with pest, diseases and weeds. Several biosecurity issues are prevalent throughout Australia and control and eradication is expensive and timely (or in some cases can be practically impossible). Known major biosecurity issues include footrot, Bovine or Ovine Johne's Disease, Q-Fever, Phylloxera, dieback/Phytophthora, Mundulla Yellows, Red Imported Fire Ant, Myrtle Rust and Equine Influenza[6] and there are numerous lesser biosecurity issues that can be important at a local level – such as importing weed seed, moulds or rusts into a high value agricultural cropping area or area of remnant native vegetation, etc.

Each State and Territory has specific legislation which assigns responsibility for the prevention and control of the spread of pests, diseases and weeds to those individuals and organisations whose activities could result in biosecurity impacts.

Pipeline construction and operation have the potential to facilitate the spread of pest, diseases and weeds through the movement of vehicles, equipment and personnel, and the transportation of contaminated materials, plant or equipment. This section presents guidelines for the prevention and control of the spread of pest, diseases and weeds during the construction and operational life of a pipeline.

9.3.1 WEED MANAGEMENT

Noxious or declared weeds can be a significant problem in Australia in terms of agriculture and the conservation of native flora and fauna. Management of declared and noxious weed species in each State and Territory is controlled under specific legislation which assigns responsibility for the prevention and control of the spread of pests, diseases and weeds to those individuals and organisations whose activities could result in biosecurity impacts. Numerous noxious or declared weed species are known to exist in Australia, all of which are classified according to their potential threat to agriculture and/or the environment.

A declared or noxious weed is defined as a plant that has, or has the potential to have, a detrimental effect on economic, social or conservation values. Environmental weeds are generally considered to be plants that invade areas of native vegetation, usually adversely affecting the regeneration and survival of native flora and fauna, while agricultural weeds have the potential to result in financial impacts to the landowner.

Apart from the clear potential impact to stakeholders from poor biosecurity by the proponent during construction, both environmental and agricultural proclaimed noxious weeds can cause issues during operations, for pipeline licence holders, even if their own easement is correctly managed for weeds, by accessing the easement from infestations located off easement in the surrounding area.

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[7] State or Local government requirements, such as the Qld EPA, may also apply

There are many weeds that are not declared or noxious, and an understanding of these species, many of which are pioneers in disturbed ground, can be beneficial, as if appropriately managed, they can provide stability to disturbed ground, rapidly stabilise watercourse banks, and can aid with erosion and sediment control.

All deliberate use of weeds for environmental purposes should only be undertaken in consultation with the affected landowner and regulatory authorities. Following construction, the cleared pipeline easement can be subjected to invasion of weed species due to:

- disturbance of topsoil/ surfacing of pre-existing seed stock
- greater pioneering capability for weeds than for native vegetation
- removal of vegetation competition
- creation of favourable conditions such as increased water and light
- redistribution of propagative material
- introduction of weeds from outside the easement.

Appropriately-trained personnel are required to identify potential weed problems and to develop suitable control procedures. A specific control program may be required for some particularly invasive or undesirable weed species. The control program will be required to meet the requirements of relevant local or state authorities and should be developed and implemented in consultation with the relevant landowners. Note that, in some areas with a high level of weed invasion, it may be impractical to maintain a weed-free pipeline easement, and in such areas, pipeline surveillance should monitor the density and abundance of weeds and schedule weed control as required.

Construction activities may provide conditions for weeds to invade, as certain opportunistic weed species thrive in disturbed soils. This is compounded by the longevity of seed viability of many weed species, which can remain dormant in soil for many years until the soil is disturbed. The construction of a linear pipeline development presents the potential risk of spreading weeds significant distances along the easement as construction progresses if unmanaged, as does any subsequent maintenance or on-ground surveillance activity during the operation of the pipeline. This section presents guidelines for the prevention and control of the spread of noxious weeds during each phase of a pipeline life cycle.

WEED MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Spread of noxious weed species
- Potential for unsustainable rehabilitation
- Competition from weed species and loss of agricultural land use and native flora
- Reduced primary industry productivity and produce quality
- Reduction in diversity of native species
- Impacts to sensitive environments adjacent to weed infected areas

- Loss of visual amenity

WEED MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To minimise the introduction and/or spread of weeds
2. To promptly identify weed species and habitats likely for each species to occur in, and adopt specific weed control procedures
3. To eliminate infestations of noxious weed species
4. To effectively control weed species
5. To avoid impacts to primary industries
6. To avoid impacts to flora and fauna

WEED MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Weed Control	• An appropriately detailed weed control program should be incorporated into the CEMP and/or OEMP. • The weed control program should include adoption of a weed hygiene procedure for known areas of weed infestation. • The weed control program should be developed in consultation with local authorities. Where relevant, the program should utilise existing weed datasets and landowner input into the presence and location of weeds. • An inventory of noxious or declared weed species occurring along the easement shall be compiled and appropriate weed control procedures shall be developed, • Weed management goals and desired outcomes should be established, based on regulatory pest plant control guidelines, regional weed control programs, an assessment of weed risk and consultation with landowners. • Consultation should be conducted with relevant landowners and regulatory authorities regarding

		any special management measures required for an area or property such as weed management provisions, quarantine provisions, certified area provisions (e.g. organic,). • Arrangements should be developed to ensure project and contractor staff are inducted into weed control issues and solutions, and appraised of relevant project commitments and their responsibilities in fulfilling these.
	Pipeline Easement Management and Access	• Existing roads, tracks and areas of disturbance should be used wherever practicable. New access tracks and roads should be designed and constructed to avoid or minimise impacts on areas of serious weed infestations. Access to the pipeline easement shall be managed to minimise potential weed impacts.
	Reinstatement and Rehabilitation	• Rehabilitation procedures shall include provision for weed management where required – refer to Section 6.13 Rehabilitation and Reinstatement
	Watercourse Crossings	• Construction machinery shall be weed free prior to entering a flowing watercourse, or starting construction of a watercourse crossing.
Construction	Construction Operations	• All machinery, equipment and vehicles brought to site should be free of any soil, seed or plant material. All soil and organic matter should be removed, including under the vehicle and in the cabin or load trays. • All machinery, equipment and vehicles brought to site should be inspected upon entry, and either admitted or refused entry on the basis of presence / absence of soil seed or plant material. Records of inspection shall be maintained. • Major construction operations should include vehicle washdown bays at the site entry point(s), for use by machinery entering or leaving the site • All machinery, equipment and vehicles should be free of any soil, seed or plant material prior to being floated from one project work area to another. Records or movement between sites shall be maintained. • Evidence of compliance with hygiene requirements

		should be documented, e.g. on a Vehicle Wash down Register.
		• Appropriate weed control measures applied prior to and during construction include:
		  ○ consideration of engagement of a licensed and suitably qualified or experienced weed control sub-contractor
		  ○ ensuring weeds have been effectively controlled in work areas prior to commencing construction
		  ○ ensuring construction crews involved in clear and grade and reinstatement are trained in the recognition and dispersal methods of weeds
		  ○ applying weed hygiene measures, such as spraying with non-residual herbicide, use of wash down or blow down bays, in areas of significant noxious weed infestation (note that weed wash down wastewater or sediment may require treatment by physical or chemical means to ensure weeds do not occur at discharge locations)
		  ○ adoption of weed hygiene for all vehicles, equipment and portable infrastructure.
		  ○ restricting access of vehicles and personnel to areas of known noxious weed infestation. Vehicles exiting such areas may need to be re-cleaned.
		  ○ ensuring imported construction materials are sourced from clean locations and meet applicable Australian Standards .
		• Transportation of topsoil along the pipeline corridor should be avoided where practicable.
		• Where demountable buildings are used on the pipeline easement or work site, the floors will be cleaned regularly, by brushing/washing, to good hygiene practices.

	Pipeline Easement Management and Access	• Appropriate weed biosecurity measures shall be applied as necessary. • Frequent access to the pipeline easement may

		increase the risk of weed introduction and establishment. In areas where vehicular movement is so frequent that processes such as wash down are deemed impractical, other suitable controls should be considered (such as drive-through herbicide bays, limiting washdown to first visit or to plant arriving from specific known weed areas, etc). • The presence of noxious weeds should be reported to affected landowners and local authorities, and the control of significant species should be conducted in conjunction with affected landowners and local authorities.
	Fuel and Chemical Management	• Weed control activities involving the use of chemicals shall be undertaken in consultation with the relevant landowners and regulatory authorities, giving due consideration to sensitive land uses (e.g. chemical free, organic and biodynamic farming, run off potential, wind drift and flora and fauna sensitivities).
Operation	Pipeline Easement Management and Access	• Patrol officers should be trained in the identification of all weed species likely to be encountered, particularly declared noxious and environmental weed species, and in techniques for their eradication. • Inspection of the pipeline easement should include an assessment of weed impacts. If significant infestations are found, aspects noted should include: o weed species that are present (noxious weeds should be noted as such) o estimated coverage of total area o possible reasons for infestation o suggested management measure(s). • All maintenance inspections should include notes on weeds encountered and actions taken / recommended
	General activities	• In identified weed infestation areas, all vehicles and machinery entering or exiting the pipeline easement or other work sites shall comply with weed biosecurity requirements. All soil and organic matter should be removed, including under the

		vehicle and in the cabin or load trays. • Evidence of compliance with weed biosecurity requirements should be documented, e.g. on a Vehicle Wash down Register. • Maintenance crews should be made aware of weed control requirements and their compliance with biosecurity requirements monitored as appropriate. • Where appropriate, the ground surface of facilities will be gravelled to reduce the potential for weed infestation.
Related Sections Flora Management Biosecurity Management		

9.3.2 PEST AND PATHOGEN MANAGEMENT

PEST AND PATHOGENMANAGEMENT – KEY ENVIRONMENTAL ISSUES
▪ Reduction in agricultural productivity ▪ Adverse effects on the health of livestock or other fauna ▪ Damage to or loss of native vegetation ▪ Loss of biodiversity ▪ Poor regeneration ▪ Impaired visual amenity
PEST AND PATHOGEN MANAGEMENT – ENVIRONMENTAL OBJECTIVES
1. To prevent the spread of pests, diseases and pathogens as far as is reasonably practical. 2. To prevent the introduction of pests, diseases and pathogens into new areas. 3. To avoid impacts on primary industry, affected landowners and the environment.

PEST AND PATHOGEN MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Pipeline Easement Management and Access	• Information on pest and disease should be obtained from the relevant regulatory agencies and local landowners, and the relevant hygiene requirements and access restrictions conveyed to personnel. • An appropriately detailed pest and disease control program should be incorporated into the pipeline CEMP and OEMP. This should outline known locations, site specific management measures that should be applied when working in (or in proximity to) infected areas and additional provisions on precautionary pest and disease management and control measures that will be applied throughout the remainder of the easement. • Consultation with relevant landowners and regulatory authorities regarding any special management measures required for a specific area or property - such as pest and disease management provisions, quarantine provisions, certified area provisions (e.g. organic properties). • New access tracks and roads should be designed and constructed to avoid or minimise contact with areas of known infestations or high risk potential (such as major flying fox camps, landfills, etc). Quarantined areas or areas of high risk on the pipeline corridor requiring special hygiene management should be identified, or alternatively in potentially affected areas, the entire pipeline corridor should be considered at risk and managed accordingly. • Pest and/or disease infected areas on the pipeline corridor requiring special hygiene management should be identified and avoided if possible. • Location of demountable buildings and other work areas shall avoid areas of known infestation where possible.

		• Consider, as required, the engagement of a suitably qualified or experienced pest and disease professional (integrated pest management) sub-contractor. • All activities within areas of potential disease or pathogen high risk should be monitored in accordance with a management program designed to detect pest or disease occurrence and respond appropriately.
Construction and Operation	All ground disturbance activities	• Personnel should be trained adequately in vehicle and machinery hygiene management. • Machinery and vehicles should be cleaned prior to exiting high risk areas. The method of cleaning is dependent upon the type of pest or pathogen, government agency hygiene requirements, remoteness of the area and cleaning agent (usually water) availability. Types of cleaning include wash down with high-pressure water containing disinfectant or application of other cleaning solutions and should remove all soil and vegetative material from the interior and exterior of machinery and vehicles, and from equipment and boots. • Hygiene points should be located close to infected/infested areas along the pipeline corridor to reduce the risk of spreading infected/infested material. • In areas of confirmed infection/infestation, stringent wash down must be completed before leaving the area, removing all soil and vegetative material from cabins, trays, and undercarriages. This may include removal by physical, mechanical or chemical means. Records of treatment methods and the date/time of application should be maintained. • Facilities should be provided for site workers to decontaminate their footwear prior to moving out of infected/infested areas. • Evidence of compliance with hygiene requirements should be documented, such as on a Machinery/ Vehicle Wash down Register.
	Hydrostatic Testing	• To eliminate the potential spread of weed, pest, and disease, water used for hydrostatic testing shall be free of any known pathogens, weed seeds etc.

	Pipeline Easement Management and Access	• Transportation of topsoil or subsoil along the pipeline easement should be limited to the extent of the landform / soil type, and generally restricted to local movements only, with particular care to be taken when working in or near high risk areas. • Appropriate and applicable pathogen hygiene measures shall be applied in problem areas to prevent spreading. • Vehicles and machinery should be prevented from carrying any soil or vegetative matter out of the area. • All activities within areas of potential disease or pathogen high risk should be monitored in accordance with an approved biosecurity management program.
Related Sections Flora Management Fauna Management Biosecurity Management Traffic Management Waste Management		

9.4 HERITAGE MANAGEMENT– NATURAL AND BUILT ENVIRONMENTS

Significant heritage features of natural or anthropological origin are protected by a range of Commonwealth, State and local laws. For the purpose of this Code natural and built heritage includes:

- natural features or places which are considered to possess significant value, such as fossils, unique landforms, significant flora and fauna; and
- features or places possessing significant European historical values such as buildings, infrastructure and commemorative locations.

During the impact assessment stage, ecological and cultural and historical heritage surveys are necessary along the proposed pipeline corridor to identify areas of potential heritage impact. Where significant heritage features are identified, a range of management options which aim to avoid and minimise impacts may be implemented during the pipeline planning and

construction phases. These may include pipeline route re-alignment around a feature, excavation and salvage of heritage artefacts, or site-specific measures which permit the pipeline to be placed in close proximity to heritage sites while avoiding direct disturbance. In achieving the latter, heritage sites may require fencing and/or flagging of the features to be avoided. It should also be noted that cultural heritage training for construction personnel is a useful tool to increase knowledge, awareness and respect for historic artefacts and sites.

Flagging will be used to identify sensitive 'no go' areas and features of heritage significance, both natural and built environments. Features marked in this manner shall not be disturbed unless authorised by relevant regulatory authorities and, in the case of indigenous community heritage sites, authorised representatives of the relevant community. Flagging or marker tape used to identify sites shall be in a standardised colour and consistently applied throughout the project. Instruction on flagging or marker tape importance and colouring shall be included in project Inductions. Flagging shall be removed at the completion of construction to avoid drawing attention to sites.

During construction, there is potential for construction activities, such as earthmoving to uncover previously unrecorded heritage sites. In the event that this occurs, procedures in compliance with any applicable regulatory requirements and agreed to by all relevant stakeholders shall be followed.

Heritage sites are of cultural value to the community and are protected by law. Such sites may comprise areas or items of archaeological, anthropological, ethnological, environmental or scientific significance. Most impacts occur during construction, but while it is unlikely that damage to heritage sites will result from pipeline operations, undisturbed sites on the easement or within proximity to the easement must be afforded continued protection.

Appropriate approvals must be obtained prior to any activity that will disturb or destroy a heritage site or item. The operations workforce should be made aware of the location and value of known sites in order to ensure that they are avoided, and of the procedures to be applied if any new sites or objects are encountered (for example, if floods uncover previously unrecorded items).

	HERITAGE MANAGEMENT– KEY ISSUES
	▪ Locating items of heritage value ▪ Damage to heritage objects ▪ Determining the heritage significance of items encountered
	HERITAGE MANAGEMENT –OBJECTIVES
	1. To protect and preserve heritage value 2. To mitigate and manage the impacts of pipeline projects on heritage items and areas – by creating awareness of heritage items in the project workforce and by effective engagement with relevant

	stakeholders

HERITAGE MANAGEMENT MEASURES

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Pipeline Easement Management and Access	• Heritage sites should be identified prior to pipeline construction with appropriate input from the heritage stakeholders. • Identified sites should be assessed to gain a measure of their significance, location and management measures for each site, and this information entered onto a database which shall be available to patrol officers and environmental advisers and auditors during operations. • Identified heritage sites that are on the preliminary alignment should be avoided by re-alignment of the pipeline corridor where possible. New access tracks and any other associated facilities should also avoid identified sites. • A program shall be developed and implemented to facilitate effective consultation with heritage and interested community groups, regulatory authorities and other relevant stakeholders where impacts on heritage items or areas are anticipated.
	Clearing	• In the case of protected or retained vegetation within the pipeline construction area, where there is significant natural, heritage or visual amenity values to protect, the vegetation shall be marked with flagging or marker tape to indicate that it should be avoided. Marker paint shall **not** be used.
	Borrow Pits	▪ Proposed borrow pit sites shall be assessed for potential impacts relative to flora, fauna, landform and heritage. ▪ Borrow pits shall avoid known sites of natural, scientific, or heritage significance.

Construction/ Operation	Pipeline Easement Management and Access	• A database of heritage sites on or in close proximity to the pipeline corridor should be maintained during construction and operation.
		• Sites that are within or immediately adjacent to the easement should be given adequate physical protection. Such measures include:
		  ○ installing flagging or barriers
		  ○ installing appropriate signs
		  ○ inclusion in project inductions.
		• Physical protection measures shall be adequately maintained.
		• Patrol officers should be adequately trained in heritage and cultural issues and management.
		• Patrol officers will record any disturbance to heritage sites. Actions to address site disturbance shall be taken in consultation with regulatory authorities and the relevant stakeholders, as necessary.
		• Where appropriate, patrol officers shall monitor any work activities on the easement.
		• All operations activities must comply with the permit and reporting requirements under relevant State and Commonwealth heritage legislation

Related Sections Grading Clearing Aboriginal Cultural Heritage Management		

9.5 ABORIGINAL CULTURAL HERITAGE MANAGEMENT

Aboriginal and Torres Strait Islander heritage is an important part of Australia's history and heritage, with evidence of the occupation of Australia by Aboriginal and Torres Strait Islander people dating back more than 60,000 years.

Aboriginal cultural heritage consists of places and items that are of significance to Aboriginal people's traditions, observances, lore, customs, beliefs and history. It provides evidence of the lives and existence of Aboriginal people from before European settlement through to the present day.

Heritage items include both physical and non-physical elements. Physical items include things created by traditional societies, such as stone tools, grinding grooves, culturally-modified trees, art sites and ceremonial or burial grounds. Aboriginal cultural heritage also relates to the connection and sense of belonging that people have with the landscape and with each other. Non-physical heritage includes peoples' memories, story-lines, ceremonies, language and 'ways of doing things' that continue to enrich local knowledge about the cultural landscape and facilitate local Aboriginal people's connection with the land.

Culturally-modified tree

CNC Project Management

Ground edge axe - CNC Project Management

Australia's state and territory governments have broad responsibilities for recognising and protecting Australia's Indigenous heritage, including archaeological sites. This body of legislation acts to ensure cultural heritage is conserved - by ensuring acts that might affect it are controlled and can only be undertaken under permit or through application of some other approved impact management mechanism.

The majority of states and territories maintain registers of indigenous heritage sites. The relevant contents of registers should be reviewed during the planning phase of all projects with the potential to interfere with places and objects of heritage value, however proponents should be aware that the registers may not be comprehensive, or may contain information that is not published. For these reasons it is advised that contact is made directly with the relevant state or territory government agency.

Consultation

Aboriginal community consultation is an integral part of the assessment of Aboriginal cultural heritage significance, as aboriginal stakeholders should be considered the primary source of information about their cultural heritage and how it is best protected and conserved. Consultation should be carried out in line with the relevant state or territory best practice guideline. The aims of the consultation process are as follows:

- To identify Aboriginal community groups and individuals with an interest in being involved in the ongoing consultation process;
- To provide representatives of the Aboriginal community with the opportunity to participate in the field assessment process and to inspect and comment on the Aboriginal sites and values of the study area;
- To encourage all Aboriginal stakeholders to participate in the cultural heritage assessment process through provision of knowledge that will ensure that sites are avoided, protected and any potential damage mitigated;
- To identify the Aboriginal cultural heritage values of the study area;
- To provide an opportunity for the registered stakeholders to comment on the outcomes and recommendations of heritage assessment and reporting; and,
- To integrate Aboriginal heritage values and recommendations into project construction and operational procedures (CEMP and OEMP).

Pipeline proponents should be aware that their initiation of consultation over cultural heritage, especially if the Aboriginal group approached has no prior experience in such consultation, may give rise to complex reactions within the Aboriginal stakeholder group, as the enquiry acts as a catalyst for important internal discussions on locations, kinship, information availability, custodial responsibility and so forth, to take place. For this reason, proponents should approach initial cultural heritage discussion with an open mind and a sympathetic approach, should be prepared to resource complex internal consultation processes and should resist placing strict time constraints on the required outcomes.

ABORIGINAL CULTURAL HERITAGE – KEY ISSUES
▪ Locating items of aboriginal heritage ▪ Damage to aboriginal objects ▪ Consultation with aboriginal stakeholder groups ▪ Determining the aboriginal heritage significance of items

ABORIGINAL CULTURAL HERITAGE –OBJECTIVES

1. To protect and preserve aboriginal cultural heritage
2. To mitigate and manage the impacts of pipeline projects on heritage items and areas
3. To create awareness of aboriginal cultural heritage
4. To engage with aboriginal stakeholders

ABORIGINAL CULTURAL HERITAGE MANAGEMENT MEASURES

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Early consultation with relevant state or territory department and aboriginal stakeholders. • The relevant state / territory database of registered cultural heritage sites should be consulted prior to pipeline construction by suitably qualified persons with appropriate input from indigenous communities. • Any activity that is likely to have a significant impact to an area of cultural heritage sensitivity requires survey by a qualified archaeologist accompanied by members of the appropriate Aboriginal representatives. • Following survey, a Cultural Heritage Management Plan (CHMP) or equivalent shall be produced. The CHMP will identify all proposed areas of impact and contain recommendations for impact avoidance and minimisation on sites that have been identified within the survey area. The CHMP also contains provision for cultural heritage monitoring during ground disturbance activities and procedures to be applied should additional cultural heritage items be uncovered during construction.

	Clearing	• Where a registered site exists on, or immediately adjacent to the pipeline corridor, flagging or marker tape should be used to protect the site. • Clearing personnel should be inducted into the locations of known cultural heritage, of applicable marking and delineation procedures and of reporting requirements in the event that known cultural heritage sites are impacted during clearing operations.
	Borrow Pits	▪ Proposed borrow pit sites shall be included as part of the CHMP assessment. ▪ Borrow pits should avoid known or identified sites of natural, scientific, or heritage significance.
Construction/ Operation	Pipeline Easement Management and Access	• A register of cultural heritage sites and their location should be maintained during construction and operation. • All management measures in relation to registered sites should be undertaken in accordance with the recommendations contained within the CHMP. • Sites that are within or adjacent to the easement should be given adequate physical protection in accordance with the CHMP. Such measures include: o installing barriers such as flagging or fencing o installing appropriate signs o designating land zones within and adjacent to RoW. • All cultural heritage monitoring requirements should be outlined in the CHMP or will be subject to agreements with relevant cultural heritage groups. • Regular pre-start toolbox meetings should contain an appropriate level of cultural heritage guidance during ground disturbance activities in areas of sensitivity where appropriate. • Physical protection measures shall be adequately maintained.

		• On the discovery of physical remains or other suspected cultural heritage material, work should stop and procedures within the Cultural Heritage Management Plan should be followed. • Project maintenance patrol officers must be adequately trained in heritage and cultural issues and management and must be familiar with the cultural heritage register, its contents and the conservation requirements for registered cultural heritage. • All operations activities must comply with the permit and reporting requirements under the relevant State and Commonwealth legislation. • Patrol officers will record any disturbance to heritage sites. Actions to address site disturbance shall be taken in consultation with regulatory authorities and local community groups, as necessary. • Where appropriate, patrol officers shall monitor any work activities on the easement.
	Construction Camps and Worksites	▪ For cultural heritage purposes, construction camps and worksites are subject to the same CHMP requirements as activities along the construction RoW.
Related Sections Clearing Grading Heritage Management – Natural and Built Environments		

9.6 SOIL MANAGEMENT

Soil management is one of the most critical aspects of good environmental management on pipelines. Effective management of different soil horizons and soil types can lead to maintenance of control on sediment and erosion during ground disturbance activities and can significantly contribute to positive rehabilitation outcomes.

During pipeline construction, a wide variety of soils may be encountered, and some of their characteristics can be problematic during construction and rehabilitation of the pipeline - and can have ongoing effects on landform stability and pipeline integrity. This section outlines some of the standard principles of effective soil management that should be applied across all pipeline activities. It also expands on effective management measures for some specific soil types that require more defined management when encountered, including the following soil types:

- Highly erosive soils
- Acid sulfate soils
- High shrink/swell soils
- Salty soils
- Soils in dry/desert environments
- Wetland soils
- Soils with pH extremes
- Shallow/rocky soils

9.6.1 GENERAL SOIL MANAGEMENT

	GENERAL SOIL MANAGEMENT – KEY ENVIRONMENTAL ISSUES
	▪ Soil erosion ▪ Sediment release to land and water ▪ Damage to native vegetation and wildlife ▪ Damage to agricultural production and other land uses ▪ Subsidence of pipeline trench.
	GENERAL SOIL MANAGEMENT – ENVIRONMENTAL OBJECTIVES
	1. To minimise the potential for soil erosion 2. To adequately prevent or control sediment release to land and water 3. To avoid unacceptable damage to native vegetation or wildlife habitats 4. To prevent damage to agricultural production or other legitimate

land uses

5. To minimise the risk of buried pipe exposure
6. To adequately control subsidence of the pipeline trench

GENERAL SOIL MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Pipeline Easement Management and Access	• Prepare soil management plan using available soil mapping. Soil management plan should identify the soil types anticipated along the pipeline corridor, their associated potential impacts and recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes. • Potential impacts associated with soil and ground stability should be monitored as part of a structured inspection and monitoring program. • Where there is a potential for land degradation, access along the easement during wet weather should only be undertaken in consultation with the relevant landowner. Similarly, where access along private roads may lead to road degradation but is required for maintenance purposes, it should only be undertaken in consultation with the relevant landowner. • Vehicle access should be restricted to stable ground where practicable. Additional care should be taken near watercourses and drainage lines. • Prior to construction, means of disposal of any excess soil should be identified.
	Clearing	• Clearing activities shall be scheduled to minimise the time between initial clearing and rehabilitation.
	Grading	• Prior to grading, the appropriate soils management procedures (i.e. width and depth of topsoil stripping, location and management of stockpiles) should be determined by a qualified soil scientist or experienced land manager.
	Reinstatement and	• Any imported material required for rehabilitation works should be obtained with landowner approval. If

	Rehabilitation	the regulator permits soil to be brought in for rehabilitation works, it should preferably be sourced locally and be free of weeds and other contaminants.
	Construction Camps and Worksites	• New sites shall be located at existing clearings or disturbed areas where practicable, and on well drained land with suitable access in all weather conditions. • New sites shall be designed to minimise the area of disturbance. • Topsoil cleared from any site shall be retained and conserved and used in rehabilitation upon completion of the work.
Construction	Pipeline Easement Management and Access	• During earthworks, topsoil should be stockpiled locally, separately from subsoil, and respread over the disturbed area at completion of works in order to aid rehabilitation. • Subsoil displaced by the pipe and not required for trench backfill, may be stockpiled in locations approved by landowners and regulatory authorities. • Where required and approved by the regulator and the landowner, any topsoil imported to the site shall be of an appropriate quality and weed free. • Topsoil will be required to cover subsoil used for easement repairs. • Stability of the pipeline easement and, in particular, the condition of watercourse bed, banks and riparian vegetation should be determined regularly, but particularly following a significant rainfall event.
	Grading	• As part of the initial preparations of site access, topsoil shall be removed, and either stockpiled in windrows adjacent to temporary access for respreading during reinstatement, or stockpiled for use at other locations if the access is to remain permanently. • Soil and surface stability shall be maintained at all times, e.g. cut and fill excavation shall be shaped to maintain slope stability and will employ temporary erosion control berms. Overall, drains and sediment barriers shall be installed as necessary and maintained until final construction reinstatement is completed.
	Trenching	• The subsoil horizons of trench spoil shall not be permitted to mix with stockpiled topsoil and

		vegetation.
	Pipelaying and Backfilling	• Rock removed from the pipeline corridor shall be stockpiled in an adjacent area, and either re-used as rip-rap or removed for off-site disposal as appropriate. • Backfill soils shall be compacted to a level consistent with surrounding soils, with the aim of preventing trench subsidence. During final re-profiling of the pipeline construction area, a low crown of soil mounded over the trench may be necessary to compensate for potential subsidence. Overland water flow must be diverted away from the newly completed backfill crown, or alternatively, a cambered RoW may be an appropriate means of protecting the backfill crown from runoff erosion • Where obvious demarcations between soil horizons exist, they shall be replaced in order of excavation
	Reinstatement and Rehabilitation	• The pipeline construction area shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features as far as possible. Site-specific stabilisation measures may be necessary to prevent slumping or erosion. • Upon completion of pipeline construction, temporary access tracks shall be closed and rehabilitated to a condition compatible with the surrounding land use and as pre-agreed with the affected landowner. • Rehabilitation procedures shall include: o removing all waterway crossing structures and stabilising stream banks and beds, as required, with suitable materials (e.g. rock rip-rap, geotextiles, hydromulch) o removal of excess rock or fill material o re-profiling of the site in a manner which ensures soil stability and which is as near as practicable to pre-existing contours o soil compaction relief in trafficked areas as necessary (i.e. ripping along the contours) o re-contouring the road to match the profile of the adjacent landscape and stabilising drainage and road cut and fill o ripping along the contours to relieve

		compaction and promote regeneration. Figure eight or zigzag rip lines may be appropriate in flat to low gradients to prevent rilling along the road ○ respreading stockpiled topsoil over the rehabilitation area ○ respreading stockpiled vegetation, either whole or mulched, over the pipeline construction area and other disturbed areas. Respreading techniques should be considered on a case-by-case basis
	Borrow Pits	• Site rehabilitation shall include: ○ soil compaction relief in trafficked areas as necessary (i.e. ripping along the contours). Ripping should aim to permit the site to drain freely unless it has been otherwise specified for use as a dam ○ re-profiling of the site to achieve soil stability and congruity with the surrounding landscape. A minimum 2horizontal:1vertical batter on side slopes is considered suitable to assist stabilisation ○ respreading stockpiled topsoil, where present, over the rehabilitation area ○ erosion control and site stabilisation measures such as, erosion berms and contour ripping on the borrow pit side slopes to create terracing
Operation	Reinstatement and Rehabilitation	• The reinstated pipeline trench should be routinely checked for subsidence and exposure of pipe, particularly at watercourse crossings and drainage depressions.
Related Sections Flora Management Water Management Drainage, Erosion and Sediment Management		

9.6.2 EROSIVE SOILS (SLAKING AND DISPERSION)

Soil characteristics:

- Occurrence may be due to high sodium, high magnesium or low calcium:magnesium ratio
- Hazard arising from exposure to water (with or without soil disturbance)
- Easily detected by field tests (Emerson test)
- Lab tests required to determine specifics of individual occurrences and identify management measures
- Dispersion related to soil structure
- Salt in the soil or water reduces the dispersive effects on soil particles

EROSIVE SOILS – KEY ENVIRONMENTAL ISSUES

- Soil erosion
- Sediment release to land and water, reducing soil and water quality
- Damage to agricultural production and other land uses
- Damage to native vegetation and wildlife
- Damage to infrastructure
- Subsidence of pipeline trench

EROSIVE SOILS – ENVIRONMENTAL OBJECTIVES

1. To minimise the potential for soil erosion
2. To avoid unacceptable damage to land, water, native vegetation or wildlife habitats
3. To adequately prevent or control sediment release to land and water
4. To minimise the risk of pipe exposure
5. To minimise damage or subsidence to the pipeline trench
6. To minimise damage to infrastructure
7. To prevent damage to agricultural production or other legitimate land uses

EROSIVE SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measure**
Planning	Pipeline Easement Management and	• Soil mapping to be conducted sufficient to identify areas where problem soil exist and

	Access	allow avoidance where possible. • Prepare soil management plan using available soil mapping. Soil management plan should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes. • Avoid steep slopes where possible (i.e. >10%).
	Clearing	• Design clearing programs that minimise clearing, employ a staged approach to clearing, adopt erosion and sediment control structures during clearing.
	Grading	• Minimise the exposure of erosive soil layers. • Implement a staged approach to grading and adopt erosion and sediment control structures during grading.
	Trenching	• Minimise the exposure of erosive soil layers. • Stabilise any exposed erosive soil layers as soon as possible.
	Pipe laying and Backfilling	• Minimise the time that the trench is open at any one location. • Apply compaction to prevent an increase in permeability from natural soil (i.e. return soil to trench with similar or greater bulk density to that of the surrounding soil) • Apply ameliorants only to the top of the reinstated material, not throughout.
	Reinstatement and Rehabilitation	• Apply ameliorants to the top of the reinstated material. • Prevent concentration of water flows. • Employ erosion and sediment control structures (refer to guidance in website of International Erosion Control Association

		http://www.austieca.com.au. • Revegetate as soon as possible.
	Borrow Pits	• Erosive material to be avoided.
	Construction Camps and Worksites	• Construct and manage to ensure erosive soils are either avoided, or are left unstabilised for as short a time as practicable . • Note that erosive soils are less suitable than other soils as sites for effluent irrigation.
Construction	Pipeline Easement Management and Access	• Apply management measures. • Limit vehicle traffic to essential vehicles only. • Install erosion and sediment control structures. • Consider application of specific seasonal or intense weather controls eg; to be applied prior to the onset of the wet season, or for the anticipated onset of cyclonic rainfall events.
	Clearing	• Install erosion and sediment control structures.
	Grading	• Install erosion and sediment control structures.
	Trenching	• Install erosion and sediment control structures.
	Pipe laying and Backfilling	• Minimise exposure of erosive soil material. • Ensure adequate compaction in trench to prevent an increase in permeability from natural soil. • Divert overland runoff flows away from backfill.
	Reinstatement and Rehabilitation	• Use ameliorants on surface soil layers. • Revegetate as soon as possible.
	Borrow Pits	• Use only where erosive material to be adequately compacted and below the soil surface.

Operation	Reinstatement and Rehabilitation	• A patrol officer to inspect easement for signs of erosion either at intervals specified in the soils management plan, or at regular intervals (minimum 6 monthly), and particularly after heavy rain events.

9.6.3 ACID SULFATE SOIL (POTENTIAL AND ACTUAL)

Soil characteristics:

- Potential Acid Sulfate Soils (PASS) are benign, anaerobic subsoils in their natural state
- PASS are predominantly coastal, occurring predominantly below 5 metres AHD
- Exposure (Oxidisation) leads to production of H_2SO_4 (sulfuric acid) in the soil ('Actual Acid Sulfate Soil - AASS)
- AASS release acid and dissolved metals
- Field testing (pH test of runoff, ponds or puddles) may be used as guide, with Lab testing required to identify PASS and AASS

	ACID SULFATE SOILS – KEY ENVIRONMENTAL ISSUES
	▪ Damage to native land and aquatic vegetation and wildlife ▪ Damage to agricultural production and other land uses ▪ Significant adverse effects on soil and water quality ▪ Corrosion of concrete and steel infrastructure ▪ Reduced working life of construction materials ▪ Danger to project staff (acid burns, damage to PPE)
	ACID SULFATE SOILS – ENVIRONMENTAL OBJECTIVES
	1. To minimise PASS disturbance or AASS creation in all operational areas 2. To prevent contamination of surface water, watercourses and groundwater with leachate or runoff from oxidised acid sulfate soils 3. To identify and manage acid sulfate soils so as to minimise potential adverse impacts associated with disturbance or oxidation 4. To minimise impacts to soil, water, native flora and fauna (including aquatic habitats)
	ACID SULFATE SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measure**
Planning	Pipeline Easement Management and Access	• Soil mapping should be referenced or undertaken as part of the planning process to identify PASS and known AASS areas. • Acid sulfate soil disturbance shall be avoided where possible. • A soils management plan (i.e. how to avoid, limit and manage oxidisation of acid sulfate soils) shall be prepared by a qualified soils specialist with reference to any applicable regulatory guidelines. • In sensitive environmental areas specific environmental management procedures shall be adopted to minimise environmental impacts. • Compute likely volumes required and plan ahead to ensure there is adequate neutralisation material (type and volume) available on site at all times. • Where required, ensure that a treatment pad has been designed and constructed ahead of likely requirement. • Where encounters with PASS are considered a possibility, a suitably qualified environmental officer will be onsite during construction, and if necessary, during operations and decommissioning. • Pre-arrange an acceptable licensed receival facility in the event that large amounts of PASS or AASS require safe disposal (note that in some areas, AASS may only be disposed of to a licensed hazardous waste facility).
	Clearing	• Ground disturbance and vegetation clearing shall be planned to minimise disturbance or oxidation of PASS.

	Grading	• Ground disturbance shall be planned to minimise disturbance or oxidation of PASS, or to increase runoff from AASS.
	Trenching	• The planning of time between trenching and backfilling shall be minimised to prevent oxidisation of exposed soils. • Backfill to commence immediately following pipelay. • Investigate methods of reducing the drainage of surrounding acid sulfate soils (eg: drain soils to a central treatment pond; consider installation of galvanised sheet piling or the like, to minimise the volume of soil potentially oxidised during construction). • Adequate planning to ensure that acid sulfate soil remains in stockpiles for the minimum amount of time. • Plan to manage any acid sulfate soil stockpiles to ensure minimal oxidation (i.e. cover with a membrane, irrigate to keep wet/saturated). • Base pH buffering treatment rates on laboratory analyses. • Plan treatment areas where acid sulfate soil material can be treated adequately. • Plan validation testing of treated acid sulfate soil to be used as fill material. • In AASS areas, trench water should be tested and treated as required to achieve a pre-determined acceptable pH prior to disposal to natural waterways.
	Pipe laying and Backfilling	• Base pH buffering treatment rates on laboratory analyses. • Calculate a nominal pH buffering rate (using laboratory information gathered during soil mapping) for application to the trench area prior to backfilling to account for oxidisation of soil on sides and bottom of trench during operations.

		• In PASS areas, plan to backfill acid sulfate soil material in locations below the water table wherever possible. • Ensure there is adequate space available to store soil from PASS and non-PASS horizons separately, to allow PASS to be backfilled under non-PASS soils.
	Reinstatement and Rehabilitation	• PASS is generally found under naturally neutralised surface layers, so soil reinstatement should be carried out in the order in which it was removed, to ensure no acid sulfate soil material is placed on or near the surface. • Control overland runoff flows in areas of PASS or AASS, to minimise off-site transport of low pH runoff. Collect runoff from suspect areas and treat as required prior to release • Acid sulfate soil material is to be reinstalled below the water table wherever possible. • AASS material can be used for rehabilitation, provided its pH matches that of the surrounding area).
	Borrow Pits	• No acid sulfate soil to be used as fill material.
	Construction Camps and Worksites	• It is recommended that construction camps or worksites avoid on acid sulfate soil areas, unless the PASS is at such a depth as to not be disturbed or require extra management considerations.
Construction	Pipeline Easement Management and Access	• Follow routes that avoid acid sulfate soil (potential and actual) areas to minimise disturbance of acid sulfate soils. • Construction contractor staff will need to include expertise in AASS matters, and will diligently manage any soil disturbances in areas identified as containing PASS. • Follow the prepared acid sulfate soil management plan, including surface water

		pH monitoring and response, and the installation of piezometer wells for groundwater monitoring. • Environmental management procedures in the CEMP and OEMP will include measures (staffing, training, procedures) to minimise PASS and AASS environmental impacts during all stages of construction.
	Clearing	• Ground disturbance and vegetation clearing shall be planned so as to minimise disturbance or oxidisation of PASS.
	Grading	• Ground disturbance and vegetation clearing shall be kept to a minimum to reduce disturbance or oxidisation of PASS. • Any PASS disturbed during the grading process will be treated at the appropriate rate determined from the laboratory results obtained during the soil mapping.
	Trenching	• Minimise time trench is open. • Ensure adequate neutralising material is readily available, and apply to soil and trench water as indicated by analysis.
	Pipe laying and Backfilling	• Apply neutralising material at a nominal rate (using laboratory information gathered during soil mapping) to the trench area prior to backfilling to account for oxidation of soil on sides of trench during construction. • Ensure soil reinstatement is carried out in the order from which they were removed, so acid sulfate soil material is placed at the base, and preferably below the water table. • Treat any AASS to the degree indicated by analysis as that necessary to neutralise its acid producing potential prior to re-placement.
	Reinstatement and Rehabilitation	• PASS is generally found under naturally neutralised surface layers, so soil reinstatement should be carried out in the

		order in which it was removed, to ensure no acid sulfate soil material is placed on or near the surface. • Control overland runoff flows in areas of PASS or AASS, to minimise off-site transport of low pH runoff. Collect runoff from suspect areas and treat as required prior to release. • Acid sulfate soil material is to be reinstalled below the water table wherever possible. • AASS material can be used for rehabilitation, provided its pH matches that of the surrounding area).
	Borrow Pits	• No acid sulfate soil to be used as fill material.
Operation	Reinstatement and Rehabilitation	• During pipeline operations, the disturbance of acid sulfate soils should be avoided or minimised. Barriers or other control measures should be implemented to ensure such soils are not released to surrounding land and water and that disturbed PASS does not drain to natural waterways. • Patrol officers will be trained in AASS matters, and will follow the pH monitoring plan included in the soil management plan for areas identified as containing acid sulfate soils.

9.6.4 HIGH SHRINK/SWELL SOILS

Soil Characteristics:

- These soils have high clay content and mineralogy
- Soils shrink and swell dependent on moisture content
- Vegetation communities are a useful surface indicator
- Gilgai microrelief (small ponding of water) common on these soils
- Infrastructure on and in the ground can be at risk

HIGH SHRINK/SWELL SOILS – KEY ENVIRONMENTAL ISSUES

- Damage to infrastructure
- Increased cost of infrastructure
- Access when wet

HIGH SHRINK/SWELL SOILS – ENVIRONMENTAL OBJECTIVES

1. To prevent adverse impacts on soil quality
2. To minimise damage to infrastructure

HIGH SHRINK/SWELL SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Design route to avoid soils with high shrink/swell values where possible • Prepare soil management plan using available soil mapping. Soil management plan should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes. • Develop contingency plans – especially for overland access – to be applied during wet weather. • Ensure shrink/swell characteristics are recognised in engineering specifications for infrastructure.
	Clearing	• Limit soil disturbance.
	Grading	• Limit soil disturbance.
	Trenching	• Plan effectively so that trenching is undertaken during dry conditions.
	Pipe laying and Backfilling	• Plan to reinstate the soil layers in the order they were removed. • Ensure adequate/extra non shrink/swell padding material is available.

	Reinstatement and Rehabilitation	• Maintain even moisture conditions where possible.
	Borrow Pits	• Not recommended in this soil type.
	Construction Camps and Worksites	• Ensure shrink/swell characteristics are recognised in engineering specifications for construction camps / worksites.
Construction	Pipeline Easement Management and Access	• Not recommended during wet weather.
	Pipelaying and Backfilling	• Ensure adequate/extra non shrink/swell padding material is placed around pipework.
	Reinstatement and Rehabilitation	• Ameliorants may assist with breaking up coarse soil structure.
	Construction Camps and Worksites	• Ensure shrink/swell characteristics are recognised in engineering specifications for construction camps / worksites.
Operation	Reinstatement and Rehabilitation	• A monitoring plan to be followed to ensure that infrastructure damage is identified in a timely manner (i.e. during season changes, after extensive rain periods and especially during subsequent dry times).

9.6.5 SALTY SOILS

Soil characteristics:

- Any soil type can become affected
- Can be detected by EC meter in the field, with extent to be confirmed by lab tests
- Unique vegetation species (for established areas) or unhealthy vegetation (for new areas)
- May occur on the surface or deeper in the soil
- Commonly associated with elevated water tables
- Can be due to both natural and created situations
- Soil salinity can be reduced by lowering the water table and/or leaching of salts

SALTY SOILS – KEY ENVIRONMENTAL ISSUES
▪ Reduced success of rehabilitation

	▪ Damage to infrastructure and reduction in effectiveness of cathodic protection measures ▪ Ecological damage from brackish runoff to natural waterways
	SALTY SOILS – ENVIRONMENTAL OBJECTIVES
	1. Limit flow-on effects caused by reduced vegetation growth 2. To improve the success of rehabilitation 3. To minimise damage to infrastructure

SALTY SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Pipeline Easement Management and Access	• Prepare soil management plan using available soil mapping. Soil management plan should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes.
	Pipe laying and Backfilling	• If topsoil is non-saline, identify topsoil reserves and keep separate from remaining saline subsoil material.
	Reinstatement and Rehabilitation	• Prepare a rehabilitation plan (eg. ameliorants and drainage.)
	Borrow Pits	• Not recommended.
Construction	Pipeline Easement Management and Access	• Minimise disturbance where possible.
	Pipelaying and Backfilling	• Identify any non-saline soil material and stockpile for replacement at or near the soil surface; saline material to be the most deeply buried.
	Reinstatement and Rehabilitation	• Improve drainage characteristics to allow for leaching of the salt from the soil • If salty soil is a natural characteristic of the area, use salt-tolerant species for

		rehabilitation. • Where salt is being leached from the soil and transported to the surface around the disturbed area due to raising of the water table, deep rooted, salt-tolerant tree species can be used to lower the water table in areas immediately adjacent to the RoW.
Operation	Reinstatement and Rehabilitation	• A monitoring plan should be followed to ensure that rehabilitation in suspected salty soil areas is successful.l

9.6.6 SOILS IN DRY/DESERT ENVIRONMENTS

Terrain Characteristics

- Varied soil types encountered
- Many areas devoid of vegetation
- GIS for identification (isohyets and vegetation communities)
- Soil and vegetation management important to ensure maximum utilisation of unpredictable moisture
- Establishment improved with supplementary irrigation
- Soil seed reserves often limited, therefore topsoil management critical

SOILS IN DRY/DESERT ENVIRONMENTS – KEY ENVIRONMENTAL ISSUES
▪ Reduced success of rehabilitation
SOILS IN DRY/DESERT ENVIRONMENTS – ENVIRONMENTAL OBJECTIVES
1. Limit the disturbance of fragile environments 2. Improve the success of rehabilitation
SOILS IN DRY/DESERT ENVIRONMENTS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Pipeline Easement Management and	• Minimise disturbance area due to the difficulty of rehabilitation (where

	Access	vegetation exists).
	Reinstatement and Rehabilitation	• Good knowledge of local drought-resistant species required. • Adequate watering regime required to re-establish vegetation.
Construction	Pipeline Easement Management and Access	• Maintain vegetative cover where possible.
	Reinstatement and Rehabilitation	• Establish a suitable watering regime to re-establish vegetation.
Operation	Reinstatement and Rehabilitation	• Seek local advice on local pioneer specie.s • A monitoring plan should be followed to ensure that rehabilitation is successful.

9.6.7 WETLAND SOILS

Soil Characteristics:

- Hydrosols (Isbell 2002), soil textures range from sands to clays
- Grey/gley soils , often mottled throughout, supports unique vegetation communities
- GIS (wetland mapping) and/or field descriptions should be utilised for identification
- Can contain PASS

WETLAND SOILS – KEY ENVIRONMENTAL ISSUES
▪ Damage to wetland ecosystems ▪ Subsidence of pipeline trench ▪ Damage to infrastructure
WETLAND SOILS – ENVIRONMENTAL OBJECTIVES
1. Limit the disturbance of wetland environments 2. Reduce damage to infrastructure

WETLAND SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**

Planning	Pipeline Easement Management and Access	• Avoid through re-alignment where possible. • In sensitive environmental areas specific environmental management procedures shall be developed by suitably qualified and experienced soil scientists or advisors to minimise environmental impacts.
	Clearing	• Minimise extent of clearing.
	Trenching	• Investigate construction methods that stop the trench acting as a drain for the surrounding wetland (eg. sheet piling) • Investigate application of trenchless techniques.
	Reinstatement and Rehabilitation	• Use local provenance species to reinstate.
	Borrow Pits	• Should be avoided.
	Construction Camps and Worksites	• Should be avoided.
Construction	Pipeline Easement Management and Access	• Follow environmental management procedures.
	Pipelaying and Backfilling	• Backfilling shall be conducted so as not to provide a conduit for soil water to drain from the wetland. • Surface level should be re-established to the original height, and compaction level should replicate soil density of surrounding areas – to avoid trench acting as a sump.
	Reinstatement and Rehabilitation	• Ensure drainage of site is reinstated as far as possible. • Local provenance species to be returned to site where possible.
Operation	Reinstatement and Rehabilitation	• A monitoring plan should be followed to ensure that rehabilitation is successful.

9.6.8 SOILS WITH PH EXTREMES (HIGH AND LOW)

Soil Characteristics:

- Incorporates a large range of soil types
- Extreme pH is most likely to be encountered with subsoil rather than with topsoil
- Identification can be initially determined from soil maps (if available), with field tests very useful (pH powder or pH meter) and lab analysis required for final confirmation and accurate quantification
- Can alter the availability/toxicity level of nutrients
- Limits establishment and persistence of vegetation can corrode infrastructure and can affect the efficiency of cathodic protection measures
- Soil management important to ensure topsoil and subsoil stored separately and reinstated in order
- Ameliorants readily available to adjust pH (elemental sulfur and lime/dolomite)

	SOILS WITH PH EXTREMES (HIGH AND LOW) – KEY ENVIRONMENTAL ISSUES
	▪ Reduced success of rehabilitation ▪ Damage to infrastructure
	SOILS WITH PH EXTREMES (HIGH AND LOW) – ENVIRONMENTAL OBJECTIVES
	1. To limit flow-on effects from reduced vegetation growth 2. To improve the success of rehabilitation 3. To minimise damage to infrastructure
	SOILS WITH PH EXTREMES (HIGH AND LOW) – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Prepare soil management plan using available soil mapping. Soil management plan should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes.

		• Using soil mapping to determine potential for encountering pH extreme soils, and to calculate the amounts and types of ameliorants required.
	Reinstatement and Rehabilitation	• Identify the symptoms of extreme pH effects on rehabilitated RoW. • Monitoring equipment available.
	Borrow Pits	• Limited use.
	Construction Camps and Worksites	• Limited use without amelioration.
Construction	Trenching	• Separate excavated topsoil from subsoil material.
	Pipelaying and Backfilling	• Return excavated soil in same order as it was removed. • Add ameliorants to top of reinstated material (i.e. similar to rooting depth of vegetation).
	Reinstatement and Rehabilitation	• Monitor for pH conditions and visible symptoms on reinstated vegetation, and ameliorate as required.
	Borrow Pits	• Use only below soil surface, consider amelioration.
	Construction Camps and Worksites	• Amelioration and monitoring required.
Operation	Reinstatement and Rehabilitation	• Monitor for pH conditions and visible symptoms on reinstated vegetation, and ameliorate as required.

9.6.9 SHALLOW ROCKY SOILS

Soil Characteristics:

- Minimal soil present
- Can be identified by referencing contour information and soil mapping
- Conservation of available soil material is vital
- Importation of soil may be required for backfill and for rehabilitation
- Reinstatement of rock material as a mulch will help reduce erosion

SHALLOW ROCKY SOILS – KEY ENVIRONMENTAL ISSUES

- Minimal soil for disturbed area rehabilitation

SHALLOW ROCKY SOILS – ENVIRONMENTAL OBJECTIVES

1. Limit flow-on effects from reduced vegetation growth
2. Improve the success of rehabilitation

SHALLOW ROCKY SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Plan alignment to reduce length in rocky soils where possible. • Prepare soil management plan using available soil mapping. Soil management plan should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes.
	Grading	• Consideration must be given to equipment selection.
	Trenching	• Consideration must be given to equipment selection.
	Pipelaying and Backfilling	• Separating rock material from soil may be required, with rock stockpiled for later reuse as mulch. • Crushing of rock may be required for padding material. • Provision for the importation of padding material may be required.
	Reinstatement and Rehabilitation	• Provision for the importation of topsoil may be required. • Re-spread rock may be a useful mulch. • Local provenance species should be used in rehabilitation.

	Borrow Pits	• Borrow pits may be suitable for use as a source of aggregate material for bedding.
Construction	Pipeline Easement Management and Access	• Retain as much soil material present as possible. • Where possible, separate soil from rock and stockpile rock for later re-spreading as mulch. • May need to utilise alternate methods to trenching (rocksaw, blasting, etc).
	Pipelaying and Backfilling	• Padding material may need to be imported/crushed.
	Reinstatement and Rehabilitation	• Soil may need to be imported to establish vegetation for rehabilitation. • Local provenance species should be used in rehabilitation. • A suitable watering regime of reinstated areas should be prepared to gain good rehabilitation outcomes.
	Borrow Pits	• Borrow pits may be suitable for use as a source of aggregate material for bedding. Ensure provisions for borrow pits are in accordance with this Code.
Operation	Reinstatement and Rehabilitation	• A monitoring plan shall be followed to ensure that rehabilitation of any areas disturbed during operations is successful.l

9.7 DRAINAGE, EROSION AND SEDIMENT MANAGEMENT

Much of the Australian landscape is fragile, with ancient soils that are susceptible to wind or water erosion. Construction activities involving earthworks increase erosion risks by removing protective / stabilising features such as vegetation cover.

Drainage, erosion and sediment control are discussed as they relate to a particular construction activity, throughout this document, with additional guidelines considered in this section.

Erosion controls (berms and sediment fences) at a watercourse crossing. W. Mathieson

	DRAINAGE, EROSION AND SEDIMENT MANAGEMENT – KEY ENVIRONMENTAL ISSUES
	▪ Loss of topsoil and sub-soils ▪ Siltation and sedimentation of land and water ▪ Reduced potential for rehabilitation success ▪ Long term stability of disturbed areas ▪ The requirement for costly rectification measures
	DRAINAGE, EROSION AND SEDIMENT MANAGEMENT – ENVIRONMENTAL OBJECTIVES
	1. To minimise potential for soil loss and degradation, both on and off construction areas 2. To prevent adverse impacts on water quality
	DRAINAGE EROSION AND SEDIMENT MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	General Planning	• Installation of drainage, erosion and sediment control measures shall be in accordance with best practice Erosion and Sediment Control Guidelines. The pipeline should be risk assessed against the

		following provisions to determine the level of sediment and erosion control management that is required during construction: • natural and constructed drainage patterns • corridor soil types and erosion potential • corridor slopes • rainfall frequency and intensity • catchment size and, therefore, required capacity and coordination of control structures • existing vegetation cover • proximity to sensitive environments, particularly sedimentation leading to impact on water quality • land use impacts (e.g. cultivation and grazing). • A drainage, erosion and sediment control plan should be developed, applying best practice guidelines where appropriate, as part of the CEMP and OEMP document. • The CEMP and OEMP will usually require approval by the regulatory authorities as a pre-start condition of approval, and should document sediment and erosion control measures for specific locations and soil types along the pipeline corridor and at other project-related sites of disturbance. • Where practicable, pipeline route selection shall avoid soils highly prone to erosion and minimise exposure to areas of higher erosion risk generally, such as waterways. • Appropriate measures shall be developed to address wet weather considerations, including access and minimising soil erosion and sedimentation to waterways. • Consideration should be given to scheduling works outside known wet periods and allowing for wet periods in construction schedules.

	Pipeline Easement Management and Access	• Ground disturbance activities, including the creation of access tracks, shall not result in an uncontrolled sediment release to land or water. Planning consideration shall be given to adopting appropriate management actions including: ○ provision for storage of topsoil and spoil away from areas of surface water flow ○ diverting overland flows from disturbed areas ○ provision of space for larger sediment control structures (e.g. sediment basins) ○ minimising the number of watercourse crossings during route selection.
	Grading	• To minimise the risk of erosion and potential for site runoff, the period of time between grading and reinstatement shall be minimised.
	Horizontal Directional Drilling	• To avoid contaminated water or sediment leaving the site, sediment and erosion controls sized to contain site run-off shall be installed at drill pad sites, together with diversion structures that re-route uncontaminated overland flows from the adjacent area around the site.
	Pipelaying and Backfilling	• Assess and manage the risk of subsurface water flow and subsequent erosion of the backfilled trench. • Appropriate measures shall be employed to prevent obstruction of sub-surface water flows in side slopes (e.g. natural seepage zones) across the trench, such as the installation of trench breakers or permeable zones within the backfill adjacent to the seepage, or other forms of subsoil drainage. • Minimise length of time trench is open or pipe exposed. Backfill to commence as soon as is practical following pipelay.
	Borrow Pits	• Site layout plans identifying topsoil, vegetation and spoil storage areas, access tracks, excavation boundaries and borrow pit drainage controls shall be prepared prior to commencement of borrow pit operations.

	Open-cut Watercourse Crossings	• In the absence of official flow data, advice should be sought from the relevant landowner about the flow characteristics of potential waterway crossing locations. • Watercourse crossing sites will be located and designed in a manner which minimises scour potential e.g. the crossing location shall be at low velocity, straight sections, with the pipeline orientated as near to perpendicular to water flow as practicable. • Site layout plans detailing proposed drainage and sediment control measures shall be developed for significant waterway crossings. Crossings shall be designed to ensure that on-site drainage and sediment controls are capable of accommodating locally significant rainfall events.
	Construction Camps and Worksites	• Site layout plans shall be prepared during the planning phase identifying topsoil stockpile, vegetation stockpile and spoil storage areas, access tracks, excavation boundaries, and drainage and sediment control structures for all site offices, construction camps and temporary worksites.
	Reinstatement and Rehabilitation	• Rehabilitation of the pipeline construction area shall incorporate drainage, sediment and erosion control measures to manage surface water flows during site re-establishment. • Where the pipeline is likely to cause or be affected by soil erosion, stabilisation works including diversion structures may be required. These may involve geotextiles, rock stabilisation, concrete lining, localised drainage modification or other site-specific measures as appropriate. • The period of time between backfilling and rehabilitation of the pipeline construction area shall be minimised to reduce the potential for erosion. • Site-specific or property-specific rehabilitation plans may be necessary for areas that require focussed reinstatement effort, (e.g. problematic soils, significant habitat or species). Rehabilitation plans should include:

		• Description of planned works, including an installation schedule • Site layout plan of rehabilitation works • The proposed inspection program and schedule • Anticipated ongoing maintenance measures.
Construction	Erosion Controls	• The first consideration when managing potential erosion is to adequately manage drainage, then to focus on erosion and sedimentation controls. • Installation of drainage and erosion control structures should be undertaken in accordance with the provisions of the drainage, erosion and sediment control management plan (e.g. table drains, erosion berms, silt fences). • Erosion control berms shall be designed and constructed in a manner which ensures discharge run-off water does not lead to erosion or sedimentation by incorporating the following design characteristics: ○ The focus should be on structures and measures that direct runoff away from exposed works, that avoid concentrating run-off, and that slow the pace of its flow ○ erosion control berm gradients shall closely follow land contours, to ensure low velocity discharge away from the exposed soils ○ run-off water from erosion control berms shall be directed to the downslope side of the pipeline to prevent discharge water from crossing the pipeline construction area again ○ where necessary, the installation of erosion control berms shall coincide with the location of Trench Blocks to enable more effective water diversion • Erosion control berms and drains shall be constructed so as to permit traffic to move over them safely without destroying them.

		• Access track drains shall discharge run-off water in a manner which does not lead to sedimentation or erosion, i.e. low gradient run-off, broad dish shaped outlets to appropriately stable areas (e.g. vegetated or rip-rap stabilised). • Erosion control structures shall be routinely inspected and maintained to ensure they remain effective (i.e. removal of silt build up, reinforcing or re-establishing failed structures), particularly before and after major rainfall events. • Appropriate measures shall be applied during all phases of construction to control drainage, erosion and sediment on the pipeline construction area (including aboveground infrastructure sites), work and camp sites as required. • Ground disturbance and vegetation clearing shall be minimised as far as practicable, to minimise areas of soil instability. • The period for which the soil is left exposed to erosion shall be minimised.
	Sediment Controls	• Sediment control structures may include: o sediment or silt barriers generally constructed from geotextile silt fence or filter fabric secured in place with star pickets or sand bags, concrete saddle weights or culverts o sediment basins or ponds which are constructed downslope and are designed to catch and retain run-off water allowing sediment to settle out. • Installation of sediment control structures should be undertaken in accordance with the provisions of the drainage, erosion and sediment control management plan, which will usually have been approved by the regulatory authorities as part of the CEMP or OEMP. • Sediment control structures shall be regularly inspected and maintained to ensure they remain effective (i.e. removal of silt build up, replacement/re-installation of failed components

		such as straw bales and fencing), particularly after high intensity rainfall or run-off events.
	Discharge Water Erosion and Sediment Control	Wastewater discharge from construction activities (e.g. hydrotesting, trench de-watering or well-point de-watering) shall be managed in accordance with the following principles: • Where necessary, discharge water quality shall be monitored against relevant water quality standards prior to release and appropriate disposal options determined in consultation with relevant regulatory authorities and, if appropriate, the relevant landowner. • Soil erosion and sedimentation of land and water caused by the discharge of site pump-out water shall be prevented by: ○ applying inlet filters or screens on water uptake hoses ○ supporting the inlet hose above the sediment layer in the water ○ avoiding discharge directly to waterways where discharge water sediment loads significantly exceed that of the receiving waters ○ allowing for sufficient settlement to occur before discharging water ○ consideration of adding a flocculent and a filter or settlement basin to separate out the sediment prior to release ○ discharging water in a manner which does not result in flooding of land both on and off the pipeline construction area or run-off beyond the intended receiving area into waterways ○ discharging diverted watercourse water (i.e. flume and dam and pump crossings) directly back into the watercourse over rip-rap protection downstream of the crossing ○ discharging trench and hydrotest water through sediment filters (e.g. hose outlet filters, geotextiles or straw bales) to

		remove solids ○ discharging water to holding or settling ponds to avoid erosion and permit sediment to settle out of the water column ○ discharging trench and hydrotest water to stable land through flow diffusers (e.g. spray bars) and energy dissipaters (e.g. rock rip-rap or geotextile filters/fabrics).
	Grading	• Graded topsoil shall be stockpiled separately from other materials (e.g. vegetation), where it can be readily recovered for respreading and where loss through wind or water erosion or other means will be minimised. • Soil and surface stability shall be maintained at all times, e.g. cut and fill excavation shall be shaped to maintain slope stability and temporary erosion control berms, drains and sediment barriers shall be installed in accordance with the management plan and all structures and surfaces shall be maintained in as stable a state as is practicable until final construction reinstatement is completed.
	Trenching	• Consider the use of trench shoring as opposed to benching to reduce spoil generation in deeper trenches. • Where well point de-watering is necessary to stabilise saturated soils (e.g. high watertable areas such as floodplains), appropriate water quality management and erosion control measures shall be adopted for discharge water. Erosion protection may include water discharge flow dissipaters, such as rock rip-rap, geotextiles or straw bales. • Appropriate management measures for drainage, sediment and erosion control shall be adopted when trenching in problem soil areas, e.g. salty or PASS soils. • Spoil stockpiles shall be located, formed, stabilised and protected so as to minimise loss of material through water or wind erosion. • Spoil stockpiles shall not impede natural or

		constructed surface drainage channels or access tracks unless appropriate diversion management measures are in place. • Erosion within the trench shall be prevented utilising trench plugs at appropriate intervals.
	Rehabilitation and Reinstatement	• Rehabilitation will be undertaken in accordance with the site rehabilitation management plan. • Drainage, sediment and erosion control measures will be installed to assist in diversion, stabilisation and management of anticipated surface water flows during site re-establishment. • The project disturbed areas shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features. • A low crown of soil mounded over the trench may be necessary to compensate for potential subsidence of trench soil (except in cultivation areas). Breaks in the crown at intersecting drainage lines will prevent the impediment or channelling of surface drainage and shall coincide with drainage and erosion control features. Post-construction monitoring of the reinstated pipeline alignment will pay particular attention to maintenance of these mound breaks. • During rehabilitation, cleared vegetation may be re-spread over the pipeline construction area or in filter strips, as an alternative or addition to erosion control berms. • Erosion and sediment control measures – such as diversion berms, geotextile matting, silt fences, straw bales, and sediment basins - shall be installed as required, particularly on moderate to steep grades, as per best practice guidelines. • Regular monitoring for trench subsidence shall be undertaken during the pipeline construction maintenance period and operations phases.
	Borrow Pits	• Drainage, erosion and sediment controls will be implemented in accordance with the borrow pit layout plan and monitored regularly to ensure that control measures are operating effectively.

	Construction Camps and Worksites	• Drainage, erosion and sediment control measures shall be installed in accordance with the approved plan in the CEMP and OEMP (or the approved site management plan if construction camps and work areas are not covered on the CEMP or OEMP) to prevent site run-off leading to erosion and sedimentation.
	Watercourse Crossings	• Utilise relevant erosion and sediment control guidelines and ensure appropriate monitoring to determine their ongoing adequacy. • Crossings shall be completed promptly in order to minimise exposure to weather events. • Diversion dams shall be constructed of appropriate materials which will minimise watercourse sedimentation, such as steel plates, sand bags or inflatable dams. Unprotected earthen dams shall be avoided. • Risk of erosion and sedimentation resulting from trenching adjacent to watercourses shall be mitigated by: o delaying grading of banks and slopes leading to watercourses until construction of the crossing is imminent, thus minimising erosion and sedimentation risk o ceasing trenching on approaches to wet watercourses leaving hard trench plugs in place for the maximum period possible pending pipelaying o stockpiling excavated bank material at an appropriate distance from the watercourse or behind adequate stockpile berms o installing sediment and erosion control measures in accordance with the site layout plan (e.g. silt fences, sediment basins and erosion berms) on watercourse approaches and banks
Operation	Pipeline Easement Management	• During operational maintenance activities, erosion and sediment controls should be installed in accordance with best practice guidelines and should be routinely checked, especially following significant rainfall events, to ensure they are in

		good condition, are stable and are effective. Repair works should be undertaken as required. • Where erosion is occurring due to inadequate vegetation cover on the easement, the site should be reinstated and consideration should be given to revegetating the area or installing an erosion control device. Such work should be conducted in consultation with the landowner. • If significant erosion is encountered, erosion and sediment control structures should be installed and monitored. • Vehicle access should be restricted to stable ground where practicable. Additional care should be taken near watercourses and drainage lines. • The reinstated pipeline trench should be routinely checked for subsidence and exposure of pipe, particularly at watercourse crossings and drainage depressions after rainfall events. • Importation of material required for rehabilitation works should only be undertaken after consultation, and approval if required, with the regulator and the landowner; imported material should preferably be sourced locally and should be free of weeds, seeds and other contaminants. • Potential impacts associated with soil and ground stability should be monitored as part of a structured inspection and monitoring program.
	Watercourse Crossings	• Erosion and sediment controls should be installed and managed in accordance with best practice guidelines (see Appendix 4 for further guidance). • Erosion control measures such as silt fences, berms and drains shall be appropriately maintained. Monitoring should note the condition of such measures and the need for remedial action. • Where required, designated crossing points should be used and the bed and banks maintained in a stable condition. • Should erosion and sedimentation occur, appropriate corrective actions should be undertaken (consideration to be given to

		permanent rather than temporary repair). This may include restoring bank profiles, reseeding slopes, replacing sandbags or gabions, installing additional silt fences or geotextile fabric or generally hardening the site with engineered structures.
Related Sections Flora Management Water Management Soils Management		

Erosion controls at a trench de-watering site. Ecos

9.8 WATER MANAGEMENT

Water is an important feature of the Australian environment. Pipeline operations should aim to minimise potential impacts on water quality and/or quantity. Such impacts may be associated with sediment loads to streams, the potential for spills of product or chemicals and the maintenance of appropriate surface and groundwater flow regimes.

WATER MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Reduction in water quality as a result of increased sediment load
- Contamination of surface or groundwater by product or chemicals
- Altered drainage patterns and water flow regimes
- Secondary impacts on flora and fauna as a result of altered water quality or quantity.

WATER MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To control and minimise the volume of sediment entering waterways from erosion, from the pipeline corridor, from associated project works or facilities or from operational activities
2. To prevent contamination of surface water, watercourses and groundwater
3. To manage surface water flows and to minimise potential adverse impacts associated with altered flow regimes
4. To minimise indirect impacts to flora and fauna, and direct impacts to riparian, aquatic and water-dependant flora and fauna

WATER MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Construction water sourcing options and any related approval requirements should be considered in planning documentation, including anticipated volumes and intended sources. • The requirement for holding dams should be determined at the project planning phase, including their indicative locations. • Requirements for and potential locations of holding dams should be discussed with the relevant landowner – to facilitate their post-construction re-use, if permitted and appropriate, as farm infrastructure

		• Holding dams, if required, shall be located, constructed, managed and rehabilitated in accordance with the principles outlined for construction camps and work sites.
	Clearing	• Cleared vegetation shall be stockpiled away from watercourses and shall not be stored in or felled so as to land in watercourses. • At ecologically-sensitive watercourse crossings, mechanical slashers and extensive trimming shall be considered for use in site preparation, as an alternative to vegetation clearing.
	Grading	• Grading and stockpiling of soil shall not, as far as practicable, impede surface drainage or water flows. • Grading of watercourse beds and banks shall be minimised, leaving an undisturbed organic mat within the riparian zone, or delayed until construction of the crossing is imminent, thus minimising risk associated with sediment release into watercourses - refer to Section 6.11 Watercourse Crossings for detail. • When working through sensitive areas, consideration should be given to locating soil stockpiles in an adjacent, less sensitive area, so that the construction ROW width can be minimised. • Grading machinery and equipment have high weed transfer potential. It is essential to manage weed hygiene effectively, to conduct regular, thorough biosecurity inspections and to maintain biosecurity records.
	Trenching	• Where trench de-watering is required, permission should be sought from the relevant landowner/ regulator • appropriate measures shall be undertaken to protect water quality which may include: landowner o Testing water prior to disposal to determine if it meets the relevant

		regulatory standards and / or ANZECC criteria ○ Containing and / or treating water onsite or removing water off-site for treatment/disposal if it does not meet criteria for disposal on-site ○ Dewatering to stabilised ground via low dispersion methods to prevent erosion ○ Preventing discharges entering surface water bodies unless permitted by relevant authority ○ Use of sediment traps where required ○ Bunding of dewatering pumps to prevent fuel spill contamination.
	Hydrostatic Testing	• Prior to the commencement of hydrotesting activities, a hydrostatic testing program / procedure shall be prepared. • Where discharge water quality criteria apply and testing is required, testing should be undertaken by an accredited testing laboratory and in accordance with relevant Australian Standards. • Water that does not meet discharge quality criteria shall not be released without the approval of the regulator, or further treatment sufficient for it to meet the discharge quality criteria.
	Borrow Pits	• Borrow Pits to be located away from recharge zones (hydraulic conditions) to prevent damage to groundwater sources.
	Construction Camps and Worksites	• Where practicable, camps and worksites (excluding Horizontal Directional Drilling sites and other water crossing construction sites) shall be located so as to not drain directly to major water courses, creeks or other surface water bodies.
	Watercourse Crossings	• For major crossings, hydrological and hydraulic modelling should be conducted to determine watercourse characteristics and determine the most appropriate methodology for construction. • Where flow data are not available, proponents should consult affected landowners over the flow characteristics of the water body.

		• Site-specific or type-specific watercourse crossing techniques shall be determined by the pipeline proponent in consultation with relevant regulatory authorities following consideration of environmental sensitivities (natural and social). • Schedulers shall remain vigilant regarding the likely onset of significant rainfall or flood events, receiving daily weather reports and subscribing to long range forecasts and flood warning services where relevant.
Construction	General	• Erosion and sediment controls should be implemented as per site-specific management plans, to protect water quality. • The removal and subsequent discharge of water from the pipeline corridor shall not result in erosion or pollutants (such as sediment, saline, contaminated or pH-modified water) being released to land or water outside of acceptable parameters. Water quality shall be monitored and appropriate discharge options adopted to ensure discharge water quality remains acceptable.
	Fuel and Chemical Management	• Fuels, lubricants and chemicals, including drilling fluids, shall be stored and, where practicable, handled within containment facilities such as bunded areas or over leak proof trays, designed to prevent the release of spilled substances to the environment.
	Hydrostatic Testing	• Where practicable, test water shall be re-used for multiple test sections. • In the absence of specific approval conditions relating to its discharge, hydrotest water shall only be discharged or recycled for secondary uses, such as pasture irrigation or livestock watering, where its quality is within relevant statutory water quality guidelines • The use of environmentally-harmful chemical additives in the hydrotest water, such as corrosion inhibitors and biocides, shall be avoided where practicable. Appropriate treatment measures may be required when such chemicals

		are used, prior to discharge of the test water to the environment.
	Watercourse Crossings	• See Section 6.11 for provision of construction management provisions to protect water quality at watercourse crossings.
Operation	Pipeline Easement Management and Access	▪ During operational maintenance activities, erosion and sediment controls should be installed in accordance with best practice guidelines and should be routinely checked, especially following significant rainfall events, to ensure they are in good condition, are stable and are effective. Repair works should be undertaken as required. ▪ Should erosion and sedimentation occur, appropriate corrective action should be undertaken (consideration to be given to permanent rather than temporary repair). This may include restoring bank profiles, reseeding slopes, replacing sandbags or gabions or installing additional silt fences or geotextile fabric. ▪ Stability of the pipeline easement and, in particular, the condition of watercourse bed, banks and riparian vegetation should be inspected in accordance with an agreed inspection program. ▪ Changes to the pattern of water flow should be monitored. Prior to installing any new surface control structures (such as berms or diversion drains) the implications for existing land use and downstream environments should be considered.
	Fuel and Chemical management	▪ The refuelling or maintenance of equipment, machinery and vehicles, should be conducted as far away as is reasonably practical from any surface water body, to reduce the risk of water pollution resulting from accidental fuel or oil release. ▪ All chemicals used during operations shall be transported, stored, handled and disposed of in accordance with the requirements of the relevant dangerous goods and environmental legislation, industry standards and applicable Safety Data Sheets (SDS - previously known as Material Safety Data Sheets or MSDS). ▪ Hazardous wastes shall not be stored or handled in

		areas that drain directly to any waterway or surface water.
Related Sections Flora Management Fauna Management Fuel and Chemical Management Soils Management Drainage, Erosion and Sediment Management		

9.9 WASTE MANAGEMENT

During the construction and operation of a pipeline, domestic and industrial wastes such as waste oils, packaging, drums, timber skids, sewage, used lube oils and general refuse may be generated. Sewage and putrescible waste may also be generated from work sites, site offices and camps. All waste management practices and disposal methods must comply with the relevant State legislation and local planning requirements.

Opportunities for recycling shall be investigated throughout all phases of the pipeline lifecycle. There shall be a strong emphasis placed on housekeeping and cleanliness at all sites in order to promote safety and minimise environmental impact.

Historically, asbestos has been used as a constituent of pipeline coating. The removal of asbestos, in particular friable asbestos products, poses health risks to humans if the fibres are inhaled. Any material that contains more than 1 per cent asbestos by volume should be regarded as asbestos material. If repair or disposal of this pipeline coating type is required, appropriate safety measures and waste management protocols for asbestos handling and disposal shall be applied.

	WASTE MANAGEMENT – KEY ENVIRONMENTAL ISSUES
	▪ Contamination of soil and water ▪ Health risks to the community and the workforce ▪ Adverse effects on native vegetation and wildlife ▪ Reduction of visual amenity ▪ Optimised opportunities for waste reuse or recycling ▪ Waste minimisation and appropriate disposal ▪ Impact on post construction land use
	WASTE MANAGEMENT – ENVIRONMENTAL OBJECTIVES
	1. To avoid the contamination of soil and water 2. To minimise potential risks to workers and the public 3. To minimise adverse effects on native vegetation, livestock and wildlife 4. To minimise visual impacts 5. To maximise the efficiency of resource use 6. To minimise health risks associated with waste management 7. To minimise environmental impacts related to waste management 8. To promote the principles of reduce, reuse and recycle

WASTE MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Waste Management Plan	• Prior to the commencement of construction, waste management plans shall be developed, detailing the required waste management procedures and commitments to reuse and recycling for all waste-generating activities. • Waste management plans shall meet all necessary regulatory requirements and should be based on the following principles listed in order of priority: o Reduce wastes at the point of use o Reuse materials where possible o Recycle wastes where practicable o Dispose of wastes appropriately and responsibly. o Consider alternative methodologies of avoiding and reducing generation of on-site waste. • Consideration should be given to Life Cycle Assessment of pipeline and facility items during the procurement phase, with preference assigned (subject to other considerations such as cost and availability) to goods with the least impact, when assessed from a whole-of-life perspective. • Consideration should be given during the planning phase to adopt a purchasing policy that encourages suppliers to reduce and/or collect packaging and supply recycled products where appropriate.
	Pipeline Easement Management and Access	• Waste streams should be identified during the planning phase and provision should be made to allow for appropriate on-site waste separation and management.
	Blasting	• Blasting refuse, such as containers, cartridges, caps and wire, shall be retrieved for disposal at an approved waste depot (note that requirements differ between jurisdictions).
	Hydrostatic	• Planning should include the review of beneficial re-

	Testing	use opportunities for hydrotest water.
Construction/ Operation	General	• Waste material shall not be left on-site or buried in the pipeline easement, unless such a disposal mechanism is approved by the regulator and supported by the relevant landowner. • Waste generated on site, including packaging waste, should be secured to prevent any material blowing off-site. • Waste should be removed from site regularly and progressively to maintain good housekeeping practices. • Waste receptacles should be appropriate to the nature and volume of waste being produced on site and should be emptied regularly to prevent overloading or the overflow of waste materials.
	Solid Inert Wastes	Solid inert wastes associated with pipeline construction may include building rubble, concrete, bricks, timber, plastic, glass, metals, bitumen/ road base and tyres. Appropriate solid waste management shall be applied during construction and may include: • Stockpiling reusable and recyclable wastes, such as timber skids, pallets, drums, scrap metals, pipe transport spacers and tyres, for salvage. • Collecting and transporting general refuse to local council-approved disposal sites. • Development of on-site collection and/or disposal areas, in accordance with regulatory requirements and in consultation with affected landowners. • Supplying designated collection bins at work sites for aluminium cans, glass and paper recycling (where recycling facilities are available). • Collecting and transporting general refuse to landfill sites approved by the local authorities.
	Liquid Inert Wastes (for use in trenchless construction)	• Drilling fluids shall consist of approved products or synthetic lubricants, and shall be contained within the fluid circulation system (i.e. mud tanks, fluid pump system, drill point bell holes and drilling orifice) during drilling. Drilling fluids shall be recycled for use where practicable, or disposed of in accordance with regulatory requirements.

	Recyclable wastes	• Providing suitable collection points for reusable and recyclable wastes such as timber skids, pallets, drums, scrap metals and pipe transport spacers for salvage. • Recyclable waste products including timber, steel, plastics, etc should be reused and recycled where possible. • Where possible, appropriate and permitted, hydrotest water and pigging water discharge should be recycled for secondary uses, such as pasture irrigation or livestock watering.

	Construction camps and worksites	• Putrescible wastes are organic wastes able to be decomposed by bacterial action and may include discarded food, domestic garbage, commercial wastes and garden clippings. Appropriate putrescible waste management shall be applied during construction and may include:
		  • Collection and transportation to a landfill approved by the relevant regulatory authority (usually local government).
		  • On-site disposal at camp or work sites - l only in remote areas where storage and transportation to a registered landfill depot may lead to the creation of unacceptable health risks.
		• The pipeline construction area and associated camp, work and storage sites shall be maintained in an hygienic state free from the presence of exposed putrescible wastes.
		• Appropriate measures shall be taken to ensure litter accumulation is avoided, such as the provision of litter bins on-site and through regular site maintenance. Adequate resourcing should be provided to ensure waste receptacles are in sufficient supply, and that their maintenance (emptying and cleaning) can be conducted as required.
		• Housekeeping should form a central part to project environmental inductions and toolbox meetings.
		• Site reinstatement shall include regular progressive removal of temporary infrastructure and wastes from site.

		• Soil suspected of being contaminated should be analysed, and if confirmed as contaminated, should be disposed of in a manner and to a location approved by the regulatory authorities and, if relevant, the affected landowner. • Sewage and sullage disposal shall be via approved septic systems, mobile chemical treatment systems or, alternatively, via municipal sewage treatment plants. • Recycled wastewater may be utilised for plant irrigation where water quality is within acceptable parameters for release.
	Fuel and Chemical Waste Management	Hazardous wastes are those which pose an immediate potential risk to human health and/or the environment. Such wastes, which are relevant to pipeline construction, may include: radiography or cleaning chemicals, waste oils, medical wastes or sewage. Management measures include: • Purchasing supplies in bulk containers, where practicable, to minimise packaging. • Managing hazardous wastes in accordance with all relevant regulatory requirements. Many hazardous wastes may also be declared as prescribed wastes under State or Territory legislation for which specific management requirements may be imposed (e.g. waste inventories, tracking systems and permitting). • All waste chemicals and other toxic materials shall be stored and collected for safe transport off-site for reuse, recycling, treatment or disposal at locations approved by relevant regulatory authorities. • Hydrocarbon wastes, including lube oils and oily sludge's, shall be collected for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. • Hazardous waste storage areas must be suitably designed to adequately contain any spills & leaks (e.g. bunded in accordance with statutory requirements). • The potential for contamination of soils (e.g. loading bay drain/PIG trap contents, oil/fuel spills) must be managed according to the location, concentration of contaminants, the potential to leach and the extent

		of the potentially- affected area. Appropriate disposal options shall be determined in consultation with the relevant environment protection authorities and, if relevant, affected landowners. • Management of hazardous liquid wastes such as radiography or cleaning chemicals and waste oils shall comply with relevant regulatory requirements. Management measures include: o safe storage prior to collection and transport off-site for reuse, recycling, treatment or disposal at locations approved by relevant regulatory authorities o storage areas must be suitably designed to contain any spills and prevent contamination of soil or water (e.g. bunded or otherwise contained in accordance with statutory requirements). • Suppliers shall be asked to accept returned used or exhausted hazardous materials that they originally supplied, or should be required to accept the used or exhausted materials they are proposing to replace with new.
	Asbestos	• Asbestos should be processed and handled in accordance with regulatory requirements. Generally, management measures include: o a licensed contractor should be used to collect and dispose of asbestos o asbestos must be handled so as to minimise release of fibres or dust to the air. Where possible, the asbestos should be wet when handled, in order to prevent dust being released o Appropriate PPE should be worn (gloves, face mask) at all times when in the presence of asbestos, with disposable full-body suits to be worn if exposure is constant o collected material should be placed in polythene bags (0.2mm thick) or double-wrapped in sheets of polythene. Packages should carry an asbestos warning label o owners of vehicles transporting asbestos

		may be required to hold a waste transport permit. This requirement should be checked with the regulatory authorities. ○ vehicles must be carefully cleaned following asbestos transport ○ asbestos shall only be disposed of at an appropriately licensed site. • Soil with an asbestos content equal to or greater than 1 per cent by volume should be regarded as a hazardous waste. Protection and management measures as outlined above should be applied.
Related Sections Fuel and Chemical Management Dust and other Air Emissions Management Soils Management Biosecurity Management		

9.10 NOISE MANAGEMENT

Construction activities will generally cause temporary increases in local noise levels, however the progression of the construction crew along the linear construction corridor results in construction noise impacts being short lived at any one location.
During operation and maintenance activities on the pipeline, noise emissions may be generated by:

- vehicles and machinery travelling along the pipeline easement and access tracks
- activities such as earthworks and vegetation management
- maintenance at aboveground sites
- gas vented from pressurised equipment
- equipment noise at aboveground sites.

Noise emissions, in particular those with tonality, modulation or impulsiveness, may adversely impact local residents. All plant and facilities should be designed and operated to comply with relevant State noise regulations and *Australian Standard AS 1055 – Acoustics*.

This section outlines management measures to avoid or attenuate construction noise where there is a potential for it to result in impacts to sensitive receptors.

NOISE EMISSIONS – KEY ENVIRONMENTAL ISSUES
▪ Disturbance to local residents and other land users ▪ Disturbance to livestock and wildlife
NOISE EMISSIONS – ENVIRONMENTAL OBJECTIVES
1. To minimise construction and operational noise impacts on adjacent residents and other land users 2. To minimise construction and operational noise impacts on wildlife and livestock

NOISE EMISSIONS MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Residents/Noise complaints	• Preparation of a noise assessment of the proposed activities shall be undertaken for inclusion in planning documentation. • Where practicable, excessively noisy activities shall be scheduled for periods that are less likely to result in a noise nuisance. • Areas where the pipeline corridor will be in close proximity to sensitive receptors (residences, wildlife habitat) shall be identified during the planning phase and provisions shall be considered to minimise noise emissions during construction. • A noise complaints management procedure shall be developed during the planning phase, and implemented as part of the CEMP and OEMP (note that some regulatory jurisdictions have mandated complaints handling procedures. • Landowners and local residents shall receive adequate notice of all noisy activities associated with the project, prior to their commencement. • Where vibration is likely to be an issue, dilapidation surveys shall be undertaken to record pre-construction condition of buildings in proximity to work areas that might be affected.
	Pipeline	• Access to the pipeline easement shall be

	Easement Management and Access	conducted in a manner that adequately considers potential noise or vibration impacts. In some areas, access, particularly for heavy vehicles and equipment, may need to be restricted to specific times as determined in consultation with local authorities or landowners.
	Pipe Stringing	• Appropriate measures shall be taken as required to minimise pipe transport-related noise.
	Blasting	• Blasting program design shall conform to the appropriate noise, comfort and vibration criteria applicable in the relevant jurisdiction. Note that most jurisdictions require advance warning of blasting activities to be given to affected stakeholders.
	Pipeline Purging	• Adjacent residents shall be advised of pending venting operations prior to their occurrence. • Gas vents shall be located at an appropriate distance from residential areas and infrastructure, in accordance with relevant regulatory requirements.
	Borrow Pits	• Borrow pit location should be away from sensitive receptors and extraction activities should be scheduled for standard working hours.
	Equipment	• Equipment should be selected in consideration of its noise emissions. Where practicable, equipment should be selected that is likely to result in the lowest noise impact whilst still completing the required task. • Equipment shall be fitted with appropriate noise abatement devices (e.g. mufflers, silencers and screens) and shall be maintained in good working order.
Construction	Construction Operations	• Construction activities shall comply with all relevant regulatory requirements and guidelines pertaining to noise control. • Monitoring of construction noise should be conducted at locations of sensitive receptors, to validate noise propagation predictions and to validate requests from the sensitive receptors, if any, for additional noise reductions measures

		• Where construction is adjacent to residences, noisy construction activities shall be undertaken within standard construction hours, except where unavoidable for practical reasons or agreement is obtained from affected residents. Affected residents shall be advised in advance of when loud construction activities will occur[7]. • As part of noise management procedures in the CEMP and OEMP, noise complaints should be registered and investigated as soon as possible following its receipt. Remedial action should be undertaken as indicated by the complaint investigation, and the complainant should be advised of the proponent's response to their complaint.
Operation	Management of Pipeline Facilities	• Noise-generating equipment, such as generators, shall be located at appropriate distances from residences, and/or within noise enclosures if necessary. • Noise attenuation screens shall be provided where appropriate. • Noise from pipeline facilities shall be within acceptable regulatory limits and be subject to a monitoring program to ensure that noise emissions are within acceptable limits. • A complaints management system will be applied to operations just as for construction. Any noise complaint received should be registered and investigated as soon as possible following its receipt. Remedial action should be undertaken as indicated by the complaint investigation, and the complainant should be advised of the proponent's response to their complaint.
Related Sections Dust and other Air Emissions Management		

[7] State or Local government requirements, such as the Qld EPA, may also apply

9.11 DUST AND OTHER AIR EMISSIONS MANAGEMENT

Due to the nature of pipeline construction activities involving earthworks, dust emissions, plant and equipment exhaust emissions and hazardous materials' vapour emissions may result. Dusty conditions result from the exposure of soils, therefore many control measures relevant to erosion and sediment control are also relevant to dust control (refer to Section 9.7Drainage, Erosion and Sediment Control). This section details air emission and dust prevention and suppression measures which aim to minimise air emission levels and ensure they do not exceed acceptable limits.

Air emissions from planned gas pipeline operations are generally small in quantity. Emissions that may have an adverse effect on air quality include:

- the intentional release of natural gas during pipeline purging to allow certain maintenance activities
- the products of combustion (particularly nitrous oxides) associated with flaring
- the accidental release of odorant or of odorised gas
- vehicle and machinery exhaust emissions
- emissions from generators supporting on-site works, site camps or offices
- dust blown off un-vegetated lengths of the pipeline alignment.
- dust emissions from vehicle and equipment movement

	DUST AND OTHER AIR EMISSIONS – KEY ENVIRONMENTAL ISSUES
	▪ Odour emissions ▪ Temporary reduction of amenity associated with dust ▪ Soil erosion and sedimentation of land and water ▪ Depletion of water resources ▪ Impacts on sensitive flora and fauna ▪ Inconvenience to sensitive receptors such as residents and construction workforce ▪ Generation of greenhouse gases and other reportable emissions
	DUST AND OTHER AIR EMISSIONS – ENVIRONMENTAL OBJECTIVES
	1. To minimise impacts on the community and the construction workforce 2. To minimise impacts on land, water and air quality 3. To minimise impacts on flora and fauna 4. To reduce water use 5. To reduce emissions across the project, particularly those that are reportable

6. To minimise the creation of emissions-related safety hazards

DUST AND OTHER AIR EMISSIONS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	General considerations	• Dust suppression strategy shall plan for prevention and avoidance of dust generation in the first instance, before consideration of dust suppression measures • Existing climate and conditions should be evaluated to determine the most appropriate dust suppression methodology, having regard to limited water resource availability in dry climates or drought conditions. • Planning should include investigation of ground engineering products as part of the dust suppression strategy. • Water supplies for dust suppression should be identified during the planning phase. • Provision should be made to monitor emissions through the construction period, to enable effective management. This should include accounting for all on-site emissions. • Consideration should be given to adopt a purchasing policy that encourages procurement of reduced- emission vehicles, machinery, equipment and plant items.
	Pipeline Purging	• The planned release of gas from pipelines, including flaring of purged gas, shall be minimised for economic and greenhouse gas emissions reasons, and in compliance with any applicable approval conditions. • Where practicable, planned gas releases, including flaring of purged gas shall be conducted under favourable meteorological conditions that will facilitate rapid atmospheric dispersion of the gas. • Gas vents shall be located an appropriate distance from residential areas and infrastructure, in accordance with relevant regulatory and Australian

		Standards requirements. • Adjacent residents and local authorities shall be advised of any pending venting operation prior to commencement of the activity.
Construction	Construction Operations	• Vehicles shall travel at appropriate speeds to minimise generation of dust - generally a maximum speed of 20kph over unsealed site roads and tracks, at work and camp sites, and at the pipeline construction area, is appropriate. • To minimise the generation of dust, traffic movements on the RoW shall be minimised to essential movements only in dry conditions • Known sources of air emissions shall be identified, and treated by an appropriate mitigation measure, such as location away from sensitive receptors, strict use of suppression measures, covers or seals, location downwind of receptors, etc. • Road surfaces shall be constructed materials that minimise dust creation, particularly if frequently trafficked and adjacent to residences. • Multiple plant or equipment close to sensitive receptors may need to be monitored for exhaust emissions as well as noise production. • Plant and equipment to be maintained to minimise emissions. Any plant releasing heavy emissions should be removed and serviced immediately. • Minimise ground disturbance through retaining existing groundcover vegetation where possible. • Water should be applied to exposed soils, as required, to prevent dust generation. Water supplies shall be of an appropriate quality and should not lead to soil contamination (e.g. through use of saline groundwater or contaminated waste water). • In heavily-trafficked areas, or where water resources are scarce, reduced speed limits or the use of dust stabilisers may be employed. In problem areas it may be appropriate to remove additional soil layers down to the harder subsoils. • In areas of stony soils, trench spoil can be sieved

		into soil and stone fractions, with the soil used for backfill, and the stone fraction applied to road surfaces as a dust suppressant • Appropriate signage should be installed where dust conditions are high and in proximity to adjacent public roads. • Dust generated from soil stockpiles shall be minimised. Effective mechanisms include ensuring exposure time is minimised, applying water, covering stockpiles with protective materials such as hessian or tarpaulins, or by applying polymers or sowing sterile grass as a longer term stabiliser on stockpiles or exposed slope batters. • If normal methods of dust stabilisation fail to suppress dust created by particular activities to acceptable levels,, those particular activities may need to be temporarily halted until either dust generating conditions subside or an alternative, less dusty form of the activity is identified, or additional methods of dust stabilisation are identified and effectively applied.
	Blasting	• Monitoring of noise, vibration and dust resulting from controlled blasts should be conducted in areas where sensitive receptors are impacted.
	Reinstatement and Rehabilitation	• Progressive reinstatement shall be undertaken to reduce the distance of open RoW and associated potential for dust generation.
Operation	Pipeline Easement Management and Access	• If dust problems still occur at particular sections of the easement, the following measures should be adopted as appropriate: o revegetate using existing species and prevent access until vegetation is established. o ensure speed limits are appropriate and being observed. o minimise vehicle movements or harden road surfaces. o use geotextiles, hessian or mulched vegetation on localised areas. o if available, spray water on the problem

		areas. • In areas of heavy "bulldust", the easement may be stripped and the more stable subsurface watered to provide a firm base (although this may not always be possible for very deep bulldust)[8].
	Management of Pipeline Facilities	• Pipeline licensees should maintain an accurate record of operational emissions. • Where technically and economically feasible, natural gas should be flared rather than vented. • Any venting should be conducted in compliance with the requirements of AS 2885.3 • Where required, odorisation of gas (i.e. mercaptan dosing) should be undertaken in a manner that minimises the risk of accidental release of odorant. Odorising equipment should be appropriately maintained and waste materials should be disposed of in a manner which minimises opportunities for uncontrolled odour releases.
	Pipeline Spill Prevention and Response	• Periodic leakage surveys shall be conducted to detect fugitive gas releases from the pipeline, and any reports of gas odours in the vicinity of the project works shall be investigated as a priority. • In the case of a spill of odorant, it should be controlled and cleaned up in accordance with its Safety Data Sheet, and the approved OEMP spill response procedure.
Related Sections Waste Management Noise Management		

9.12 VISUAL AMENITY MANAGEMENT

Visual amenity is a measure of the visual quality of a landscape, area or site experienced by the residents, workers or visitors. It is the cumulative impacts on the visual components of a

[8] Soybean oil soapstock, a by-product of the soybean oil production process, is an environmentally friendly, biodegradable material used in some overseas dust suppression situations, exhibiting much longer effective life than water. When used at suggested levels, this material does not migrate into the groundwater nor harm agricultural crops. At the time of writing the authors were not aware of its use in Australian situations, and proposals for use may attract regulator and / or community scrutiny

locality that visual amenity is judged upon. Visual amenity is an intrinsic component of the planning and assessment elements of all pipeline projects.

Proponent assessment of visual amenity should consider the following factors:

- Temporary activities and infrastructure associated with construction
- Long term activities and infrastructure associated with operations
- Short term activities associated with operational maintenance of the pipeline
- Short term activities and infrastructure associated with decommissioning

	VISUAL AMENITY – KEY ENVIRONMENTAL ISSUES
	▪ Presence of workforce and ground disturbance activities ▪ Project visual impacts and modification on existing viewscape ▪ Re-instatement and rehabilitation of existing environment
	VISUAL AMENITY – ENVIRONMENTAL OBJECTIVES
	1. To minimise impact on sensitive receptors 2. To minimise visual changes to the viewscape 3. To ensure rehabilitation and re-instatement following construction minimises permanent visible change as far as is practicable

VISUAL AMENITY MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	Pipeline Easement Management and Access	• Utilisation of existing roads, tracks and areas of disturbance where practicable. New access tracks and roads should be designed and constructed to avoid or minimise visual impacts in sensitive areas. Mitigation may include screening to minimise line of sight.
	Clearing	• Relevant stakeholders and landowners shall be consulted during the planning phase to identify aspects of visual amenity that are valuable to them. These shall be avoided by the construction works as far as is practical. • Consideration should be given to retention of significant vegetation patches or individual trees

		within the approved corridor, where there are significant visual amenity values to protect. • In the case of protected or retained vegetation within the pipeline construction corridor, where there are significant natural, heritage or visual amenity values to protect, the vegetation shall be flagged for avoidance.
	Reinstatement and Rehabilitation	• Pre-construction survey should include establishment of the visual landscape prior to construction. This survey should include photographs and GPS references as required for benchmarking post rehabilitation. • Appropriate methods of reinstatement shall be planned to reflect the surrounding environment. Rehabilitation plans should consider creating a positive visual outcome as far as is possible.
	Borrow Pits	• Borrow pits shall be located in a manner which minimises aesthetic impacts, e.g. shielded by vegetation or landforms, or situated away from public areas.
	Construction Camps and Worksites	• Where practicable, sites shall be located in a manner which minimises visual impact and where casual viewing likelihood, such as from a passing road, is reduced.
Construction	Pipeline Easement and Access	• Site-specific screening plantings may be necessary at critical viewing locations where unacceptable visual impacts are evident, e.g. some road crossings or aboveground pipeline facilities such as scraper stations.
Operation	Management of Pipeline Facilities	▪ Pipeline facilities shall be kept in a clean and tidy condition. Where visual treatments, such as painting or screening by vegetation or other means, were applied during construction, such treatments shall be maintained in an effective condition. ▪ In residential areas, or areas used for tourism or for social or leisure pursuits, changes to visual presentation of the project should be considered from time-to-time and new measures adopted where necessary. Examples of such changes could include refreshment of natural screens, repainting, recolouring, etc.

Related Sections

Flora Management

Traffic Management

Waste Management

9.13 TRAFFIC MANAGEMENT

Traffic assessment and management is an important component of pipeline planning and construction as pipeline projects have the potential to significantly alter local traffic regimes. Potential negative impacts on local traffic regimes can occur during:

- Transportation of pipe sections along the road network to storage areas or the pipeline easement;
- Mobilisation and demobilisation of construction machinery, equipment and camps;
- Construction activity at or near road crossings; and
- Movement of the construction workforce between construction sites and accommodation facilities.

Local amenity and air quality can be adversely affected by project vehicle and plant movements, particularly during the construction phase. A traffic management plan can include site-specific mitigation measures aimed at reducing the overall impact of increased traffic volumes and variations in normal traffic conditions.

	TRAFFIC MANAGEMENT – KEY ENVIRONMENTAL ISSUES
	▪ Safety hazard resulting from increased traffic ▪ Traffic impact on flora, fauna and cultural heritage ▪ Soil erosion and degradation on the RoW and on access tracks ▪ Reduction in air quality and visual amenity ▪ Increased noise and vibration from increased traffic
	TRAFFIC MANAGEMENT – ENVIRONMENTAL OBJECTIVES
	1. To minimise the impact of noise, visibility and odour resulting from traffic 2. To minimise disturbance from traffic to flora, fauna and cultural heritage 3. To minimise soil erosion and degradation 4. To minimise unnecessary traffic movements 5. To work with road authorities, councils and communities to develop appropriate traffic management strategies

TRAFFIC MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	General considerations	• A traffic management plan should be produced outlining assessment of the most effective methodology for construction logistics (transport of equipment, plant, materials including pipe, work force etc.). This should be undertaken in consideration of the transportation network surrounding the proposed pipeline corridor and outline any restrictions (e.g. structures with height or weight restrictions, unsuitable roads, etc.). • Pipe transport routes, including utilisation of existing roads and tracks, shall be determined in consultation with relevant stakeholders, e.g. regulators, landowners and communities, with a view to minimising hazards, road damage and adverse impacts. • Access/egress points to the RoW should be well planned with turning areas, temporary stockpiles and other areas of additional workspace being identified during the planning phase. • Preference should be given to the utilisation of existing roads, tracks and areas of disturbance where available. • Application of relevant legislative and design requirements where appropriate. Pipeline access shall be designed and maintained to accommodate the intended construction traffic volume. • Any vegetation removal associated with new access or widening of existing access must be assessed during the planning process and will be included in the calculations required to scope any necessary project offsets.
Construction	Pipeline Easement Management and	• Appropriate measures shall be employed to prevent surface damage to public roads, e.g. limiting dirt track access during wet weather and

	Access	protecting bitumen surfaces where tracked machinery is required to cross roads. • Where vehicles are required to cross existing utilities (e.g. pipelines, fibre optic cables) permits may be required and protective measures such as berming or bridging may be necessary, particularly on aboveground utilities, in consultation with the utilities owner. • Appropriate measures shall be applied to ensure vehicles remain on designated access roads and tracks, and within defined a pipeline construction area and associated work/camp sites, e.g. workforce education, signs, boundary markers and fences, strictly enforced non-compliance measures. • Vehicles shall travel at safe speeds that minimise dust generation and access track deterioration. • As a general rule, gates shall be left as they are found or as signposted. If closed gates are required to be opened for extended periods (e.g. convoy passage) they shall not be left unattended unless otherwise agreed with the landowner. • Vehicle parking shall be restricted to the pipeline construction corridor and other pre-designated areas. • Parking under trees shall be discouraged to prevent root zone soil compaction, to prevent root damage and to prevent impairment of water infiltration into the soil.
	Clearing	• Cleared vegetation shall be stockpiled separately in a manner which does not impede vehicles.
	Grading	• Vehicles shall not drive on stockpiled topsoil. It is important to preserve the soil structure as far as is possible to gain good rehabilitation outcomes. • Stockpiled soil shall not impede the movement of vehicles across the pipeline construction area. Stockpile breaks shall coincide with designated access roads or tracks, fence lines and gaps in stockpiled vegetation.
	Pipe Stringing and Welding	• Pipe shall be strung allowing gaps for the passage of vehicles between the line of pipe. Gaps shall

		coincide where possible with access roads or tracks, stock and wildlife trails, boundary fences and gaps in stockpiled vegetation. • Welded pipe sections (pipe strings) shall not impede vehicle passage. Gaps shall be left which coincide with the gaps in the topsoil and vegetation stockpiles, designated access tracks/roads and fence lines, and shall be located in consultation with relevant landowners.
	Watercourse Crossings	• Access tracks and roads shall, where practicable, avoid crossing waterways. Where necessary, water course crossings shall be: ○ via existing crossings ○ on a formed track through the stream bed within the pipeline construction area corridor at dry waterway crossings (e.g. ephemeral streams). However, access shall be limited, where practicable, to vehicles and equipment essential to construction at the site, or ○ via culvert causeways, bridges or other such crossing structures.
	Construction camps and worksites	• Site camps and worksites shall be constructed in accordance with the site layout plan. • Sufficient parking and turning space shall be provided around construction camps and worksites away from areas of native vegetation.
	Reinstatement and Rehabilitation	• Compaction relief shall be undertaken as required by ripping or scarifying soils along the contours, particularly on heavily-trafficked areas such as the pipeline construction work site, temporary access roads and turning circles, and in trafficked areas of camps and work sites. Figure eight or zigzag rip lines may be appropriate in flat to low gradients to prevent rilling.
Operation	General Provisions	• Any on-easement access will be in accordance with the provisions of the OEMP. • Vehicle parking shall be restricted to designated areas. • Parking under trees shall be discouraged to

		prevent root zone soil compaction, to prevent root damage and to prevent impairment of water infiltration into the soil.

Related Sections

Noise Management

Dust & other Air Emissions Management

Weed Management

Biosecurity Management

9.14 FUEL AND CHEMICAL MANAGEMENT

The use and storage of oils, fuel and chemicals on-site can pose a threat to the environment and personnel if not managed properly. Management procedures must be put in place prior to the introduction and use of any chemical on the pipeline easement or associated facilities.

Control of these substances, from both environmental and safety aspects, relies primarily on the selection of chemicals that pose less risk to the safety of employees or the environment. Emphasis is then placed on the safe and secure transport, storage and application of chemicals to prevent harm to the environment.

FUEL AND CHEMICAL MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Contamination of soil and water, including ground water
- Safety and health hazards to the workforce and the public
- Air and odour emissions

FUEL AND CHEMICAL MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To prevent contamination of soil and water
2. To avoid unacceptable safety or health hazards to the workforce and the public
3. To minimise atmospheric emissions

FUEL AND CHEMICAL MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management Measures**
Planning	General provisions	▪ Detailed spill response procedures, for land and water, shall be formulated during the project planning phase; these are to be supplemented, using applicable Safety Data Sheets, if / when additional fuels or chemicals are proposed to be introduced to the site during construction or operations. ▪ Targeted workforce training shall be conducted in fuel and chemical handling, spill response and materials recovery procedures for land and water. ▪ Appropriate fuel and chemical handling procedures shall be adopted, aiming to avoid spills onto land or into water (e.g. use of spill mats), and to reduce

		handling hazards to project personnel. ▪ Induction will include training as required on appropriate fuel and chemical handling procedures developed for the project. ▪ Provision should be made to allow for deployment of appropriate spill response equipment, including containment and recovery equipment, to be readily available on-site close to active work fronts, maintenance areas and site offices.
Construction	Pipeline Easement Management and Access	• The storage and handling of fuels and chemicals shall comply with all relevant legislation and *Australian Standard AS1940 – The storage and handling of flammable and combustible liquids*. • Safety Data Sheets (SDSs) should be obtained when purchasing chemicals and should be available on-site for all chemicals stored and handled. Persons handling chemicals shall wear PPE as designated in the applicable SDS, and shall be provided with appropriate training. • The minimum practicable volume of chemicals should be stored on-site. • Chemicals use should be minimised where practicable.
	Pipe Stringing and Welding	• Associated consumables such as cleaning solvents, primer and dangerous goods shall be suitably stored in accordance with the applicable SDS.
	Hydrostatic Testing	• The use of environmentally-harmful chemical additives in the hydrotest water, such as corrosion inhibitors and biocides, shall be avoided where practicable. Spent hydrotest water may need to be held for testing and treatment before release to land.
	Construction camps and worksites	▪ Fuels, lubricants and chemicals shall be stored in accordance with their SDS and, where practicable, handled within containment facilities (e.g. bunded areas, leak proof trays) designed to prevent their release to the environment. ▪ SDS should be obtained when purchasing chemicals and should be available on-site for all chemicals stored and handled. Persons handling chemicals shall wear

		appropriate PPE, as defined in the applicable SDS and shall be provided with appropriate handling and usage training. ▪ The minimum practicable volume of chemicals should be stored on-site. ▪ Chemical use should be minimised where practicable. ▪ Adequate PPE must be on-site to allow for the handling of fuel and chemicals stored on site.
	Spill Prevention and Response	▪ Spill response kits will be adequately provisioned and maintained, and positioned sufficiently close to active construction activities to enable effective deployment in the event of a fuel or chemical spill. ▪ If a fuel or chemical spill occurs outside a bunded area, spill response procedure must be followed to control, isolate and remediate the spill. ▪ An inventory of spill response kits, their contents and location should be prepared and maintained throughout construction. ▪ Toolbox meetings should include regular attention to spill response processes, to ensure that work crews are refreshed and understand spill response procedures and subsequent reporting requirements. ▪ Spill response drills should be conducted when and where appropriate (for example, when a new chemical or fuel is introduced to the site, when there are numbers of new personnel, etc)
Operation	Management of Pipeline Facilities	▪ The storage and handling of fuels and chemicals shall comply with all relevant legislation and *Australian Standard AS1940 – The storage and handling of flammable and combustible liquids*. ▪ Fuels, lubricants and chemicals shall be stored in accordance with their SDS and, where practicable, handled within containment facilities (e.g. bunded areas, leak proof trays) designed to prevent releases to the environment. ▪ Where practicable, fuels and chemicals shall not be stored or handled in the vicinity of natural or built waterways or water storage areas (e.g. streams, canals, dams, lakes). ▪ Areas for storage of liquids such as oil or pipeline liquids should be bunded and drains from bunds kept

		clear of foreign material.
	Spill prevention and response	▪ Spill response kits will be adequately provisioned and positioned at permanent facilities and during repair or maintenance works, to enable their effective deployment should a fuel or chemical spill occur. ▪ If a fuel or chemical spill occurs outside a bunded area, spill response procedure must be followed to control, isolate and remediate the spill. ▪ An inventory of spill response kits, their contents and location should be prepared and maintained. ▪ Toolbox meetings should include regular attention to spill response processes, to ensure that work crews are refreshed and understand spill response procedures and subsequent reporting requirements. ▪ Spill response drills should be conducted when and where appropriate (for example, when a new chemical or fuel is introduced to the site, when there are numbers of new personnel, etc).
Related Sections Water Management Waste Management Pipeline Failure and Response		

9.15 FIRE RISK MANAGEMENT

Pipeline construction activities have the potential to temporarily increase the risk of bushfires. Although bushfire risk in relation to pipeline construction is considered low, there are two primary issues for consideration: Firstly, the potential for construction activities to generate a bushfire, and secondly, the potential for bushfires to impact on the pipeline or associated infrastructure, assets or activities.

Considering pipeline operations and maintenance activities, generally, the risk of fire ignition and spread is considered low.

Potential bushfire ignition sources associated with pipeline construction are predominantly cutting, welding and grinding activities, as well as the operation of equipment (e.g. petrol driven pumps) or vehicles in high fire hazard areas or on days of extreme fire risk. This section provides guidelines for conducting pipeline construction, operational or maintenance activities in a manner which minimises fire risks.

It should be noted that the residual risk after application of risk minimisation strategies can still be high if proposed for days of extreme fire danger (referred to as Catastrophic in some jurisdictions) and any planned activities within the pipeline corridor on days of extreme fire danger rating should be separately risk-assessed prior to their commencement.

FIRE RISK MANAGEMENT – KEY ENVIRONMENTAL ISSUES
▪ Injury to the public or project personnel ▪ Damage to, or loss of, flora, fauna or habitat ▪ Loss of or damage to primary industry production ▪ Loss or damage to homes or property ▪ Damage to, or loss of, third party infrastructure
FIRE RISK MANAGEMENT – ENVIRONMENTAL OBJECTIVES
1. To minimise the risk of fire ignition 2. To prevent the spread of fire in the event of ignition 3. To protect the public and project personnel 4. To minimise damage to or loss of private or public property or third=party infrastructure 5. To minimise damage to or loss of flora, fauna or habitats 6. To provide adequate response in the event of ignition

FIRE RISK MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines: See Appendix 4.		
Phase	**Activity**	**Management measures**

Planning	Fire Prevention and Preparedness	• Measures to prevent and respond to fire incidents should be developed in the project planning phase in accordance with:
		  ○ AS 2885
		  ○ fire prevention planning
		  ○ emergency preparedness and response planning.
		• Project planning should include provisions to address the risk posed by project personnel smoking, including the identification of no-smoking places and times, and the designation of smoking areas, as required.
		• Prior to the commencement of construction, consideration must be given to fire prevention and response based on a risk assessment of proposed activities. A fire prevention management strategy shall be incorporated into the CEMP, and shall include bushfire prevention resourcing, emergency preparedness provisions, emergency contacts, equipment, fire watcher(s), response procedure and training (including drills), and shall be linked to the Project's safety and emergency response procedures.
		• Responsibility for maintaining the fire prevention management strategy shall be allocated.
		• Regular and timely consultation shall be undertaken with all relevant regulatory authorities and fire / bushfire services, and planning will ensure compliance with relevant fire restrictions, notification requirements, permitting procedures and requirements.
		• Fire risk management measures to be applied during the planning phase may include:
		  ○ aligning the pipeline to avoid high fire danger areas

		○ scheduling construction to avoid high fire danger periods. ○ allowing for postponement of construction in fire prone areas during extreme fire rating periods. ○ allowing for flammable material to be regularly cleared from around potential fire ignition sources. ○ planning for the use of tarpaulins or fire resistant mats at welding or grinding stations on days of high fire danger. ○ documenting procedures to ensure flammable materials are cleared from the immediate vicinity of field equipment which may pose a potential fire hazard e.g. petrol driven pumps, generators. ○ maintenance and operation of all machinery and equipment so as to comply with relevant fire safety standards thus minimising fire risk. ○ documenting a requirement that machinery and vehicles not in use shall be parked with the ignition off in areas free of flammable material and vegetation (e.g. not parked over shrubs, tall grass or cleared vegetation residue). • Fire response preparation measures shall include: ○ purchase, deployment and maintenance of appropriate fire fighting equipment at all work and camp sites in accordance with applicable fire safety regulations. ○ equipping construction machinery and vehicles with fire fighting equipment (e.g. fire extinguishers, water knapsacks, rakehoes) in accordance with the applicable fire safety regulations. ○ having fire control equipment, such as earthmoving machinery and water trucks or mobile tanks, available for fire control at the construction site during work operations in high fire risk areas or at times

		of extreme fire danger rating. • Construction workforce bushfire education and training shall be undertaken as appropriate, detailing fire prevention and safety, instructions, personnel responsibilities and basic fire suppression techniques.
	Pipe Stringing and Welding	• Precautions shall be taken to minimise fire risk in accordance with the requirements of relevant fire protection legislation and regulations. • Consultation with relevant local fire and emergency service authorities should also be undertaken to discuss high risk activities during months of heightened fire risk. • Hot works permits and permits to undertake works may be required from local fire / bushfire or other authorities prior to commencement of welding, cutting or grinding activities, particularly on days of extreme fire danger rating.
Construction	Clearing	• Stockpiling vegetation at the side of the pipeline RoW should be risk-assessed in terms of fire risk, and appropriate management measures applied as required.
	Pipe Stringing and Welding	• Pipe shall be strung, allowing gaps for emergency response access across the line of pipe. Gaps shall coincide where possible with access roads or tracks, stock and wildlife trails, boundary fences and gaps in stockpiled vegetation.
	Construction camps and worksites	• Adequate and properly maintained fire fighting equipment shall be provided at camps and worksites. Fire breaks around offices and camps should also be installed and maintained, as required.
Operation	General Operation	• Pipeline operations and maintenance shall be conducted in accordance with the requirements of regulatory and local fire authorities. In particular, operations shall comply with relevant fire restrictions, notification requirements and permitting procedures. • Any non-essential maintenance works should be avoided on days of extreme fire rating or total fire ban.

		• All equipment shall comply with relevant fire safety standards. • Machinery and vehicles not in use shall be parked in areas of low fire risk (e.g. not parked over shrubs, tall grass or cleared vegetation debris) with the ignition switched off. • Vehicles shall be regularly cleaned and checked to ensure that combustible materials such as grass and debris do not build up in critical areas where ignition could occur. • Smoking shall be banned in all project vehicles • Where flammable or combustible chemicals are required to be stored on-site, appropriate fire-fighting equipment shall be available; incompatible chemicals should not be stored together, and where practicable, flammable liquids should be stored in fire-resistant cabinets.
	Management of Pipeline Facilities	• Fire fighting equipment shall be maintained on-site in areas of higher fire risk (e.g. at facilities close to residences, cropping lands or areas of sensitive native vegetation). • Where appropriate, the ground surface of facilities will be hardened (eg, gravelled) to reduce fire risks and prevent weed infestation.
Related Sections Stringing, Coating and Joining		

GLOSSARY OF TERMS AND ABBREVIATIONS

Abandonment	See 'Decommissioning'
Acid sulfate soil	Soils which form when sulfate-rich soils or sediment are exposed to oxygen. Drainage or other disturbance which causes oxidisation results in the release of acidic leachates from the soil
AGA	Australian Gas Association
Anthropological	Pertaining to human societies
ANZECC	Australian and New Zealand Environment and Conservation Council
APPEA	Australian Petroleum Production and Exploration Association
ARPEL	Regional Association of Oil, Gas and Biofuels Sector Companies of Latin America and the Caribbean
Aspect	Element of an organisation's activities, products or services that can interact with the environment
AS 2885	Australian Standard AS 2885 Pipelines – Gas and liquid petroleum
Bell hole	An enlarged area of trench
Borrow pit	Surface excavation for the extraction of materials such as sand or clay
Bulldust	Highly dispersive soil which becomes powdery (talc-like) when disturbed, with potential to cause large movement of sediment and soil particles due to wind and water erosion
Bund	An earth, rock or concrete wall constructed to prevent the inflow or outflow of liquids
Cathodic protection system	Application of an electrical current to the pipeline exterior to prevent the electrochemical corrosion
CEMP	Construction Environmental Management Plan
Clean Water Diversion	A form of obstruction that directs rainwater or runoff that is yet to enter the site away from disturbed areas, keeping it 'clean' from any on-site contamination, usually from sediment
Clear-and-grade	The preparation of the right of way for vehicular movement, trenching and other construction activities, involving clearing vegetation and other obstacles from the right of way, grading topsoil to the edge of the right of way, and creating a safe working surface (and slope) for construction
Decommissioning	(also Abandonment) The process by which a pipeline is made inoperative at the end of its useful life. This involves dismantling

	and decontaminating the pipeline safely to the satisfaction of the regulator
Dieback	A soil borne plant pathogen (*Phytophthora cinnamomi*), commonly referred to as cinnamon or dieback fungus. The disease affects the roots of native Australian plants, in particular forest tree species, leading to their eventual decline. The fungus thrives in newly-created situations of perpetual wetness
DTI	Department of Trade and Industry (United Kingdom) (now Department for Business Innovation and Skills)
Easement	A right held by the proponent to make use of the land (in this case, for the installation and operation of a pipeline)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC	*Environment Protection and Biodiversity Conservation Act, 1999*
Erosion control berms	Compacted earthen banks strategically placed to divert erosive and/or silt-contaminated water away from vulnerable areas such as the pipeline corridor or water resources
ESD	Ecologically Sustainable Development. Defined by the Australian National Strategy for ESD (1992) as "*development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends*"
Flow line	A pipeline used to relay raw gas, condensate or oil from a well to a processing plant
Gabions	Small rocks enclosed within wire mesh, used to stabilise slopes
Geofabric or geotextile	Permeable or semi-permeable fabric for placing on ground surfaces to minimise erosion
Grading	Levelling of the right of way using graders, backhoes or bulldozers
Hazard	The potential of something to cause injury or harm
Horizontal directional drilling	One method by which a pipeline tunnel is drilled at a shallow angle under a crossing (e.g. a waterway, wetland, road or railway) through which the pipe is then threaded
Hydrocarbon	A class of organic chemical compounds consisting primarily of the elements hydrogen and carbon. Petroleum hydrocarbons are complex mixtures of hydrocarbons ranging from light gas to heavy oil compounds. Some common petroleum hydrocarbons include methane, ethane, propane, butane, naphtha, condensate, crude oil and asphaltenes
Hydrostatic testing (or	A pipeline testing process used to test welds and pipeline integrity

hydrotesting)	in high pressure hydrocarbon pipelines. The process involves filling the newly constructed pipeline with pressurised water or other medium enabling the detection of leaks.
Impact	Result of an organisation's aspect actually causing an environmental harm
Landowner	A general term used to refer to the legal owner or manager of a parcel of land. It may be a private landowner, Government or private utility, or a Government Agency responsible for management of a particular parcel of Crown land (e.g. National Parks or Forestry areas).
Line list	A document for construction contractors which itemises the management procedures to be undertaken and which contains site-specific or property-specific information for field reference
Line management	Each individual employee and contractor operating within an agreed management structure or 'chain of command'
Mainline valves	Valves located in a pipeline at intervals along its length
MCMPR	Ministerial Council on Mineral and Petroleum Resources
Padding	Fine-grained soil placed in the trench to protect the pipeline coating from damage
PIG	Pipeline Inspection Gauge. A tool which is inserted into a pipeline and propelled along by hydrotest water or the gas flow, to clean and inspect the pipe internally
Problematic Soils	A soil whose properties increase the risk of environmental harm and where additional management measures may be required. Such soils include dispersive soils, acid sulfate soils, contaminated soils, soils affected by dryland salinity, sand or serpentine soils
Purging	Removing all air from the pipeline, using gas
Radiography	Non-destructive examination of pipeline welds using X-ray to detect defects
Rehabilitation	Rehabilitation is the process of preventing a site or area from causing further environmental harm, and customarily involves restoring the site or area's environmental attributes by returning an area to its pre-disturbance state. The process may include initial stabilisation, followed by regeneration, revegetation or restoration dependent upon the defined scope of works. Commonly the main objective of rehabilitation is either reinstatement of, or improvement on, the pre-existing condition
Reinstatement	Reinstatement is the process of re-establishing a pre-existing physical condition, and usually involves bulk earth works and

	structural replacement of pre-existing attributes of a site, such as soil surface topography, drainage, culverts, fences and gates, etc
Restoration	Restoration is the replacement of structural habitat complexity, ecosystem processes, services and function from a *de novo* or degraded site to that of a pre-determined or analogue state
Riparian	Relating to the bank or shore of a natural watercourse, such as a river or stream
Ripping	Raking or shallow ploughing to relieve compaction and to aerate soils
Rip-rap	Natural material such as rock or timber used to protect susceptible areas, such as reinstated creek beds and banks, or soils at water discharge receiving areas, from erosion caused by water flows
Risk	The probability that harm or injury may occur to persons or the environment
RoW/ROW	Right of Way. The works area required to construct the pipeline. All pipeline construction work is restricted to the RoW
Scraper stations	An aboveground facility used to launch and receive PIGs into and from the pipeline system.
SDS	Safety Data Sheet, also referred to as Material Safety Data Sheet (MSDS)
Side-boom tractors	Construction equipment, consisting of a tractor with a boom crane, designed to permit lowering of the pipe string into the trench
Skids	Timber blocks, similar to railway sleepers, used to keep the pipeline off the ground
Stringing	Laying the pipe adjacent to the pipeline trench
Third party	Those parties not directly associated with the pipeline - such as landowners, government, other commercial interests (e.g. power utilities, mining companies) and the general public.
Trench blocks (trench breakers)	Impermeable barriers placed in the trench during pipelaying to prevent erosion along the pipeline in the backfilled trench. They are generally installed adjacent to watercourses and in sloping terrain, and are designed to allow water to seep up and out of the backfilled trench, where it is diverted away from the pipeline construction area by erosion control berms
Trench plug	Short section of trench left unexcavated to allow passage of stock or wildlife across the trench
Trench spoil	Soil from the pipeline trench
Trench water	Water (usually shallow groundwater) in the pipeline trench
Waters/Watercourses	Sources of water including drainage channels, streams, creeks, rivers, dams and other water bodies. Waters can also include

trench and hydrotest discharge waters.

FURTHER READING

American Water Works Association (AWWA) Standard for Water Quality Standard

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Standards Australia (2002) *AS 2885.2 Pipelines – Gas and Liquid Petroleum – Welding (AS 2885.2:2002)*

Standards Australia (2001) *AS 2885.3 Pipelines – Gas and Liquid Petroleum – Operation and Maintenance (AS 2885.3:2001)*

Standards Australia (2003) *AS 2885.4 Pipelines – Gas and Liquid Petroleum – Offshore (AS 2885.4:2003)*

Standards Australia (2002) *AS 2885.5 Pipelines – Gas and Liquid Petroleum – Field Pressure Testing (AS 2885.5:2002)*

Standards Australia (2001) *AS 1579 – Arc Welded Steel pipes and fittings for water and waste water*

Standards Australia (2001) *AS 1281 Cement mortar lining of steel pipes and fittings*

Standards Australia (2000) *AS 2129 Flanges for Valves and pipe fittings*

Standards Australia (2004) *AS 4087- Metal Flanges and AS/NZS 2280 Ductile Iron Pipe and Fittings.*

Standards Australia (2004) *AS/NZS 31000 Risk Management. (AS/NZS 31000:2009)*

Standards Australia (2004) *AS/NZS ISO 14001: Environmental Management Systems – Requirements with guidance for use (AS/NZS ISO 14001:2004)*.

Standards Australia (2004) *AS/NZS ISO 14004 Environmental Management Systems – General guidelines on principles, systems and supporting techniques (AS/NZS ISO 14004:2004).*

Standards Australia (2003) *AS/NZS ISO 19011 Guidelines for Quality and/or Environmental Management Systems Auditing (AS/NZS ISO 19011:2003).*

Victorian Environment Protection Authority (EPA) (1996) *Best Practice Environmental Management Series – Environmental Guidelines for Major Construction Sites*

Victorian Water Industry Association Inc & Victorian Farmers Federation (2008), *Pipeline Easement Guidelines*.

Water Service Association of Australia, *Environmental Management Guidelines for the Australian Water Industry.*

APPENDICES

APPENDIX 1: ABOUT APIA

The Australian Pipeline Industry Association Ltd (APIA) is the peak national body representing the interests of Australia's transmission pipeline sector. It has a diverse membership base with approximately 400 members including contractors, owners, operators, advisers, engineering companies and suppliers of pipeline products and services. APIA's current membership is predominantly involved in the high-pressure transmission of gas, however, the Association welcomes membership of companies and individuals involved in the transmission via pipelines of other products including potable and recycled water, LNG and CO_2, petroleum and petrochemical liquids, minerals and sand slurry, sewage and wastewater removal, powerline and cable conduits.

APIA has been based in Canberra since January 1998 and has developed a strong presence and profile. The Association has a full-time team comprising a Chief Executive, Business Manager, Policy Adviser, Membership Officer and Functions/Administration Officer plus part-time Research and Technical Policy Managers and an Accounts Administrator.

The APIA web page at www.apia.net.au is a vital tool for members, providing access to specialist industry information. APIA manages and promotes an Annual Convention and Exhibition as well as a comprehensive program of seminars, luncheons and dinners. APIA also provides information and promotes the interests of the pipeline industry through public presentations, newspaper feature articles, editorial comment in *The Pipeliner* and other publications and media releases as well as a regular Chief Executive Brief to members.

An important role for APIA has been its industry research programs and the Association has strong working relationships with leading institutions. As part of this research focus, APIA has been a leading proponent in the development of the industry technical standard, AS2885.

APIA's Mission

To represent and provide services to our members to deliver a strong and dynamic pipeline industry.

APIA's Key Objectives

- Be an advocate for the industry
- Maintain a viable Association with an active membership
- Assist the industry to maintain its leadership in the management of the environment, health and safety
- Maintain research & development and knowledge transfer programs that assist in the efficient and safe construction, operation and maintenance of pipelines

A streamlined Standing Committee structure enables APIA to progress its core priorities.

APPENDIX 2: APIA ENVIRONMENT POLICY

APIA recognises the pipeline industry's responsibility to the community regarding environmental protection, and will promote the adoption of all practicable measures to ensure that pipeline planning and design, construction, operation and decommissioning is conducted in an efficient and environmentally responsible manner.

In support of this commitment APIA will promote through example, as appropriate, and encourage APIA member companies to:

- Embrace a proactive approach to environmental management in the knowledge that environmental impacts can be prevented or minimised
- Comply with relevant legislation, regulations, standards and guidelines for the protection of the environment and, in their absence, adopt the best practicable means available to prevent or minimise adverse impacts
- Actively work with government agencies and statutory bodies in drafting legislation, policies, standards and procedures for environmental protection
- Develop and maintain management systems for self-regulation which identify, document, control and monitor environmental risks and monitor compliance with environmental requirements with the intention of continual improvement
- Incorporate environmental management into the planning, acquisition, design, construction, operation, decommissioning and divesture of all pipeline related businesses and facilities
- Implement appropriate strategies that aim to minimise greenhouse gas emissions
- Implement appropriate waste management strategies based on the principles of reduce, reuse, recycle and appropriate disposal as the final option
- Ensure that all employees and contractors are aware of their environmental responsibilities and have opportunities to be trained in the necessary skills
- Communicate openly with stakeholders regarding environmental matters related to the industry's activities.

Cheryl Cartwright
APIA Chief Executive
May 2013

APPENDIX 3: LEGISLATION

The following is a list of environmental legislation relevant to the construction, operation and decommissioning of pipelines in Australia. This list of Acts is provided only as a guide, with each often having associated Regulations and Policies that should also be reviewd. Due to changing legislation, varying requirements and the often complex nature of pipeline approvals, APIA advises its members to seek advice on the legislation applicable to their specific project circumstances from appropriate technical consultants and from the relevant Commonwealth, State or Territory regulatory authorities.

COMMONWEALTH	
Aboriginal & Torres Strait Islander Heritage Protection Act 1984	*National Greenhouse & Energy Reporting Act 2007*
Australian Heritage Council Act 2003	*Native Title Act 1993*
Environment Protection & Biodiversity Conservation Act 1999	*Offshore Petroleum and Greenhouse Storage Act 2006*
Industrial Chemicals (Notification and Assessment) Act 1989	*Ozone Protection and Synthetic Greenhouse Gas Management Act 1989*

AUSTRALIAN CAPITAL TERRITORY	
Environment Protection Act 1997	*Native Title Act 1994*
Fisheries Act 2000	*Nature Conservation Act 1980*
Heritage Act 2004	*Pest Plants and Animals Act 2005*
Lands Acquisition Act 1994	*Planning and Development Act 2007*

NEW SOUTH WALES	
Aboriginal Land Rights Act 1983	*Ozone Protection Act 1989*
Catchment Management Authorities Act 2003	*Pesticides Act 1999*
Contaminated Land Management Act 1997	*Petroleum (Offshore) Act 1982*
Crown Lands Act 1989	*Petroleum (Onshore) Act 1991*
Environmental Planning and Assessment Act 1979	*Pipelines Act 1967*
Environmentally Hazardous Chemicals Act 1985	*Plant Diseases Act 1924*
Explosives Act 2003	*Protection of the Environment Operations Act 1997*
Fisheries Management Act 1994	*Road Transport Act 2013*
Forestry Act 2012	*Roads Act 1993*
Forestry and National Park Estate Act 1998	*Rural Fires Act 1997*

Heritage Act 1977	*Rural Lands Protection Act 1998*
Land Acquisition (Just Terms Compensation) Act 1991	*Soil Conservation Act 1938*
Local Government Act 1993	*Threatened Species Conservation Act 1995*
National Parks and Wildlife Act 1974	*Waste Avoidance and Resource Recovery Act 2001*
Native Title (New South Wales) Act 1994	*Water Act 1912*
Native Vegetation Act 2003	*Wilderness Act 1987*
Noxious Weeds Act 1993	*Work Health and Safety Act 2011*

NORTHERN TERRITORY	
Aboriginal Land Act	*Offshore Water (Application of Territory Laws) Act*
Agricultural and Veterinary Chemicals (Northern Territory) Act	*Pastoral Land Act*
Bushfires Act	*Petroleum Act*
Crown Lands Act	*Petroleum (Submerged Lands) Act*
Dangerous Goods Act	*Planning Act*
Energy Pipelines Act	*Soil Conservation and Land Utilisation Act*
Environmental Assessment Act	*Territory Parks and Wildlife Conservation Act*
Fisheries Act	*Traffic Act*
Heritage Act	*Transport of Dangerous Goods By Road and Rail (National Uniform Legislation) Act*
Lands Acquisition Act	*Waste Management and Pollution Control Act*
Litter Act	*Water Act*
Northern Territory Aboriginal Sacred Sites Act	*Weeds Management Act 2001*

QUEENSLAND	
Aboriginal Cultural Heritage Act 2003	*Petroleum Act 1923*
Aboriginal Land Act 1991	*Petroleum and Gas (Production and Safety) Act 2004*
Agricultural and Veterinary Chemicals (Queensland) Act 1994	*Petroleum (Submerged Lands) Act 1982*
Agricultural Chemicals Distribution Control Act 1966	*Plant Protection Act 1989*
Chemical Usage (Agricultural and Veterinary) Control Act 1988	*Queensland Heritage Act 1992*
Environmental Protection Act 1994	*Soil Conservation Act 1986*
	Strategic Cropping Land Act 2011

Forestry Act 1959

Integrated Planning Act 1997

Land Act 1994

Land Protection (Pest and Stock Route Management) Act 2002

Marine Parks Act 2004

Native Title (Queensland) Act 1993

Nature Conservation Act 1992

State Development and Public Works Organisation Act 1971

Sustainable Planning Act 2009

Torres Strait Islander Cultural Heritage Act 2003

Torres Strait Islander Land Act 1991

Vegetation Management Act 1999

Water Act 2000

Work Health and Safety Act 2011

SOUTH AUSTRALIA	
Aboriginal Heritage Act 1988	*Heritage Places Act 1993*
Agricultural and Veterinary Products (Control of Use) Act 2002	*National Parks & Wildlife Act 1972*
Climate Change and Greenhouse Emissions Reduction Act 2007	*Native Vegetation Act 1991*
Coast Protection Act 1972	*Natural Resources Management Act 2004*
Dangerous Substances Act 1979	*Pastoral Land Management and Conservation Act 1989*
Development Act 1993	*Petroleum (Submerged Lands) Act 1982*
Dog Fence Act 1946	*Petroleum and Geothermal Energy Act 2000*
Environment Protection Act 1993	*Plant Health Act 2009*
Fisheries Management Act 2007	*Wilderness Protection Act 1992*
Forestry Act 1950	*Work Health & Safety Act 2012*

TASMANIA	
Aboriginal Lands Act 1995	*Land Acquisition Act 1993*
Aboriginal Relics Act 1975	*Land Use Planning and Approvals Act 1993*
Agricultural and Veterinary Chemicals (Control of Use) Act 1995	*Major Infrastructure Development Approvals Act 1999*
Boundary Fences Act 1908	*National Parks and Reserves Management Act 2002*
Climate Change (State Action) Act 2998	*Native Title (Tasmania) Act 1994*
Crown Lands Act 1976	*Natural Resource Management Act 2002*
Dangerous Goods (Road and Rail Transport) Act 2010	*Nature Conservation Act 2002*
Environmental Management and Pollution Control Act 1994	*Petroleum (Submerged Lands) Act 1982*
Forestry Act 1920	*Threatened Species Protection Act 1995*
Gas Pipelines Act 2000	*Water Management Act 1999*
Historic Cultural Heritage Act 1995	*Weed Management Act 1999*
	Work Health and Safety Act 2012

VICTORIA	
Aboriginal Heritage Act 2006	*Heritage Act 1995*
Aboriginal Lands Act 1991	*Land Acquisition and Compensation Act 1986*
Catchment and Land Protection Act 1994	*National Parks Act 1975*
Climate Change Act 2010	*Occupational Health and Safety Act 2004*
Coastal Management Act 1995	*Offshore Petroleum and Greenhouse Gas Storage Act 2010*
Dangerous Goods Act 1985	*Pipelines Act 2005*
Environment Effects Act 1978	*Planning and Environment Act 1987*
Environment Protection Act 1970	*Water Act 1989*
Fences Act 1968	*Wildlife Act 1975*
Fisheries Act 1995	
Flora and Fauna Guarantee Act 1988	

WESTERN AUSTRALIA	
Aboriginal Heritage Act 1972	*Petroleum (Submerged Lands) Act 1982*
Biosecurity and Agriculture Management Act 2007	*Petroleum and Geothermal Energy Resources Act 1967*
Bush Fires Act 1954	*Petroleum Pipelines Act 1969*
Conservation and Land Management Act 1984	*Planning and Development Act 2005*
Contaminated Sites Act 2003	*Reserves (National Parks Conservation Parks Nature Reserves and Other Reserves) Act 2004*
Dangerous Goods Safety Act 2004	*Soil and Land Conservation Act 1945*
Environment Protection Act 1986	*Waterways Conservation Act 1976*
Fish Resources Management Act 1994	*Wildlife Conservation Act 1950*
Heritage of Western Australia Act 1990	
Native Title (State Provisions) Act 1999	

APPENDIX 4: GUIDELINES, POLICIES, CODES & STANDARDS

The following is a list of guidelines, policies codes, and standards relevant to the construction, operation and decommissioning of pipelines in Australia. This list is provided as a guide only, and due to changing legislation, varying requirements and the often complex nature of pipeline approvals, APIA advises its members to seek clarification applicable to their specific project circumstances from appropriate technical consultants and from the relevant Commonwealth, State or Territory regulatory authorities.

Commonwealth

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
Consultation		
Soil and Water	Best Practice Erosion and Sediment Control Guidelines	International Erosion Control Association
	The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) (currently under review)	SEWPaC
	National Water Quality Management Strategy (available from http://environment.gov.au/water/policy-programs/nwqms/index.html)	SEWPaC
	Australian and New Zealand Environment and Conservation Council (ANZECC). January 2000. National Strategy for the Management of Coastal Acid Sulfate Soils (ANZECC / ARMCANZ 2000).	ANZECC
Flooding	Floodplain management in Australia: best practice principles and guidelines	SCARM (CSIRO)
Flora and Fauna	Significant impact or referral guidelines for nationally listed species	SEWPaC
	Survey Guidelines for Nationally Threatened Species	SEWPaC
	National Biodiversity Conservation Strategy (available from	SEWPaC

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	http://environment.gov.au/biodiversity/publications/strategy-2010-30/pubs/biodiversity-strategy-2010.pdf)	
Noise and Air Quality	World Health Organisation (WHO) Guidelines for Air Quality (Chapter 3) 2000 National Environment Protection (Air Toxics) Measure* National Environment Protection (Diesel Vehicle Emissions) Measure* National Environment Protection (Ambient Air Quality) Measure* National standards for criteria air pollutants – available from http://environment.gov.au/atmosphere/airquality/publications/standards.html	WHO SEWPaC SEWPaC SEWPaC SEWPaC
Heritage	Burra Charter 1999	ICOMOS
Vibration	Best Practice Environmental Management in Mining: Noise, Vibration and Airblast Control 1998	SEWPaC.
Traffic	Austroads Guidelines	
Waste	National Waste Policy: less waste, more resources National Environment Protection (Movement of Controlled Waste between States and Territories) Measure National Environment Protection (Used Packaging) Measure	SEWPaC NEPC NEPC
Weeds and Biosecurity	Introductory Weed Management Manual http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/index.html	SEWPaC
Safety	National code of practice for construction industry and implementation guidelines	DEEWR
Dangerous Goods	Australian Dangerous Goods Code	

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
Planning	Matters of National Environmental Significance: Significance Impact Guidelines 1.1 Matters of National Environmental Significance: Significant impact guidelines 1.2: Actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies	SEWPaC SEWPaC
Other - biodiversity offsets	EPBC Act 1999 Environmental Offsets Policy October 2012	SEWPaC
Other – site contamination	National Environment Protection (Assessment of Site Contamination) Measure	SEWPaC
Other - wetlands	Australian National Guidelines for Ramsar Wetlands - Implementing the Ramsar Convention in Australia	SEWPaC

*National Environment Protection Measures were previously developed by the National Environment Protection Council, but are now made by the COAG Standing Council on Environment and Water. NEPMs are applicable to all Australian government jurisdictions, while the COAG SCEW is administered by SEWPaC.

New South Wales:

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
Consultation	Guideline for community consultation requirements for the exploration of coal and petroleum, including coal seam gas, March 2012 Department Guidelines in the Preparation of an Environmental Incident and Complaints Report	DRE DRE
Soil and Water	SEPP No. 14 - Coastal Wetlands Managing Urban Stormwater, Soils and Construction. Strategic Regional Land Use Policy Nov 2012 Guideline for Agricultural Impact Statements NSW Strategic Regional Land Use Policy NSW Government Aquifer Interference Policy	OEH OEH DRE DRE DRE

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	NSW Water Quality and River Flow Objectives	OEH
Flooding	NSW Coastal Policy NSW Coastal Planning Guideline: Adapting to Sea Level Rise	DPI DPI
Flora and Fauna	SEPP No. 44 - Koala Habitat Protection SEPP No. 46 - Protection and Management of Native Vegetation NSW Biodiversity Strategy (see http://www.environment.nsw.gov.au/biodiversity/nswbiostrategy.htm) Policy and Guidelines for Aquatic Habitat Management and Fish Conservation (NSW) DPI 1999 Threatened Species Assessment Guidelines - The Assessment of Significance Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Field Survey Methods The Biodiversity Banking and Offsets Scheme - established under Part 7A of the Threatened Species Conservation Act.	OEH OEH DPI OEH OEH OEH OEH
Noise and Air Quality	Interim Construction Noise Guidelines	OEH
Heritage	Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW"	OEH OEH
Vibration	Assessing Vibration: A Technical Guide (DECC 2006)	OEH
Traffic	AUSTROADS Guidelines	AUSTROADS
Waste	Environmental Guidelines: Use of Effluent by Irrigation Environmental guidelines for waste Environmental guidelines: Preparation of pollution incident response	OEH OEH

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	management plans	OEH
	NSW (DECC), Waste Classification Guidelines (Part 1, Classifying Waste, April 2008).	OEH
	Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DECC, 2007)	OEH
Weeds and Biosecurity	Draft NSW biosecurity strategy	DPI
Safety	Schedule of Onshore Petroleum Exploration and Production Safety Requirements	DRE
	Hazardous Industry Planning Advisory Paper No 6 Hazard Analysis	NSW Planning
	Hazardous Industry Planning Advisory Paper No 7 Construction Safety	NSW Planning
	Hazardous Industry Planning Advisory Paper No 8 HAZOP Guidelines	NSW Planning
	Hazardous Industry Planning Advisory Paper No 9 Safety Management	NSW Planning
	Development in the Vicinity of Operating Coal Seam Methane Wells	NSW Planning
Dangerous Goods	Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management - Part B Review of Best Practice and Regulation	OEH
	Storing and Handling Liquids: Environmental Protection (DECC, 2007)	OEH
	Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management – Part B: Review of Best Practice and Regulation (DECC, 2005)	OEH
	Storing and Handling Liquids: Environmental Protection - Participants Manual	NTC
	National Transport Commission Australia; Australian Code for the Transport of Dangerous Goods by Road or Rail 7th Edition; 2011 (ADG Code);	
Planning	SEPP (mining, Petroleum Production and Extractive Industries) 2007	DRE

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	SEPP (Major Development) 2005	DRE
	SEPP (State and Regional Development) 2011	DRE
	SEPP (Rural Lands) 2008	DRE
	SEPP No 71 – Coastal Protection	DRE
	SEPP No 55 – Remediation of Land	DRE
	SEPP No. 33 - Hazardous and Offensive Development	DRE
	Environmental management of exploration, mining and petroleum - guidelines	DRE
	Proponents Guidelines for the Review of Environmental Factors 2011	DRE
	ESG2 Environmental Impact Assessment Guidelines - For Exploration, Mining and Petroleum Production activities subject to Part 5 of the EP&A Act	OEH
	Guidelines for developments adjoining land and water managed by the Department of Environment Climate Change and Water	DRE
	Is an EIS Required – Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Department of Planning, 1995)	DRE
	Planning for Bushfire Protection	DRE
		NSW Rural Fire Service
Other	Guidelines for Digital Data Submission and Reporting of Onshore Petroleum Exploration in New South Wales	DRE

Victoria

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Guidelines for the preparation of Pipeline Consultation Plans (Pipelines Act 2005)	DEPI
	How to Get the Best Out of Planning: A Guide to	DPCD

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	Facilitating Meetings	
Soil and Water	State Environment Protection Policy (Groundwaters of Victoria) 1997 State Environment Protection Policy (Waters of Victoria) 1988 State Environment Protection Policy (Prevention and Management of Contamination of Land) 2002 Managing Urban Stormwater: Soils and Construction Volume 1 4th Edition Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting Rehabilitation Manual for Australian Streams Best practice guideline for assessing and managing coastal acid sulphate soils Industry Standard- Contaminated Construction Sites Planning Practice Note: Potentially Contaminated Land	EPA EPA EPA Landcom ANZECC LWRRDC DEPI WorkSafeVictoria EPA
Flooding	The Victoria Flood Management Strategy	DSE- Water
Flora and Fauna	Victorian Native Vegetation Management Framework Native Vegetation- Guide for Assessment of referred planning permit applications Native Vegetation- Revegetation Planting Standards- Guidelines for establishing native vegetation for net gain accounting VPP Practice Notes - Native Vegetation Offsets VPP Practice Notes - Biodiversity	DEPI DEPI DEPI DPCD DPCD

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Noise and Air Quality	EPA's Environmental guidelines for major construction sites State Environment Protection Policy (Air Quality Management) 1999 State Environment Protection Policy (Ambient Air Quality) 2001 State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) 1989	EPA EPA EPA EPA
Heritage	Aboriginal Heritage Planning Tool- online Information Sheet: Cultural Heritage Management Plans and Planning Heritage Overlay Guidelines	DPCD DPCD DPCD
Vibration	Technical Basis for Guidelines to Minimise Annoyance due to Blasting and Ground Vibration	ANZECC
Traffic	Guide to Traffic Generating Development and Road Design Guide Installation of Utility Services and Pipelines within Railway Boundaries (Engineering Standard) Third Party Access- VicTrack (online contact and application form) AS4799-2000 Installation of underground utility services and pipelines within railway boundaries	RTA ARTC VicTrack SAI Global
Waste	Industrial waste resource guidelines	EPA
Weeds and Biosecurity	Guidelines and Procedures for managing the environmental impacts of weeds on Public land in Victoria (2007) Biosecurity Guidelines for Movement of Equipment Contractors between Farms	DEPI DEPI
Planning	Planning: A short guide	DPCD

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	Using Victoria's Planning System	DPCD
	Victorian Planning Provisions	DPCD

Queensland

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Standard conduct and compensation agreement 2010	DEEDI
	Land Access Code Nov 2010	DEEDI
Soil and Water	Monitoring and Sampling Manual 2009 (Environmental Protection (Water) Policy 2009)	DEHP
	Environmental Protection (Water) Policy 2009	DEHP
	Approval of coal seam gas for beneficial use	DEHP
	Baseline assessment guideline: Underground water impact reports and final reports	DEHP
	Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998	QWQG
	Queensland Water Quality Guidelines 2007	DEHP
	Instructions for the treatment and management of Acid Sulfate Soils 2001	DEHP
	Environment Protection (Water) Policy 1997	DEHP
	Run-off control measures for erosion control in cropping land	DNRM
	Erosion control in cropping land	DNRM
	Erosion control in grazing lands	DNRM
	Soil Conservation Measures – Design Manual for Queensland	DNRM
Flooding	SPP 1/03 – Mitigating the adverse impacts of flood, bushfire and landslide	DLGP

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Flora and Fauna	Policy for native vegetation management offsets	DEHP
	Queensland Government Environmental Offsets Policy	DEHP
	Vegetation Management Regulation 2000	DEHP
	Regrowth Vegetation Code 2011	DEHP
	Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions	DEHP
	Regional Vegetation Management Code for South East Queensland Bioregion	DEHP
	Regional Vegetation Management Code for Western Bioregions	DEHP
	Regional Vegetation Management Code for Coastal Bioregions	DEHP
Noise and Air Quality	Environment Protection (Air) Policy 1997	DEHP
	Environment Protection (Noise) Policy 1997	DEHP
	Prescribing Noise Conditions for Environmental Authorities for Petroleum and Gas Activities	DEHP
	EcoAccess Guideline: Planning for Noise Control	DEHP
	Ecoaccess Guideline: Assessment of Low Frequency Noise	DEHP
	State Planning Policy 5/10 Guideline Air, Noise and Hazardous Materials	DEHP
Heritage	GLP: PMC: Guideline for Negotiating Indigenous Land Use Agreements for the delivery of public infrastructure (other than public housing) on Indigenous land	DEHP
	Guide to compiling a connection report for native title claims in the Torres Strait	DEHP
	Guide to the Pastoral ILUA template	DEHP
	Guidelines for negotiation of an indigenous land use agreement (area agreement)	DEHP
	Native title procedures: Mineral Resources Act 1989: Parts 12, 13, 18 & 19: Manual for applicants for prospecting permits	DEHP
Vibration		

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Traffic	Guidelines for Assessment of Road Impacts of Development (2006)	DTMR
Waste	Environment Protection (Waste Management) Policy 2000	DEHP
	Approval of a resource for beneficial reuse	DEHP
	Waste tracking guideline	DEHP
Weeds and Biosecurity	Queensland Weed Spread Prevention Strategy	DAFF
	Queensland Pest Animal Strategy	DAFF
Planning	A Guide to Environmental Impact Assessment	DEHP
	Preparing Environmental Management Plans	DEHP
	Role of the Environmental Protection Agency in Environmental Impact Assessment	DEHP
	Techniques for Environmental Economic Evaluation	DEHP
	National and State initiatives in environmental impact assessment	DEHP
	Preparing terms of reference and environmental impact statements	DEHP
	Assessment and approval process for environmental authorities for chapter 5A activities	DSDIP
	Guidelines for Hazard Analysis Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 (and Hazard Analysis Consultation Draft, July 2008)	DSDIP
	Risk Criteria for Land Use Safety Planning. Hazardous Industry Planning Advisory Paper (HIPAP) No. 4	

Western Australia

Environmental Aspects	Guideline, Policy, Standard or Code	Agency

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Stakeholder Consultation Guideline. Available from http://www.dsd.wa.gov.au/documents/000098.siobhan.lynch.pdf	DSD
Soil and Water	Acid Sulfate Soils Planning Bulletin No. 64 Acid Sulfate Soils Planning Guidelines Contaminated Sites Management Series: Assessment Levels for Soil, Sediment and Water, Draft for Public Comment, Version 3 Draft Treatment and management of soils and water in acid sulphate soil landscapes. Acid Sulfate Soils Guideline Series Identification and Investigation of Acid Sulfate Soils. Acid Sulfate Soils Guideline Series Guidelines for Dewatering, 2006	WAPC WAPC DEC DEC DEC DEC DoW
Flora and Fauna	Conservation of threatened flora in the wild 1992 Conservation of threatened and specially protected fauna in the wild 1991 Conserving threatened species and ecological communities (Draft) Preparation, review and amendment of monitoring protocols SOP No: 1.2 Establishing Vegetation Quadrats *SOP No:6.1* Establishing Vegetation Transects *SOP No:6.2* Observing animals from secondary signs SOP No: 7.2 Cage traps for live capture of terrestrial vertebrates SOP No: 9.2	DEC DEC DEC DEC DEC DEC DEC DEC
Noise and Air Quality	Summary of the environmental protection (noise) regulations 1997	DEC
Heritage	Aboriginal Heritage Site registration policy Aboriginal Heritage Site registration procedure	DIA DIA

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	Aboriginal Heritage Information access policy Aboriginal Heritage Due Diligence Guidelines European Heritage: State Cultural Heritage Policy (State Heritage Office)	DIA DIA SHO
Traffic	Application Kit and Guidelines for Organisations seeking to undertake works within road reserves; Complex Works	MainRoadsWA
Waste	Waste avoidance and resource recovery regulations 2008	DEC
Weeds and Biosecurity	Techniques for mapping weed distribution and cover in bushland and wetlands *SOP No: 22.1* Good Neighbour Policy (July 2007)	DEC DEC
Planning	Guide to Preparing an Environmental Scoping Document Guide to EIA Environmental Principles, Factors and Objectives Preparation, review, approval and amendment of standard operating procedures SOP No: 1.1 The Kimberley Science and Conservation Strategy The Salinity Strategy 2000	EPA EPA DEC DEC DEC
Offsets	WA Environmental Offsets Policy	DEC

South Australia

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Soil and Water	Environment Protection (Water Quality) Policy 2003 Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DEWNR DPIR

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Flooding	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Flora and Fauna	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Noise and Air Quality	Environment Protection (Air Quality) Policy 1994 Environment Protection (Industrial Noise) Policy 1994 Environment Protection (Machine Noise) Policy 1994 Environment Protection (Noise) Policy 2007 For information on air quality standards in SA, refer to the National Air Quality NEPM	DEWNR DEWNR DEWNR DEWNR SEWPaC
Waste	Environment Protection (Waste to Resources) Policy 2010 Environment Protection (Waste Management) Policy 1994 Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DEWNR DEWNR DPIR
Weeds and Biosecurity	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Planning	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR

Tasmania

Environmental Aspects	Guideline, Policy, Standard or Code	Agency

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Land Owner's Questions, at http://www.mrt.tas.gov.au/pls/portal/docs/PAGE/MRT_INTERNET_PAGE_GROUP/MRT_EXPLORATION_AND_MINING/MRT_LAND_OWNERS_Q_AND_A/OWNERS-QUESTIONS_2009.PDF	MRT
Soil and Water	Soil erosion – the issue and controls discussed in detail at http://www.dpiw.tas.gov.au/inter.nsf/ThemeNodes/TPRY-5YW2UG?open Guidelines for Assessing Applications for Well Driller's Licences Enforcement Policy for the Water Management Act 1999 Tasmanian Wetlands Strategy at http://www.dpiw.tas.gov.au/inter.nsf/WebPages/RPIO-4YH3AY?open	DPIPWE DPIPWE DPIPWE DPIPWE
Flora and Fauna	Threatened species listed at http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/SJON-58E2VD?open#ListingInformation Recovery plans listed at http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/LJEM-6H644R?open Native Plants and Animals Guides at http://www.dpiw.tas.gov.au/inter.nsf/ThemeNodes/SSKA-4X33SG?open	DPIPWE DPIPWE
Noise and Air Quality	Environment Protection Policy (Air Quality) 2004 Environment Protection Policy (Noise) 2003 (Draft)	DPIPWE DPIPWE
Heritage	A Guide to the Aboriginal Heritage Assessment Process, at http://www.aboriginalheritage.tas.gov.au/documents/guide%20to%20the%20aboriginal%20heritage%20assessment%20process%20.pdf Sampling Procedure For consultants excavating Aboriginal Heritage sites in Tasmania	DPIPWE DPIPWE
Weeds and Biosecurity	Tasmania Biosecurity Policy, at http://www.dpiw.tas.gov.au/inter.nsf/Attachments/LBUN-6Y57UE/$FILE/0D02332_biostratbroch.pdf Tasmania Biosecurity Strategy at http://www.dpiw.tas.gov.au/inter.nsf/Attachments/LBUN-6Y57CM/$FILE/0D02332_biostratnew.pdf Tasman Council Weed Management Strategy, at http://www.tasman.tas.gov.au/index.php/environment-health/natural-	DPIPWE

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	resource-management/weed-management	
Planning	Exploration procedures— Information for explorers at http://www.mrt.tas.gov.au/pls/portal/docs/PAGE/MRT_INTERNET_PAGE_GROUP/MRT_PUBLICATIONS/MRT_EXPLORATION_CODE_OF_PRACTICE/CODE_5B.PDF	MRT

GENERAL STANDARDS

AS 2507 -1998 The storage and handling of agricultural and veterinary chemicals

AS 4970 Protection of trees on development sites

AS /NZS 31000 Risk management – principles and guidelines (ISO 31000:2009

AS 1210 Pressure vessels

AS 1929 Non-destructive testing –glossary of terms

AS 2430 Classification of hazardous areas

AS 2812 Welding, brazing and cutting of metals – Glossary of terms

AS 2832 Cathodic protection of metals

AS 2832.1 Part 1: Pipes and cables

AS/NZS 9001:2008 Quality Management Systems – Requirements

AS/NZS ISO 14001:2004-Environmental Management Systems – Requirements with guidelines for use

AS/NZS ISO 14004:2004-Environmental Management Systems – General guidelines and principles, systems and support technologies

AS/NZS ISO 14015:2003-Environmental Management – Environmental assessment of sites and organisations

AS/NZS ISO 14031:2000-Environmental Management – Environmental performance evaluation guidelines

AS/NZS ISO 19011:2004-Guidelines for quality and / or environmental management systems auditing

AS/NZS 1020 The control of undesirable static electricity

AS/NZS 3788 Pressure equipment – in service inspection

AS/NZS 4853 Electrical hazards on metallic pipelines

AGA PR 3 -805 A modified criterion for evaluating the remaining strength of a corroded pipe (RSTRENG)

XK0101 Purging principles and practice

ASME BS1G Manual for determining the remaining strength of Corroded pipelines: supplement to ASME B31, for pressure piping

AS 4897-2008 The design, installation and operation of underground petroleum storage tanks

AS 4970-2009 Protection of trees in development sites

AS/NZS ISO 31000:2009 Risk management – Principles and guidelines

AS/NZS 2566.1:2002 Buried flexible pipelines Part 1: Structural design

AS/NZS 2566.2:2002 Buried flexible pipelines Part 2: Installation

GAS STANDARDS

AS 2885.0 Pipelines—Gas and liquid petroleum—General requirements

AS 2885.1 Pipelines—Gas and liquid petroleum—Design and construction

AS 2885.2 Pipelines—Gas and liquid petroleum—Welding

AS 2885.3 Pipelines—Gas and liquid petroleum—Operation and maintenance

AS 2885.4 Pipelines–Gas and liquid petroleum—Offshore submarine pipeline systems

AS/NZS 2885.5 Pipelines—Gas and liquid petroleum—Field pressure testing

AS/NZS 4645.1:2008 Gas distribution networks – Network management

AS/NZS 4645.2:2008 Gas distribution networks – Steel pipe systems

AS/NZS 4645.3:2008 Gas distribution networks – Plastic pipe systems

2430.1 Part 1: Explosive gas atmospheres

WATER STANDARDS

AS 1554 Structural Steel Welding - Welding of Steel Structures
AS 1726 Geotechnical Site Investigations

AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design

AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design – Commentary (Supplement to AS/NZS 2566.1)

AS/NZS 2566.2 Buried Flexible Pipelines – Part 2: Installation

AS 2865 Safe working in a confined space

AS 3725 Loads on Buried Concrete Pipes
AS 4087 Metallic Flanges for Waterworks Purposes
AS 5667.1 Water Quality – Sampling.

OTHER USEFUL LINKS

Australian Society for Trenchless Technology
http://www.astt.com.au/trenchless_technology/guidelines/astt_guidelines/

International Erosion Control Association http://www.austieca.com.au/region2

APPENDIX 5: PIPELINE INSPECTION CHECKLIST

An indicative pipeline checklist is attached.

Pipeline Inspection Checklist

Issue	Compliance ✓ or ✗	Location				Action / Comments
		General	ROW	Pipeline	Other sites	
Access						
Has access been only via designated tracks?						
Have there been any complaints concerning access by landholders?						
Are there any reports or evidence of unauthorized third party access to the pipeline corridor or facility sites?						
Soil and Ground Stability						
Are there any sites of significant erosion, land subsidence or compaction?						
Are control banks of appropriate height, spacing and material?						
Are there any areas of trenchline subsidence?						
Are control banks diverting run-off to stable vegetated land?						
Vegetation Management						
Has native vegetation clearance along the pipeline corridor been in compliance with approvals and with flagging or marking in the field?						
Is vegetation showing signs of water stress?						
Is vegetation showing signs of disease (e.g. Dieback)?						
Have there been reports of disturbance to protected flora or fauna?						
Is there any evidence of feral animals?						

Issue	Compliance ✓ or ×	Location				Action / Comments
		General	ROW	Pipeline	Other sites	
Weed Control						
Are any weed infested areas located on the pipeline corridor? (Note the location)						
Review the success of any current weed eradication programs on site						
Have all vehicles used on the pipeline corridor been 'washed down' to remove weed seeds? (declared weed areas only)						
Earthworks						
Is there adequate signage and fencing to ensure public safety?						
Is access being maintained across the pipeline corridor for vehicles and livestock?						
Land Use						
Has there been any disturbance to landowner infrastructure, such as fences, gates, pumps etc?						
Are crossings of railways and roads maintained so as to ensure the safety of the public in accordance with regulatory requirements?						
Bushfire Prevention						
Are local fire Authority regulations being followed?						
Is appropriate access available across / along the pipeline corridor for fire management?						
Air and Noise Emissions						
Have there been any complaints regarding dust or noise levels?						

Issue	Compliance ✓ or ×	Location				Action / Comments
		General	ROW	Pipeline	Other sites	
Heritage Issues						
Is there any visible disturbance to protected sites?						
Are there any reports of personnel accessing prohibited areas?						
Water Management						
Is there evidence of disturbance to drainage patterns (e.g. drainage shadow)?						
Are stream crossing banks stable?						
Are sections of the pipeline exposed?						
Aboveground Flowlines						
Are flowline supports in place?						
Is the flowline free from external corrosion?						
Is the flowline free from excessive stress?						
Facilities Management						
Are all facilities locked and secure?						
Waste Management						
Are drainage sumps regularly checked and drained?						
Are there any oil spills present?						
Have previous spills been cleaned up adequately?						
Are materials such as scrap metal, wood, rags etc. recycled where possible?						
Is debris from pigging operations properly collected, contained and treated?						

Issue	Compliance ✓ or ×	Location				Action / Comments
		General	ROW	Pipeline	Other sites	
Asbestos Removal						
Has all asbestos been properly collected, contained and treated?						
Chemical Storage						
Is appropriate chemical storage provided?						
Are all chemical drums properly disposed of at an appropriately licensed facility?						
Are all storage sites kept clean?						

APPENDIX 6: FAUNA MANAGEMENT PRO-FORMA

FAUNA DATABASE
Fauna Survey Data Sheet

Insert Company Logo

Date _____ Fauna Clearer _____

Location (KP to KP) _____ Weather _____

KP	Northing	Easting	Scientific Name	Common Name	No.	Comments or Action Taken

APPENDIX 7: FUTURE DIRECTIONS CONSIDERATIONS

The following table is a list of items for further consideration by the pipeline industry in regard to the management of environmental aspects of our activities and operations. These items were identified in the latest review of the Code and are under further investigation and clarification from industry experts and regulatory authorities.

Sustainability Consideration of sustainability, and National Greenhouse Emission Reporting Scheme on pipeline construction and operational phases of facilities. Identify aspects, impacts and control measures.
CO_2 and other transmission pipelines Consideration of aspects and reconcile for adequacy against APIA CoEP
Further review of monitoring aspects of the Code.
Tidal and Marine Environments. Tidal and marine environments in coastal plain areas to be considered as they present additional influences to environmental management.
Contaminated land and UXO sites management

APPENDIX 8: ENVIRONMENTAL OFFSET SUMMARY TABLE

	POLICY	PRINCIPLES	METHOD	LEGISLATION
NSW		Measures to avoid and mitigate impacts to be considered Residual Impacts to be offset Offset to result in net improvement in biodiversity overtime Offsets to be supported by sound ecological principles Offset in perpetuity Offsets agreed prior to impact occuring Offsets to be quantifiable Offset impacts -like for like Offsets located in same or similar ecological characteristics to the area being impacted Offsets to be monitored /auditable	Bio Banking Agreements Biodiversity Certification Agreements Property Vegetation Plans	EP & A Act, 1979 (Development and Land Use Planning) Native Vegetation Act 2003
QLD	Queensland Government Environmental Offset Policy (2008)	Offsets cannot be remnant vegetation	Vegetation Management Offsets	
VIC	Native Vegetation Management - A framework for action (2002)	Avoid adverse impacts Minimise through planning and design, Identify Offsets	Net Gain - to achieve a gain in the quality and quantity of native vegetation equal to native vegetation loss Bush Broker Scheme/Bush Tender -a competitive auction process that provides a fair market price for proponents to pircahse offsets generated by a third party and made available for purchase. The policy requires matching losses and gains to ensure gains are secured and protected	
WA	Environmental Offsets Policy	Minimal duplication between state and federal requirements for environmental offsets Measures to avoid and mitigate impacts to be considered Real and sustainable environmental outcomes Where possible offsets considered early in the assessment and decision making process Offsets not appropriate for all projects, will be determined on a project-by- project basis. Offsets located in same or similar ecological characteristics to the area being impacted Offsets to be supported by sound ecological principles Framework of adaptive management -take account of the potential risk, ensure mechanisims in place to minimise. Offset to be enduring, enforceable and deliver long term outcomes Offsets to be monitored /auditable	Direct Offsets - actions designed to provide on-ground improvement, rehabilitation and conservation of habitat. Indirect Offsets- Actions aimed at improving scientific / community understanding and awareness of environmental values	Environmental Protection Act 1986 Planning and Development Act 2005