Code of Environmental Practice

Onshore Pipelines

Revision 5

2022

Published by Australian Pipelines and Gas Association Ltd

Original document (1998) prepared by Ecos Consulting (Aust).

Revision 5 (2022) reviewed by members of the APGA CoEP Working Group.

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
Revision 4 September 2017
Revision 5 April 2022

Australian Pipelines and Gas Association Ltd.
PO Box 5416
KINGSTON ACT 2604
Phone: 02 6273 0577
Fax: 02 6273 0588

Email: apga@apga.org.au
Web: www.apga.org.au

Contents

Table of Figures

Acknowledgements

This revision of the Code of Environmental Practice (CoEP) has been prepared on behalf of the Australian Pipelines and Gas Association (APGA) by a working group consisting of environmental management professionals from within the APGAs membership.

The working group, led by APGAs Environmental Sub-committee chair Matt McDermott (CNC) consisted of Mark Brown (AGIG); Brynne Jayatilaka (Ventia); Jodi Wood (Jemena); Rahul Dorairaj (Jemena); Brent Davey (Monarc Environmental); James Crewe (McConnell Dowell); Christy Harvey (McConnell Dowell); Tanya Reedman (Advisian); Martin Ross (McConnell Dowell); Tim Walker (McConnell Dowell); Brett Rodgers (Nacap); Shaun Smith (Smith Environmental) and John Tunney (APA).

APGA would like to thank members of the Health, Safety and Environment Committee who reviewed the drafts of the Code, and regulators from a number of State and Territory government bodies who reviewed the penultimate draft and provided feedback which has been incorporated into the final version.

The 2021 revision of the Code of Environmental Practice was possible only because of the previous contributions made by members to its initial development and the several revisions that have been made over the years since it was first developed. We thank all those who have contributed their time and expertise to the development of this CoEP since its inception.

Disclaimer

The content of this document is a guide only.

This guideline does not represent a minimum acceptable standard for Australian Pipelines and Gas Association (APGA) members or other participants in the planning, construction, operation or decommissioning of gas (transmission and distribution), water or slurry pipelines.

Commonwealth, State and Territory legislation and regulation set out the relevant standards and obligations that must be met by a pipeline throughout its lifecycle. Contractual agreements setting out responsibilities, obligations and liabilities between counter-parties should appropriately reference the relevant legal and regulatory requirements. Any reference to this Code in a contract should use the relevant section numbers.

Legislation and regulation relevant to the planning, asset acquisition, construction, operation and decommissioning of gas, water and slurry pipelines can be frequently amended by State and Territory governments. To ensure currency and consistency with existing legislation, APGA advises its members to undertake a review prior to commencement of planning each new project. APGA 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.

All care has been taken in the research and collation of this Code, but this publication is provided on the understanding that the authors and editors are not responsible for any errors or omissions or the results of any actions taken on the basis of information in this work.

Preface

The APGA Code of Environmental Practice provides industry accepted guidance on environmental management through the planning and asset acquisition, construction, operational and decommissioning phases of a pipeline's lifecycle.

The pipeline industry has a vital role in ensuring 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 managing environmental risk in the planning and asset acquisition, construction, operational and decommissioning phases of a pipeline's lifecycle.

This Code demonstrates the industry's commitment to be leaders in environmental management and to be an active contributor to State and Federal objectives in the field of environmental management.

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 environmental practices of the time. By this continuing process of improvement, we believe our industry will maintain its position at the leading edge of environment management in Australia.

This Code has been developed by APGA 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.

APGA Members are encouraged to adopt this Code and to provide feedback on its application. Community members are invited to provide feedback to APGA on this initiative.

Comments may be forwarded to APGA at:

Australian Pipelines and Gas Association Ltd

PO Box 5416
KINGSTON ACT 2604

Phone: 02 6273 0577

Fax: 02 6273 0588

Email: apga@apga.org.au

Web: www.apga.org.au

1 Introduction

The APGA Code of Environmental Practice (CoEP) provides industry accepted guidance on environmental management through the planning and asset acquisition, construction, operational and decommissioning phases of a pipelines' lifecycle.

This Code is focused on the key activities conducted during these different pipeline lifecycle phases, and the potential environmental risks that arise from these activities.

The pipeline industry has a vital role in ensuring the economic and environmental wellbeing of Australia. Pipelines are critical in the supply of energy, water and mineral resources to communities and industries in Australia. Pipelines directly contribute to national economic growth and make up an integral part in supplying critical commodities and energy sources to domestic and international markets.

In Australia, pipelines are used for a range of purposes, including:
- gas transmission, storage and distribution
- petroleum and petrochemical liquids transmission
- domestic and industrial water supply
- sewage and wastewater removal, including recycled water
- slurry transportation
- power line and cable conduits.

In any industry, environmental management is the practice of identifying, assessing and managing the environmental risks and hazards associated with an activity and the surrounding environment. An environmental risk is the likelihood that an undesirable outcome to an environmental receptor or feature will occur (i.e. risk of environmental harm). Environmental harm could include death, removal, loss of amenity, destruction or degradation of the environment or environmental values.

The role of environmental management in business is to adequately identify, assess and manage potential impacts on the environment – the ideal outcome being avoidance or minimisation of any environmental harm – in line with, or in exceedance of, environmental laws.

Environmental management is important to the pipelines industry because Australian jurisdictions have environmental legal frameworks that manage the impacts of industries on the environment in the public interest. Equally, when managed carefully and strategically, environmental management can deliver overall benefits to the environment, community and business. The Australian pipeline industry is committed to ensuring that pipelines have a transient physical impact on the environments they pass through, and that they continue to do this throughout all phases of a pipelines lifecycle.

1.1 Purpose and scope

The purpose of this Code is:

- To provide industry accepted guidance on environmental management through the planning and asset acquisition, construction, operational and decommissioning phases of a pipeline's lifecycle.
- To inform the industry and regulators of environmental risks arising from pipeline activities.
- To provide an outline of the environment risk management methodology.
- To assist the industry to identify and meet its legal obligations to environmental management.

- To provide examples of environmental risk management methods applicable to activities within the various lifecycle phases.
- To provide State and Federal regulators with an understanding of the practices and processes that the pipeline industry implements to achieve effective environmental management.

The scope of this Code is:

- The Australian onshore pipeline industry; in particular, the planning and asset acquisition, construction, operational and decommissioning lifecycle phases of pipelines.
- In line with APGA's current core membership base, this Code has been written with high pressure gas transmission pipelines as its focus. However, this Code is considered applicable to all pipeline industry types.

The Code:

- Does not contain comprehensive detail on environmental risks or environmental risk management methods.
- Is not a suitable substitute for an asset, activity or lifecycle phase-specific environmental management plan or environmental risk assessment.
- Is not a suitable substitute for an environmental management plan to be used by contractors to the pipelines industry, the Code is intended only to provide guidance on the process and considerations when conducting activity specific environmental risk management.
- Does not provide a comprehensive summary of legislation applicable to pipelines in Australia's State, Territory or Federal jurisdictions and should not be used to establish the legal obligations which apply to a pipeline's environmental management.

1.2 Use of the Code

It is intended that industry personnel or interested parties selectively use the section of this Code that applies most to their pipeline lifecycle phase – in conjunction with descriptions of environmental risk areas / aspect (refer to Figure 1).

This Code provides industry accepted guidance on environmental management. It is structured to reflect the major lifecycle phases of a pipeline:

- planning and asset acquisition;
- construction;
- operation; and
- decommissioning.

Within each pipeline lifecycle phase, the key activities that pose environmental risks have been identified. For each activity, an environment risk profile has been developed.

In some instances, the same, or similar, activities and risks occur in different pipeline lifecycle phases (e.g. native vegetation clearing). In these cases, the pipeline activity and risk have been duplicated within the Code. This approach is intended to facilitate the useability of the Code by pipeline industry professionals who seek all relevant information for one pipeline lifecycle phase without requiring them to access all sections of the Code.

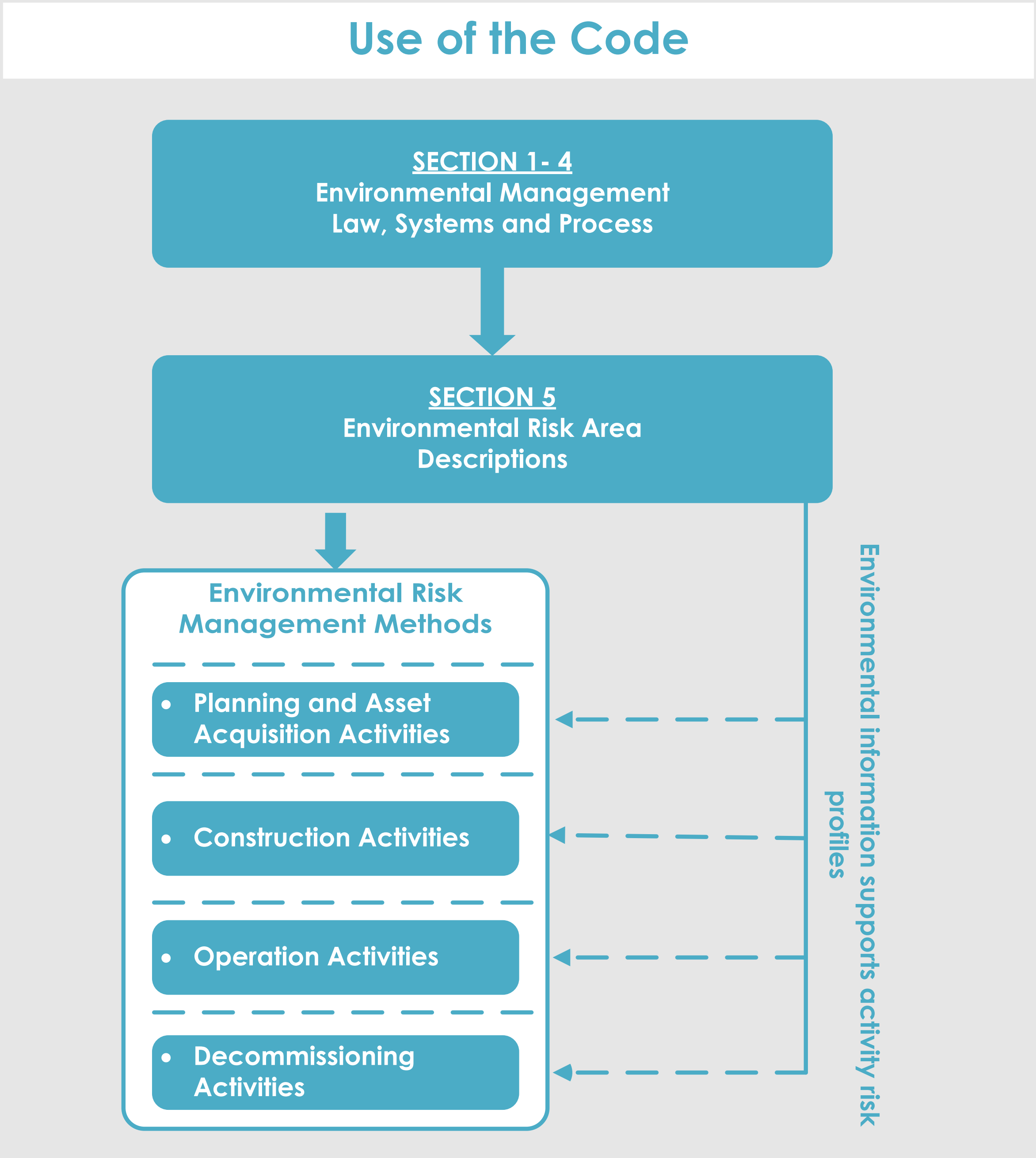


Figure 1 Use of the Code

1.2.1 Standard terms

This Code uses standardised environmental language to articulate environment risk. The Code divides environmental risk into 11 environmental risk areas / aspects:

1. Native Vegetation;
2. Fauna;
3. Biosecurity (e.g. pests, weeds, disease);
4. Natural or and Historic Heritage;
5. Indigenous Heritage;
6. Soil (e.g. erosion; acid sulphate);
7. Water (e.g. hydrology, watercourses);

8. Waste (e.g. hazardous; non-hazardous);
9. Emissions (e.g. dust; noise and vibration; gas);
10. Third parties (e.g. nuisance); and
11. Chemicals and Contamination.

Throughout the Code, the environmental risk profiles for each specific pipeline activity use these environment risk area descriptors to consistently outline the applicable type of environmental risks.

1.2.2 APGA environment document hierarchy

This Code is the primary guidance document on environmental management for the pipelines industry. Environmental management is an applied discipline and can be complex. For this reason, APGA has developed standalone technical guidelines for some issues (refer to Figure 2). These guidelines exist to provide in-depth guidance to the industry and are intended to support this Code.

APGAs technical guidelines, which support this Code, are:

- Biodiversity Offsets Guideline
- APGA Stakeholder Engagement Guideline

Third party technical guidelines, which support this code, are:

- International Erosion Control Association (IECA), Best practice Erosion and Sediment Control (IECA BPESC)– Appendix P: Land Based Pipeline construction
- Managing Urban Stormwater: Soils and Construction (Landcom Blue Book)
- ANZECC - Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
- CMIT- 2005-259 Analysis of Hydrostatic Test Water (To be read in conjunction with the APGA Code of Environmental Practice)
- The National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual

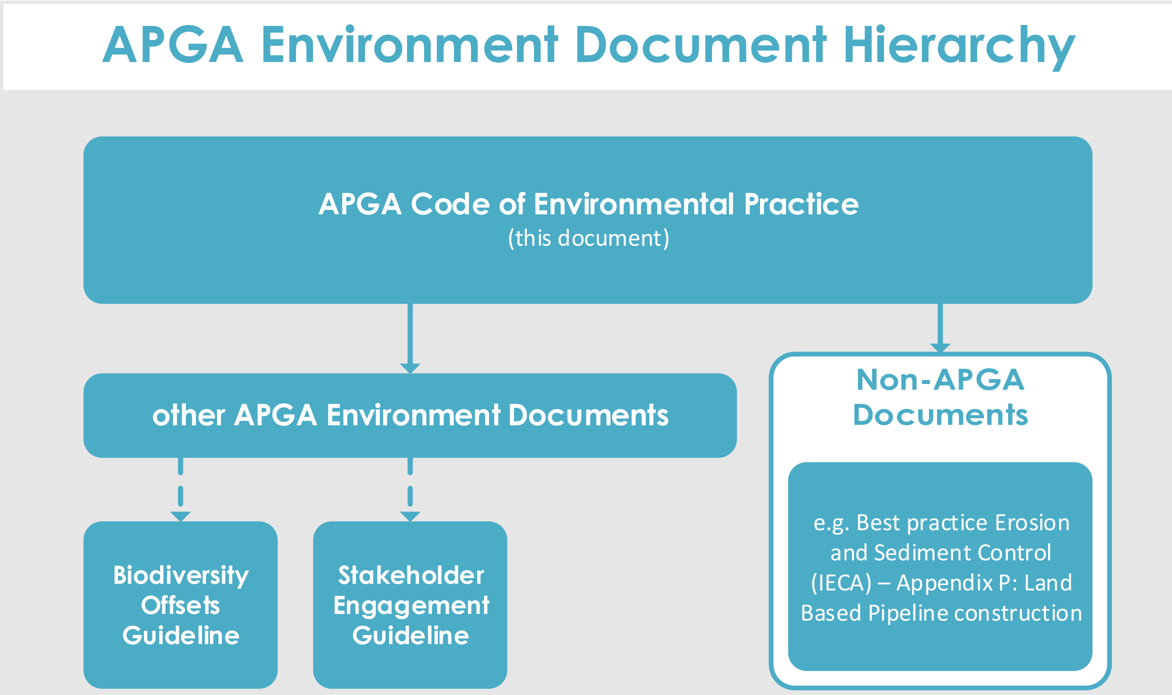


Figure 2 APGA Environment Document Hierarchy

1.2.3 Pipeline lifecycle phases

Pipelines, irrespective of the substance they transport, will invariably pass through four distinct phases during their lifecycle. The lifecycle of a pipeline is the time between pipeline conceptualisation and planning until the decommissioning and end-of-use of that pipeline. Pipelines are long-term infrastructure and the pipeline lifecycle can exceed 50 years, depending on the physical integrity of the asset.

During each lifecycle phase of a pipeline, different activities occur which can pose a variety of environmental risks. However, the environmental risk areas / aspects are common throughout all pipeline lifecycle phases.

The Code is structured to reflect the four major pipeline lifecycle phases (See Figure 3):

- **Planning and asset acquisition** – The design, preparation of pipeline activities, budgets, access, approvals ahead of the construction, operation and/or decommissioning pipeline lifecycle phases. The planning and asset acquisition pipeline lifecycle phase is the only non-linear phase and could occur either prior-to, in between, or after any other pipeline lifecycle phase.

- **Construction** – The building of a pipeline or associated pipeline infrastructure. This can include the refurbishment or upgrade of an existing piece of infrastructure.
  Commissioning (e.g. completion) of a constructed pipeline is generally carried out during, or as a part of the construction pipeline lifecycle phase, activities undertaken during commissioning may also be completed once the operation phase has begun.

- **Operation** – The use (or state of being ready for use) of a pipeline as intended by its design (this pipeline lifecycle phase can also include care and maintenance where a pipeline is considered operational but is temporarily not in use).

- **Decommissioning** – The ceasing of operation. Usually, this phase involves the dismantling and removal of above, and often below, ground, pipeline infrastructure and rehabilitation.

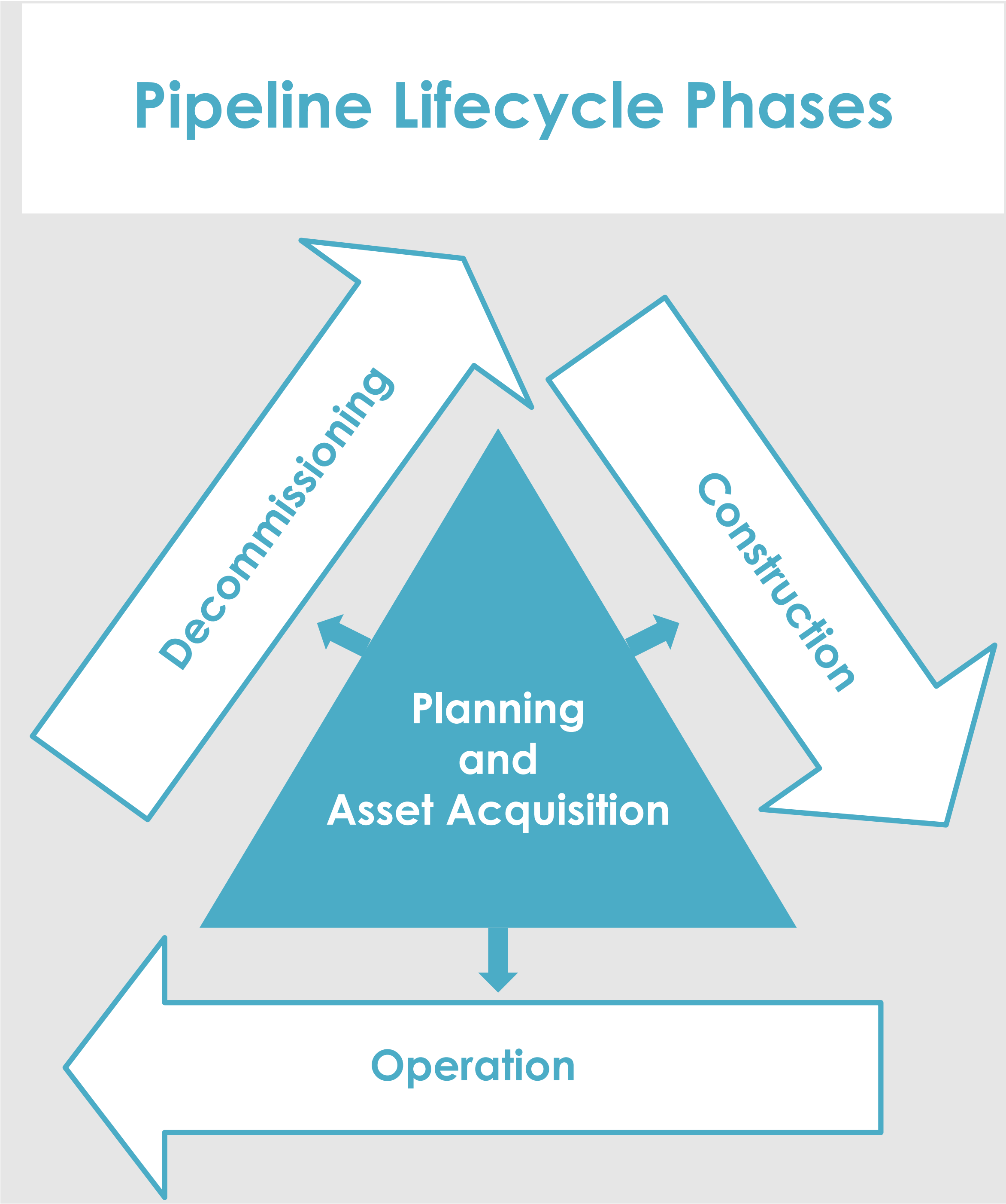


Figure 3 Pipeline Lifecycle Phases

1.2.4 Use of the Code: environmental risk profiles

In this Code, environmental risk profiles are presented in tabular form at the end of each Pipeline lifecycle phase section (see example table below).

For each relevant activity, the relevant environmental risk areas / aspects are listed; followed by the mechanism of the activity that could cause environmental harm or the type of environmental harm caused. Broadly, there are two broad categories of environmental harm. These two categories are separate, but related:

1. **Legal/regulatory environmental harm**: an undesirable outcome relating to an environmental law, legal process or condition. This could include a breach, violation or omission.
2. **Physical environmental harm:** an undesirable outcome to an environmental receptor or feature will occur. Environmental harm could include death, removal, loss of amenity, destruction or degradation of the environment or environmental values.

Examples of common environmental risk management methods are then explained (far right column).

Activity	Environmental risk area / aspect potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
ACTIVITY X (e.g. excavation)	1. Native Vegetation; 2. Fauna; 3. Biosecurity (e.g. pests, weeds, disease); 4. Natural and Historic Heritage; 5. Indigenous Heritage; 6. Soil (e.g. erosion; acid sulphate); 7. Water (e.g. hydrology, watercourses); 8. Waste (e.g. hazardous; non-hazardous); 9. Emissions (e.g. dust; noise and vibration; gas); 10. Third parties (e.g. nuisance); 11. Chemicals and Contamination.	Subtask/event of ACTIVITY X (e.g. hydraulic hose failure)	• Method #1 • Method #2

1.2.5 Sustainability

Sustainability can be defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs (UN World Commission). Sustainable infrastructure refers to the network and system, equipment and assets designed to meet the population's essential service needs, while adhering to sustainability principles. This results in infrastructure that is planned, designed, procured, constructed and operated to optimise social, economic, environmental and governance outcomes over an asset’s life.

Sustainable infrastructure protects and preserves the ecological processes required to maintain human health, equity, diversity and the functioning of natural systems. It is not just about building new projects, but also about the rehabilitation, reuse or optimisation of existing infrastructure.

Sustainable infrastructure enables economic development and the efficient use of financial resources, while enhancing quality-of-life and protecting natural resources. Sustainable infrastructure can reduce the life-cycle cost of infrastructure, while limiting negative effects on the environment.

APGA and its members are committed to being leaders in ecologically sustainable development and active contributors to national goals on biodiversity protection and greenhouse mitigation. The APGA Strategic Plan for 2021 to 2024 recognises the importance of sustainability within the pipeline industry and has a pillar focussed on social responsibility. Within this pillar, the following focus areas and strategies will be targeted that align to the above sustainability principles:

1. Environment: Promote and support enhanced environment, sustainability, emissions and decarbonisation outcomes.
2. Social: Support our members to build and enhance industry social licence.
3. Governance: A representative and proactive Board and secretariat providing effective administration and protecting the financial viability of the association.
4. Diversity and Inclusion: Support an increasingly diverse, inclusive and progressive pipeline industry.

The following provides guidance on how to integrate sustainability into a project and initiatives that should be investigated to achieve project sustainable outcomes that align to the APGA sustainability principles above.

- Strong leadership on sustainability from the top level of management down. Set sustainability objectives and targets as part of the project.
- Sustainability risks and opportunities are explored early in design and construction phases. This can be carried out as part of a sustainability workshop.
- Depending on the asset being built, climate change risk assessments should be undertaken, and adaption measures implemented where risks are high to ensure resilient infrastructure for a changing climate.
- Goods and services are procured locally and ethically. Sustainability should be considered in evaluation of tenders. Investigate opportunities to purchase recycled products in construction and operation phases.
- Use the most efficient plant as possible and consider hybrid, renewable or electric plant i.e solar light towers, hybrid generators, electric vehicles, biodiesel.
- Investigate opportunities to reduce embodied carbon of materials used in construction.
- Reduce and recycle waste on site. Adhere to the waste hierarchy.
- Maximise local industry participation via employing locals and Indigenous workforce. Maximise training and upskilling opportunities for the disadvantaged
- Beyond the asset being built, consider implementing other legacies (social and environmental) that add value.
- Keep stakeholders and community informed of planned works schedule.
- Look for opportunities to enhance biodiversity during rehabilitation and selection of indigenous species.

- Implement initiatives to reduce potable water demand and use non-potable water where feasible for hydrotest or dust suppression.

The Infrastructure Sustainability Council (IS Council) is a member-based, purpose-led peak/industry body operating in Australia and New Zealand to enable sustainability outcomes in infrastructure. The IS Council:

- Offers an infrastructure sustainability (IS) rating scheme for planning, design, construction and operations of infrastructure assets and portfolios.
- Provides education, training and capacity building.
- Connects suppliers of sustainable products and services with projects through the ISupply Directory and Products Partnership Program.
- Brings together experts and sustainability professionals from across the industry to share knowledge and strengthen the community of practice.
- Recognises and rewards best practice.

The IS Council has been operating since 2012 when the first Infrastructure Sustainability (IS) rating tool version 1.1 Design and As-Built was released. The Infrastructure Sustainability (IS) Rating Scheme rewards the sustainability performance of infrastructure assets. The scheme is intended for use by stakeholders, including infrastructure owners, designers, constructors and operators, to benchmark and drive best-practice sustainability in planning, design, procurement, construction, operation and maintenance of infrastructure. The scheme can be applied to pipeline infrastructure.

The scheme covers four themes: governance, economic, environmental and social. Each theme has one or more categories, and each category has one or more credits. To achieve a rating and to measure performance, the IS Rating Scheme has a point scoring system that is adjusted to fit the profile of each asset and its context. Recognising that every asset and project is unique, and to ensure that effort by project teams is focused on areas of greatest opportunity to drive sustainability outcomes, points are adjusted from their default position through a materiality assessment. In the four-year period FY18-FY21, a total of 176 projects with a total value of $93 billion were registered for an IS rating in Australia and New Zealand.

2 Legislation, Regulation and Standards

2.1 Legislation and regulation

Environmental laws regulate the impact of human activities on the environment. They broadly reflect the public interest and, while they rarely prohibit an activity, environmental laws place restrictions on activities that might impact on the environment.

Government regulators, and their powers, exist because of the environmental laws that they administer in their jurisdiction. The purpose of environmental law and the regulators who administer it is to protect the social and environmental values of the natural environment[1].

In practice, this means that environmental law incentivises businesses to be aware of the potential environmental impacts of their activities, and to identify and mitigate environmental risks.

There are hundreds of laws across Australia's State, Territory and Federal jurisdictions that could be characterised as environmental laws (e.g. *Environmental Protection Act 1986* (WA)). Furthermore, there are environmental protection aspects associated with non-environmental laws (*Pipelines Act 1967* (NSW)). This is particularly relevant to the principal legislation regulating the petroleum and pipeline industries.

For the pipeline industry, environmental law has a material effect on business activities. There are similarities in environmental laws across Australia; however, the regulatory and procedural differences among jurisdictions mean that environmental management for pipeline activities invariably needs to be tailored to State and Territory requirements.

An example of the range of pipeline, petroleum and environmental laws applicable to the onshore pipeline industry is outlined in Table 1 below (correct at the time of writing).

A visual summary of how environmental legislation and other documentation interact is provided in Figure 4.

A common provision in environmental laws across Australian jurisdictions is a general environmental duty. This duty applies to all individuals and businesses in the jurisdiction. Broadly, the general environmental duty is that it is the responsibility of all Australians to take all reasonable and practicable measures to prevent or minimise environmental harm.

2.1.1 Commonwealth legislation

Responsibility under the Australian Constitution for environmental protection rests with the States. However, since the High Court's decision in the 1983 Tasmanian Dams case, the Commonwealth also has some responsibilities via the external affairs power of the Constitution. This means that each tier of government has a role to play in ensuring the overall integrity of the environmental protection system[2].

The primary environmental legal instrument of the Commonwealth government is the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The EPBC Act is triggered when an activity will occur on Commonwealth land or if an activity is likely to have significant impact on a Matter of National Environmental Significance.

Other Federal instruments exist to enable collaboration between the State and Federal governments, such as the *National Environment Protection Council Act 1994* (Cth) (NEPC).

[1] Bates, Gerry. *Environmental law in Australia*. LexisNexis Butterworths, 2013.
[2] Bates, Gerry. *Environmental law in Australia*. LexisNexis Butterworths, 2013.

The NEPC makes National Environment Protection Measures (NEPMs) and provides the mechanism to assess and report on the implementation and effectiveness of NEPMs in participating jurisdictions.

2.1.2 State and Territory legislation

As the primary responsibility for environmental protection in Australia lies with State and Territory governments, those jurisdictions have the largest body of environmental legislation in Australia.

The relationship between environmental-specific laws and pipeline-specific laws is not always linear and will often vary depending on the level of potential impact, area, activity or situation that triggers an Act. State/Territory legislation and regulations applicable to environmental management in the pipeline industry are generally structured in two parts:

a) Specific pipelines and/or petroleum laws which have internal environmental management triggers and requirements (e.g. *Pipelines Act 2005* (VIC)); and
b) Environmental laws focussed on the protection of a particular environmental aspect (*Environmental Protection Act 1994* (QLD)).

Because of the critical role pipelines play in the Australian economy, pipelines may be granted exemptions under environmental laws when undertaking certain activities.

Figure 4APGA recommends seeking guidance from an experienced environmental professional (and if appropriate a legal professional) when interpreting legislation and planning for legal compliance.

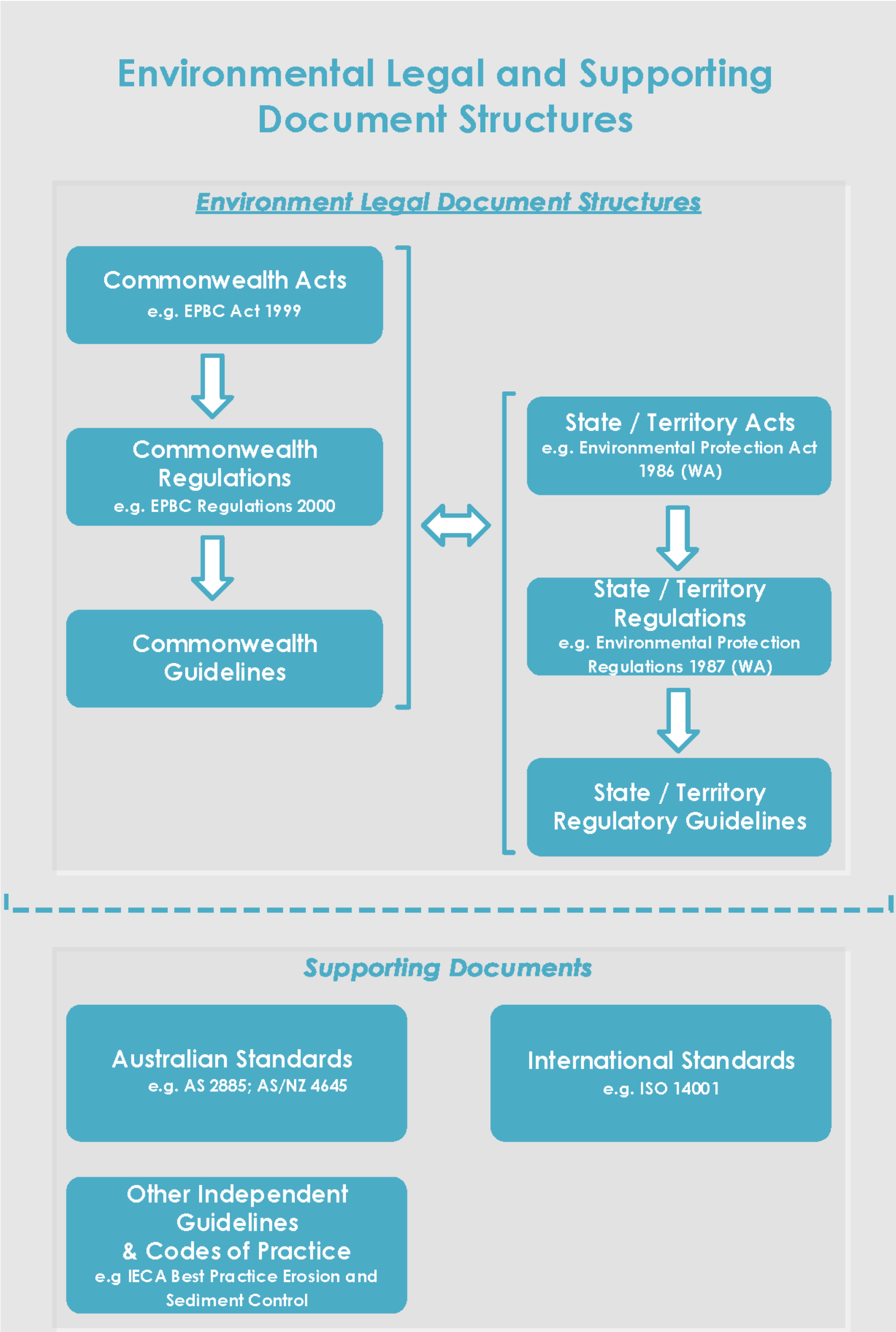


Figure 4 Environmental Legal and Supporting Document Structures

2.1.3 Environmental approvals

An environmental approval is a generic term for any consent granted from a relevant authority under, or as an exemption from, an environmental law. An environmental approval operates as complementary or exemplary function of the Act under which it was granted.

Environmental approvals must be sought and obtained prior to activity commencement. Environment approvals recognise the legality of a proposed activity and, if needed, conditions of approval are outlined which shall be implemented before, during and/or after conducting the activity.

Different environmental approval mechanisms exist for different situations. Broadly, an environmental approval can take the form of:

- a permit;
- an approval;
- a licence; or
- other similar legal tool.

Environmental approvals are a vehicle through which publicly agreed environmental protection priorities (in environmental laws) can be placed on business activities while also enabling that activity to occur.

Environmental approvals often have similar characteristics. For instance, an approval will:

- apply for a set time frame; and/or
- apply for a set location/s or spatial extent; and/or
- apply to a particular activity or group of activities.

Environmental approvals and the process of gaining environmental approvals can result in specific direction being given to a business proposing to conduct an activity. Not executing the direction given under an approval may constitute a breach of the approval, and a breach of environmental law. Examples of a direction given to a business under an approval include:

- conduct additional studies, further analysis prior to the commencement of work (e.g. field surveys)
- obtain subsequent approvals and/or additional permits/licences (e.g. heritage, fauna specific)
- undertake a detailed risk or environmental impact assessment
- prepare an environmental management plan;
- provide data as evidence of implementation and adherence to an environmental management plan.

When identifying, gaining or implementing an environmental approval it is important to budget appropriate time and resources to avoid interruption to other business activities and schedules.

Examples of environment approvals that occur in the pipelines industry include:

- Native Vegetation Clearing Permit
- Pipeline Licences
- Environmental Authorities (QLD)
- Statement of Environmental Objectives (SA).

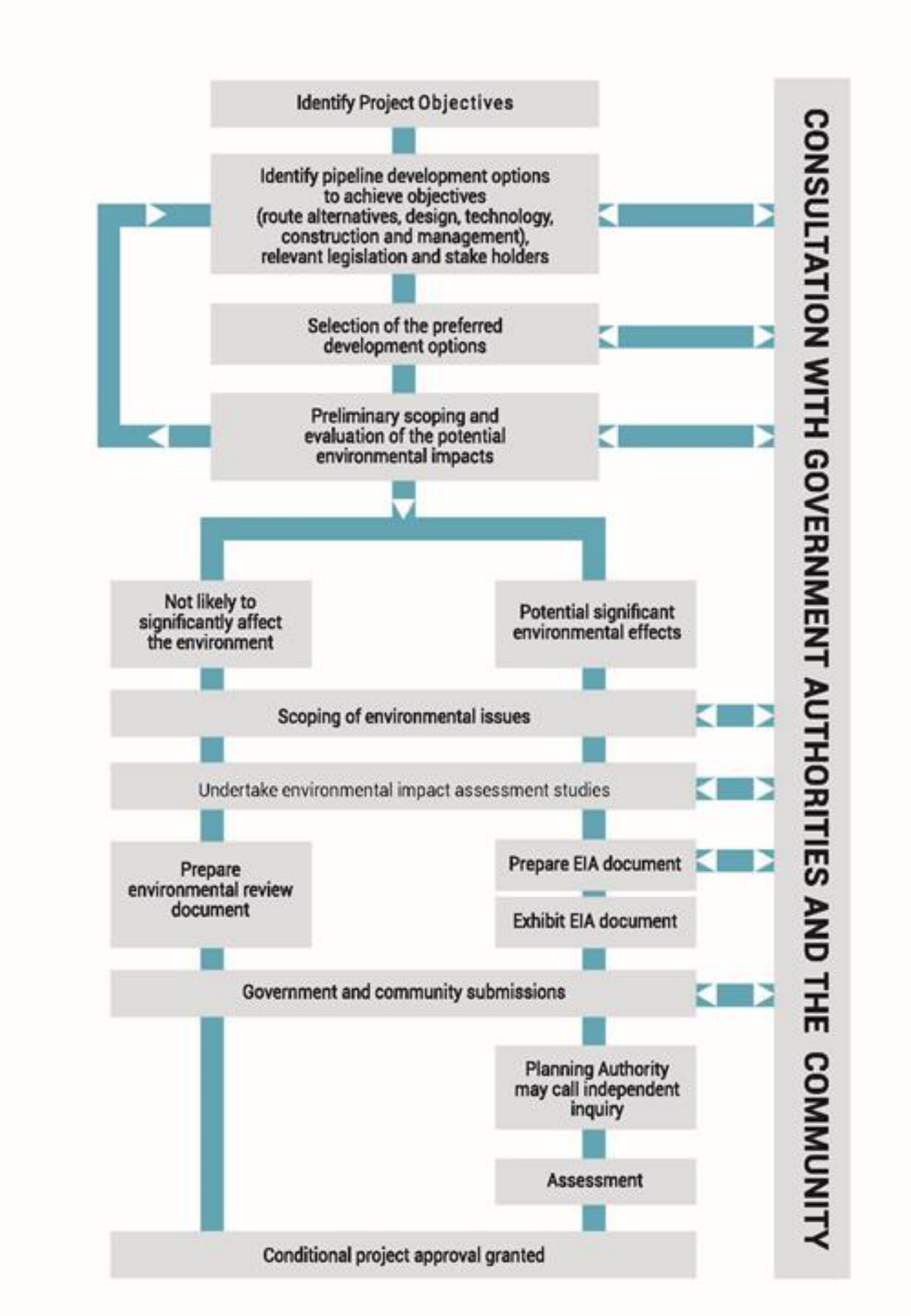


Figure 5 Key stages in the environmental approval process

Table 1 Example of the range of pipeline, petroleum and environmental laws applicable to the onshore pipelines industry

Jurisdiction	Act	Subsidiary Legislation
ACT	*Environment Protection Act 1997*	*Environment Protection Regulation 2005* *Environment Protection (Noise Measurement Manual) Approval 2009 (No 1)*
ACT	*Planning and Development Act 2007*	*Planning and Development Regulation 2008*
ACT	*Nature Conservation Act 2014*	*Nature Conservation Regulation 2015*
Cth	*Environment Protection And Biodiversity Conservation Act 1999*	*Environment Protection and Biodiversity Conservation Regulations 2000*
Cth	*National Greenhouse and Energy Reporting Act 2007*	*National Greenhouse and Energy Reporting (Measurement) Determination 2008* *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015* *National Greenhouse and Energy Reporting Regulations 2008*
Cth	*National Environment Protection Council Act 1994*	*National Environment Protection (Assessment of Site Contamination) Measure 1999*
Cth	*National Environment Protection Measures (Implementation) Act 1998*	*n/a*
Cth	*Native Title Act 1993*	*Native Title (Prescribed Bodies Corporate) Regulations 1999*

Jurisdiction	Act	Subsidiary Legislation
Cth	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984*	
NSW	*Pipelines Act 1967*	*Pipelines Regulations 2013*
NSW	*Environmental Planning & Assessment Act 1979*	*Environmental Planning & Assessment Regulations 2000* *State Environmental Planning Policy (Infrastructure) 2007* *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* *State Environmental Planning Policy (State Significant Precincts) 2005* *State Environmental Planning Policy No 55 - Remediation of Land*
NSW	*Gas Supply Act 1996*	
NSW	*Native Vegetation Act 2003*	*Native Vegetation Regulations 2013*
NSW	*Protection of the Environment Operations Act 1997*	*Protection of the Environment Operations (Clean Air) Regulation 2010* *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2014* *Protection of the Environment Operations (Waste) Regulation 2014* *Protection of the Environment Operations (General) Regulation 2009* *Protection of the Environment Operations (Noise Control) Regulation 2008*

Jurisdiction	Act	Subsidiary Legislation
NSW	*National Parks and Wildlife Act 1974*	*National Parks and Wildlife Regulation 2019*
NT	*Energy Pipelines Act 1981*	*Energy Pipelines Regulations 2001*
NT	*Environmental Offences and Penalties Act 1996*	*Environmental Offences and Penalties Regulations 2011*
NT	*Petroleum Act 1984*	*Petroleum Regulations*
NT	*Environmental Protection Act 2019*	*Environmental Protection Regulations 2020*
NT	*Heritage Act 2011*	
NT	*Northern Territory Aboriginal Sacred Sites Act 1989*	
Qld	*Environmental Protection Act 1994*	*Environmental Protection Regulation 2019 (QLD)* *Environmental Protection (Air) Policy 2019* *Environmental Protection (Noise) Policy 2019*

Jurisdiction	Act	Subsidiary Legislation
		Environmental Protection (Water and Wetland Biodiversity) Policy 2019
Qld	*Nature Conservation Act 1992*	*Nature Conservation (Administration) Regulation 2006* *Nature Conservation (Protected Areas Management) Regulation 2006* *Nature Conservation (Animals) Regulation 2020*
Qld	*Vegetation Management Act 1999*	*Vegetation Management Regulation 2012*
Qld	*Water Act 2000*	
Qld	*Planning Act 2016*	
Qld	*State Development and Public Works Organisation Act 1971*	
Qld	*Petroleum And Gas (Production And Safety) Act 2004 (QLD)*	*Petroleum And Gas (Production And Safety) Regulation 2004 (QLD)*
Qld	*Aboriginal Cultural Heritage Act 2003*	
SA	*Petroleum and Geothermal Energy Act 2000 (SA)*	*Petroleum and Geothermal Energy Regulations 2013 (SA)*

Jurisdiction	Act	Subsidiary Legislation
SA	*Environment Protection Act 1993 (SA)*	*Environment Protection Regulations 2009 (SA)* *Environment Protection (Air Quality) Policy 2016* *Environment Protection (Water Quality) Policy 2015* *Environment Protection (Movement of Controlled Waste) Policy 2014* *Environment Protection (Waste to Resources) Policy 2010* *Environment Protection (National Pollutant Inventory) Policy 2008* *Environment Protection (Noise) Policy 2007* *Environment Protection (Air Quality) Policy 2016*
SA	*Native Vegetation Act 1991 (SA)*	*Native Vegetation Regulations 2017 (SA)*
SA	*Planning, Development and Infrastructure Act 2016*	*Planning, Development and Infrastructure (General) Regulations 2017*
SA	*Aboriginal Heritage Act 1998*	*Aboriginal Heritage Regulations 2017*
SA	*National Parks and Wildlife Act 1971*	
SA	*Landscape South Australia Act 2019*	*Landscape South Australia (General) Regulations 2020*
SA	*Heritage Places Act 1993*	*Heritage Places Regulations 2020*
Vic	*Gas Safety Act 1997*	*Gas Safety Regulations (various) 2008*
Vic	*Pipelines Act 2005*	*Pipelines Regulations 2017*
Vic	*Planning and Environment Act 1987*	*Planning and Environment Regulations 2015*
Vic	*Environmental Effects Act 1978*	*Ministerial Guidelines for Assessing Environmental Effects (2006)*

Jurisdiction	Act	Subsidiary Legislation
Vic	*Environment Protection Act 2017*	*Environment Protection Regulations 2021*
Vic	*Heritage Act 2017*	
Vic	*Aboriginal Heritage Act 2006*	*Aboriginal Heritage Regulations 2018*
Vic	*Agricultural and Veterinary Chemicals (Control of Use) Act 1992*	
Vic	*Catchment and Land Protection Act 1994 (CaLP)*	*Catchment and Land Protection Regulations 2012*
Vic	*Flora and Fauna Guarantee Act 1988*	
WA	*Petroleum Pipelines Act 1969*	*Petroleum and Geothermal Energy Resources (Environment) Regulations 2013*
WA	*Petroleum and Geothermal Energy Resources Act 1967*	*Petroleum Pipelines (Environment) Regulations 2012*
WA	*Petroleum (Submerged Lands) Act 1982*	*Petroleum (Submerged Lands) (Environment) Regulations 2012*

Jurisdiction	Act	Subsidiary Legislation
WA	*Environmental Protection Act 1986*	*Environmental Protection Regulations 1987* *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* *Environmental Protection (Noise) Regulations 1997* *Clean Air (Determination of Air Impurities in Gases Discharged to the Atmosphere) Regulations 1983* *Environmental Protection (Abrasive Blasting) Regulations 1998* *Environmental Protection (Controlled Waste) Regulations 2004* *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992* *Environmental Protection (NEPM - NPI) Regulations 1998* *Environmental Protection (NEPM - UPM) Regulations 2013* *Environmental Protection (Unauthorised Discharges) Regulations 2004*
WA	*Biosecurity and Agriculture Management Act 2007*	*Biosecurity and Agriculture Management Regulations 2013*
WA	*Biodiversity Conservation Act 2016*	*Biodiversity Conservation Regulations 2018*
WA	*Gas Standards Act 1972*	*Gas Standards (Gas Supply and System Safety) Regulations 2000*
WA	*Contaminated Site Act 2003*	*Contaminated Sites Regulations 2006*
WA	*Aboriginal Heritage Act 2021*	*Aboriginal Heritage Regulations 1974*

2.2 Standards (international, regional, Australian)

Standards are developed by an independent body. They set out specifications, procedures and guidelines, intended to ensure products, services and systems, are safe, reliable and consistent.

Standards are based on industrial, scientific and consumer experience and are regularly reviewed to ensure they keep pace with new technologies. There are three kinds of standards: international, regional and Australian.

Standards are not legal documents (refer to Figure 4 above). However, the application of a Standard/s can be made legally enforceable. For instance:

- When a government references a standard in legislation, it becomes mandatory.
- Standards can also be incorporated into legal contracts.

Following this, Standards, when not reference in law or contract, can be used for guidance or as an indicator of best practice.

Two Australian Standards have been developed specifically for the Australian pipelines industry. In many Australian jurisdictions, these Standards enjoy legal force. They are:

- **AS 2885** - The central Standard developed specifically for the gas pipelines industry is the AS 2885 series. The Australian Standard for Pipelines – Gas and Liquid Petroleum (AS 2885) sets out requirements for the design and construction, welding, operation and maintenance and field pressure testing of gas and liquid petroleum pipelines. AS 2885 also includes provisions on the management of environmental risk. The Standards currently in this series relevant to onshore pipelines are:
    - AS 2885.0 Pipelines – Gas and liquid petroleum, Part 0: General Requirements
    - AS 2885.1 Pipelines – Gas and liquid petroleum, Part 1: Design and construction
    - AS 2885.2 Pipelines – Gas and liquid petroleum, Part 2: Welding
    - AS 2885.3 Pipelines – Gas and liquid petroleum, Part 3: Operation and maintenance
    - AS 2885.5 Pipelines – Gas and liquid petroleum, Part 5: Field pressure testing
    - AS 2885.6 Pipelines – Gas and liquid petroleum, Part 6: Pipeline safety management

- **AS/NZS 2566** – the 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

Specific environmental-focused Standards also provide important guidance on the development and implementation of environmental management systems, and the environmental risk management process. Internationally, and in Australia, the most important Standard of this type is the ISO14000 suite of documents.

The ISO14000 suite of documents includes:

- ISO 14001: 2015 *Environmental management systems – Requirements with guidance for use*
- ISO 14004 *Environmental management systems – General guidelines on principles, systems and support techniques*
- ISO 14015 *Environmental assessment of sites and organisations*
- 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.

2.3 Guidelines and Codes

Like Australian Standards, guidelines and codes are not legal documents (refer to Figure 4). However, the application of a guideline or code can be made legally enforceable by its reference in law.

A **code** outlines a way of doing things, which is accepted by, and applicable to, a defined scope (group of people, industry, spatial area etc). A code may contain a range of subordinate guidelines that provide further clarity of aspects of the topic.

Guidelines can be divided into two types, regulatory and technical.

- **Regulatory guidelines** – are designed as an explanatory guide to a piece of legislation or the approach of enforcing/complying with the legislation enforced by the regulatory authority.

- **Technical guidelines** – provide guidance on executing a technique or management method. Usually, technical guidelines provide guidance on what is considered best practice by a group of subject matter experts.

  Examples of technical guidelines applicable to the pipeline industry are:
  - International Erosion Control Association (IECA), Best Practice Erosion and Sediment Control (IECA BPESC)– Appendix P: Land Based Pipeline construction
  - ANZECC - Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

3 Environmental Management Systems

An environment management system (EMS) is a business tool for managing the impacts of a business on the environment. It provides a structured approach, which is integrated into other business processes, for identifying, understanding, analysing and implementing environmental legal obligations, risk management methods and/or environment protection measures.

APGA encourages its member companies to develop and maintain an appropriate EMS that is designed to suit the characteristics of their business.

APGA considers the development and implementation of an EMS a key step towards achieving management of environmental risk and encourages an EMS to be broadly consistent with the ISO 14001 suite of documents. This includes:

- ISO 14001: 2015 *Environmental management systems – Requirements with guidance for use*;
- ISO 14004: 2016 *Environmental management systems -- General guidelines on implementation*.

In practice, an EMS is implemented at both large (company) and small scales (project/activity), via the environmental risk management process. However, an EMS itself should make up, and influence, the broader systematic context of business.

An EMS should be constructed to suit the business structure, scope and risk of the business. Because of this, each EMS will be unique. Despite this, there are common risk management characteristics and processes which should make up every EMS. They are outlined visually in Figure 6 with further detail in **Error! Reference source not found.** below.

Figure 6 AS/NZS ISO 31000 relationship between components of the framework for managing risk (sourced from HB 203:2012 Managing environment-related risk)

Table 2 Core Elements of an EMS (as outlined in ISO 14001:2016)

Element	ISO 14001 Description	Possible Implementation Option
Organisation And Leadership	The organisation shall determine external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcomes of its environmental management system. Top management shall demonstrate leadership and commitment with respect to the environmental management system.	***Policy:*** a policy that articulates the organisation's environmental commitments. ***Roles and Responsibilities:*** appoint an environmental manager or management team responsible for the ongoing coordination of the EMS.
Planning	Within the defined scope of the environmental management system, the organisation shall determine the environmental aspects (including legal aspects) of its activities, products and services that it can control and those that it can influence, and their associated environmental impacts, considering a life cycle perspective.	***Procedures:*** identify legislative and regulative requirements relevant to the organisation's environmental aspects; identify the organisation's significant environmental aspects; establish environmental objectives and targets; implement programs to achieve those objectives and targets.

Element	ISO 14001 Description	Possible Implementation Option
Support And Operation	The organisation shall determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the environmental management system. The organisation shall establish, implement, control and maintain the processes needed to meet environmental management system requirements, and to implement the actions identified.	***Training and awareness***: ensure that persons doing work under the organisation's control are aware of the EMS, its function and purpose. ***Communication***: establish, implement and maintain the process(es) needed for internal and external communications relevant to the environmental management system. ***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. ***Induction (organisation/area specific)***: Environmental inductions should be conducted for all site staff who will be actively involved with a pipeline. Inductions must be undertaken prior to an individual's commencement on the work site. ***Toolbox talks***: 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. ***Environmental management plan***: An environmental management plan (or equivalent) (EMP) is a centralised, scope-specific document which describes all environmental risks related to an activity and sets out environmental risk management methods which should be implemented to avoid or minimise the environmental risk of that activity to an acceptable level.

Element	ISO 14001 Description	Possible Implementation Option
Performance Evaluation And Improvement	The organisation shall monitor, measure, analyse and evaluate its environmental performance.	***Audit and assurance***: Establish, implement and maintain an internal audit program(s), including the frequency, methods, responsibilities, planning requirements and reporting of its internal audits. ***Monitoring and inspections:*** Conduct periodic and/or ad hoc inspections of monitoring with the goal to measure progress towards achieving those objectives and targets; take steps to continually improve the effectiveness and efficiency of environmental management; strategically review the continuing effectiveness of environmental management within the organisation. ***Record keeping:*** Ensure arrangements are in place for the collection, storage and access of relevant records and data for activities. Examples of periodic data capture and record keeping includes inspections and audit records conducted periodically throughout the duration of an activity. See Record Keeping and Data Capture for further information. ***Management review:*** Top management shall review the organisation's environmental management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness. ***Continual improvement review:*** periodical review and planning for change, adaption and improve of the suitability, adequacy and effectiveness of the environmental management system to enhance environmental performance.

3.1 Compliance

Compliance is a primary driver of an environmental management system for business. When effective, an EMS can establish and quantify how regulatory requirements, organisational commitments, targets, objectives and contractual commitments are achieved and what actions need to be taken to materially demonstrate compliance with environmental law.

3.1.1 Data capture and record keeping

Data capture and record keeping is an essential task for compliance. Data capture and record keeping enables the implementation and performance of the environmental risk management process – as well as general adherence of approval conditions – to be validated by external third parties.

Data capture and record keeping can have different characteristics:

a) Ongoing or ad hoc.
   For instance:
   - records of activities completed (work planning records)
   - records of environmental controls implemented (installing sediment fences)
   - records of environmental events (waste disposal receipts, quantities of native vegetation clearing)
   - incident reporting and investigation reports.

b) Periodic/targeted.
   For instance:
   - audit reports
   - inspection reports
   - monitoring report and data.

Data capture and record keeping can be implemented and stored in a range of different, but complementary ways. It is important that data capture and record keeping be integrated into existing business processes and systems where records and data are captured. For instance, data and records could be captured in:

- activity planning and scheduling tools
- incident and investigation reporting and management systems
- audit and action tracking systems
- engineering review and methodologies
- corporate policies and statements
- risk assessment and activity risk profiles
- activity scope and methodology documentation and records
- contracts and procurement processes.

Quality of data capture and record keeping is critical to the value of records. When planning for data capture and record keeping arrangements it is important to consider how the following will be achieved:

- Effective document control – especially ordering, storage (digital or physical), labelling, access and availability for records.
- Retention and security of records – some record types have legal requirements to be stored and available as a record of activities conducted for long time periods (e.g. 7 years).

- Record access – depending on the sensitivity of a record or record type, access to view/download records might be restricted or open.

3.1.2 External auditing

State and Commonwealth regulatory authorities have the authority to conduct compliance audits on pipelines to ensure adherence to legislation and approval conditions. External audits can consist of a review on the ground of any activities, as well as desktop audits of records.

Non-compliance can give rise to a range of enforcement mechanisms, such as:

- 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 delayed notification or the provision of false or misleading information.

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

4 Environmental Risk Management Process

Environmental risk is the probability of an event having an undesirable effect (impact) on the environment. Environmental risk management seeks to determine what environmental risks exist and then determine how best to mitigate those risks to protect the environment.

The environmental risk management *process* (see Figure 7) describes the steps and considerations that should be taken to manage environmental risks thoroughly and consistently. The environmental risk management process requires consideration of legal, economic and behavioural factors as well as ecological, human health and social impacts of activities. APGA recommends aligning the environmental risk management process with the following documents:

- AS/NZS ISO 31000:2018;
- HB 203:2012 Managing environment-related risk; and
- AS 2885 Pipelines—Gas and liquid petroleum.

The environmental risk management process should be an integrated part of all business management.

For best results, multidisciplinary teams with inputs from a variety of experts should be involved at the appropriate stages of the environmental risk management process.

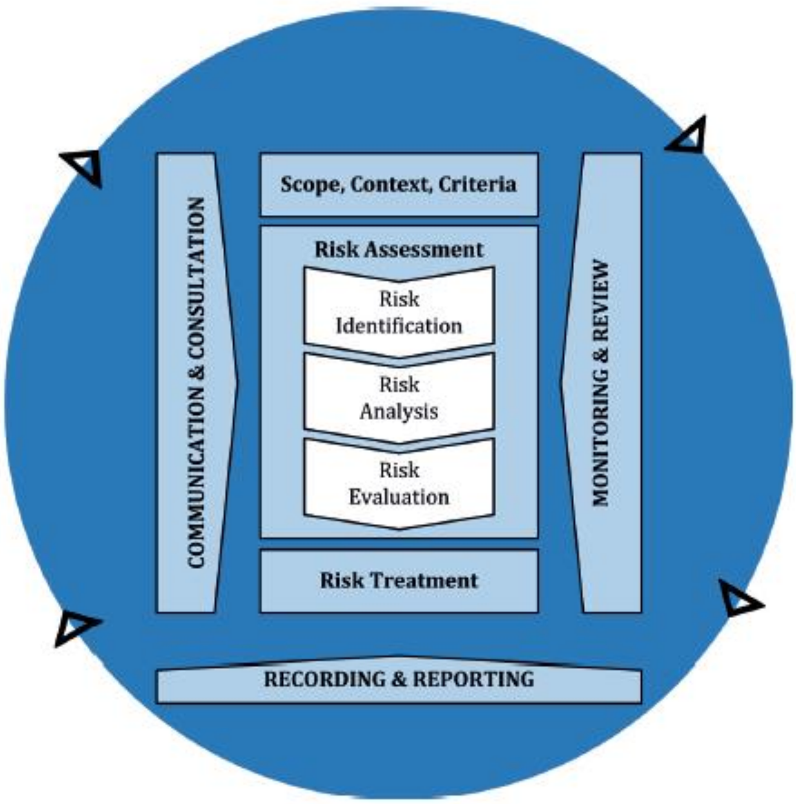


Figure 7 AS/NZS ISO 31000 Risk Management Process – Overview

4.1.1 Timing: environmental risk management

Preliminary planning is conducted well before any formal risk identification activities. Environmental risk should be a feature of this early pre-planning and should be a consideration in any formal or informal pre-risk assessment.

The success of environmental risk management will be determined by how early environmental risks are identified and embedded into the environmental system.

4.2 Environmental risk: assessment

Environmental risk assessment – or risk analysis and evaluation – is the process of evaluating the identified risks (in terms of likelihood and consequence of impacts) and developing environmental risk management methods (controls) to avoid or minimise the risk.

Prior to beginning an assessment of identified risks, the structure of the analysis and criteria against which risk will be evaluated must be defined. Defining a structure and risk assessment criteria may take the form of:

- **Environmental risk assessment: structure**
    - An environmental risk assessment structure ensures that the environmental risk assessment is consistent and transparent to any reader. APGA provides a template in Appendix 2.

- **Environmental risk matrix**
    - An environmental risk matrix ensures the analysis of risk is as consistent and qualitative as possible. A risk matrix based on qualitative or agreed boundary measures of consequence and likelihood should 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.
      Labelling the type of risk by level (high to low) is important to ensure risks are addressed in order of importance.

      APGA provides an environmental risk assessment template, adopted from AS 2885 in Appendix 2.

Techniques for determining risk severity and frequency are outlined in AS 2885.1. This system is recommended for adoption as the basis for preparing and undertaking onshore pipeline risk analyses.

4.2.1 Environmental risk management methods

The most important outcome of the environmental risk assessment is environmental risk management methods. Environmental risk management methods are agreed methods and/or techniques for avoiding or minimising the environmental risk of conducting an activity (see section 4.4 below).

This Code provides high level, generalised environmental risk management methods for activities in each pipeline lifecycle phase. They are found in the environmental risk profiles for each pipeline lifecycle phase.

Environmental risk management methods are the gateway through which environmental risk is applied to a specific scope, activity, business, jurisdiction or situation. It is therefore imperative that the environmental risk management methods are uniquely developed – as a part of the environment risk assessment process – to suit the situational, financial, operational and legal parameters of the activity being conducted.

Characteristics of appropriate environmental risk management methods are:

- They are agreed on by the business decision makers and third parties (i.e. regulators);
- Are practical and appropriate to minimise or avoid risk as far as possible; and

- Have appropriate resources (time, cost, human resources etc) allocated within the activity plan to enable timely and effective execution of the environmental mitigation measures.

Environmental mitigation measures should be centralised and articulated in an environmental management plan or equivalent documentation.

4.3 Environmental risk: identification

Environmental risk identification is the process of identifying the context, stakeholders, hazards, environmental aspects and environmental impacts of an activity. Identified environmental risks can be relevant or irrelevant, depending on the spatial and temporal constraints of an activity.

An environmental professional in consultation with relevant stakeholders should conduct the initial identification of environmental risks.

Broadly, there are two ways to identify environmental risk in business:

1) *focus on the environmental risk area / aspect,* then determine the activities which could result in impact to that risk area; or
2) *focus on the activity*, then determine the environmental risk areas / aspects which could be impacted.

There is no right way to conduct the environmental risk identification process. However, for environmental risk management to be effective, at some point environmental risk management methods must be *integrated* into the job planning, job step execution and job closeout – achieving this is the challenge of all businesses that may face environmental risks.

Environmental risk identification should also include other associated steps such as:

- *Establishing the context*
  Determining the external and internal context of the business/activity and the context of the particular application of the risk management process considered.

- *Targeted environmental assessment*
  Desktop and/or field environmental assessments to gather data or better understand the environmental risk areas / aspects.

- *Communication and consultation*
  Communicating with and consulting the internal and external stakeholders of a business/activity as appropriate concerning the risk management process as a whole.

The environmental risk profiles and activities identified as common in each pipeline lifecycle phase outlined in this Code may form the basis for identifying environmental risks associated with an activity.

Environmental risks vary spatially, and may change over time due to either physical, procedural, community sentiment or legal changes. It is important that environmental risk profiles are reviewed periodically, and in response to a major event or change, to ensure identified risks remain relevant for an activity.

4.4 Environmental risk mitigation

Environmental risk mitigation – or risk treatment – is the process of implementing environment risk mitigations, which were developed and agreed during the environmental risk assessment.

The most common and accepted way of implementing environmental risk mitigations is to develop an environmental management plan (EMP) or equivalent documentation.

4.4.1 Environmental management plan

An EMP is a centralised, scope-specific document which describes all environmental risks related to each activity and sets out environmental risk management methods which should be implemented to avoid or minimise the environmental risk of that activity to an acceptable level. Subsidiary plans to the EMP may be developed in certain high-risk situations.

Typical contents of an EMP are as follows:

1. Scope;
    a. context of the EMP within the business and business EMS
    b. context and description of the activities covered by the EMP.
2. Legislative context and requirements.
3. Environmental context:
    a. descriptions of physical/biological and social environments.
4. Environmental risk management methods (by activity):
    a. including explanation of environmental integration.
5. Roles and responsibilities.
6. Reporting and data capture arrangements.

Further guidance on the contents of an EMP is outlined in Section 3.

EMPs may be developed as construction environmental management plans (CEMP) or operational environmental management plans (OEMP) in accordance with the phase of the project. Refer sections 7 and 8 respectively for guidance on considerations for each phase.

4.4.2 Environmental integration

Environmental integration is a general term for the mechanism or strategy which ensures that the environmental risk mitigations – contained within an EMP or equivalent – are implemented as a part of an activity. The environmental integration mechanism or strategy must be agreed with and understood by all business stakeholders involved in the activity.

The environmental integration mechanism or strategy is the vehicle that takes environmental risk management from the 'environment' area, out of the EMP and ensures it is executed within the normal business activity.

An environmental integration mechanism or strategy is an imperative step in the environmental risk management process. Without environmental integration, an EMP may become a redundant document, and environmental risks have a high likelihood of remaining uncontrolled.

The most important part of any environmental integration mechanism or strategy is allocation of roles and responsibilities for executing environmental integration – and the environmental risk management methods.

Environmental integration must be as simple as possible to encourage uptake of environmental risk management methods and should align with (or be a part of) existing business processes. High-level examples of an environmental integration mechanism or strategy include:

- Incorporation of environmental risks mitigations by workplace planning and scheduling software.
- Inclusion of environmental risk mitigations as a 'job step' in a job plan.
- Inclusion of environment risk mitigations in a construction schedule.
- Implementation of an EMP in business-leaders' key performance indicators (KPIs) – e.g. project managers, general managers, engineering managers etc.

4.5 Environmental risk: audit and assurance

Environmental audit and assurance – or monitoring and review – is a broad term which describes the process of reviewing the implementation of environmental risk management methods and proposing modifications to ensure that environmental risks continue to be managed appropriately.

Environmental audit and assurance activities should be conducted by an environmental professional to ensure a clear and informed assessment of environmental risk management occurs.

Environmental audit and assurance processes can be either:

- **Internal**: instigated and conducted by the business, or business processes to review environmental risk management processes and methods; or
- **External** (third party or regulatory): review environmental risk management processes and methods instigated by the business and delegated to a third party to ensure an impartial perspective; or instigated by a regulatory authority to ensure compliance with environmental laws and approvals as a part of a regulatory regime.

The focus of environmental audit and assurance processes can be one, or a combination of the following performance indicator types:

- **Lead**: prospective and/or predictive review, indicating whether environmental risk management processes are functioning correctly *before* environmental harm may occur. For instance:
  - inspections (general, periodic or ad hoc inspections)
  - monitoring (aspect specific, and ongoing targeted monitoring triggered by a legislative requirement or approval).
- **Lag**: retrospective review of event/s where environmental risk management processes have failed or have not been adequately functioning and environmental harm has occurred. For instance:
  - incident reporting
  - incident Investigations.

Internal lead and lag audit and assurance activities form an integral part of a company's environmental management system. Internal audit and assurance – when conducted on a regular basis – can provide a timely insight into the health of environmental risk management processes and assist in rectifying any compliance liabilities early, as well as driving continuous improvement in environmental risk management.

Maintaining records of audit and assurance activities is important to ensure a transparent record of performance over time that can be critiqued by internal or external stakeholders.

To enable conclusions to be drawn, audit and assurance activities should always be benchmarked against an existing, transparent, consistent and agreed standard of practice, such as:

- environmental management plan or equivalent
- environmental management system process standards or requirements
- environmental legislative provisions
    - e.g. approval conditions
- technical or regulatory guidelines
- Standards (international, regional, Australian)
- codes of practice.

APGA recommends that the guidance provided in the ISO 19000 standard series is used to design and conduct internal audit and assurance programs.

5 Environmental Risk Areas / Aspects

Environmental risk areas /aspects create a structure for business to categorise environmental risk and focus attention on areas that may be impacted by a particular activity. Risk management processes include undertaking risk assessment workshops; identifying key activities, hazards and impacts; establishing suitable controls and assessing residual risks. Refer to Section 4 for further detail.

This code considers 11 environmental (and heritage) risk areas / aspects.

1. Native Vegetation;
2. Fauna;
3. Biosecurity (pests, weeds, disease);
4. Natural or historic heritage;
5. Indigenous heritage;
6. Soil (erosion; acid sulfate);
7. Water (hydrology, watercourses);
8. Waste (hazardous; non-hazardous);
9. Emissions (dust; noise and vibration; gas);
10. Third parties; and
11. Chemicals and contamination.

This section provides a description of each of the environment risk areas, and some common management methodologies. Throughout the Code, the environmental risk profiles for each specific pipeline activity use these environment risk area descriptors to consistently outline the type of environmental risks applicable to that activity. Hazards and controls are typically determined from a range of sources including regulatory and client requirements as well as best practice and risk assessment outcomes.

In industry, there are two types of environmental harm that could occur for each environmental risk area / aspect. These two categories are different, but related:

1. **Legal/regulatory environmental harm**: an undesirable outcome relating to an environmental law, legal process or condition. This could include a breach, violation or omission.
2. **Physical environmental harm**: an undesirable outcome to an environmental receptor or feature will occur. Environmental harm could include death, removal, loss of utility, destruction or degradation of the environment or environmental values.

5.1 Native vegetation

Native vegetation are plants that are indigenous to the area, including trees, shrubs, herbs and grasses. Pipeline activities can impact on native vegetation. Equally, native vegetation can impact on how pipeline activities are conducted. An essential part of the environmental management of onshore pipelines is gaining a detailed understanding of flora species and ecological communities present in the vicinity of an activity.

Native vegetation can be managed to accommodate and mutually benefit environmental, social and business stakeholders. For instance, native vegetation maintains ecological biodiversity, provides community amenity and prevents erosion which helps maintain pipeline integrity. Conversely, unmanaged native vegetation can increase the risk of invasive root damage to the pipeline, create a fire hazard and restrict access to operating pipelines and facilities.

Management of native vegetation should be based on the principles of avoidance and minimisation of harm and risk management. These principles form a hierarchy which explain how native vegetation (and activities which impact upon native vegetation) should be treated from the most desirable (avoid impacts) to least desirable option (impact and rehabilitate).

Preliminary desktop assessments and site ecological surveys are an important step of the processes involved to determine the most appropriate locations and design for the development of new infrastructure to minimise impact on native vegetation. Development approval applications and regulatory approval conditions are then commonly derived from the recommendations provided from the surveys to regulate the works.

When planning to clear native vegetation, vegetation 'offsets' can be applicable – see the APGA Environmental Offset Guidelines for more information.

5.2 Fauna

Australia is home to a unique and diverse range of terrestrial and aquatic fauna species. Fauna includes vertebrates and invertebrates. Pipeline activities have the potential to impact on individuals, species and communities. Equally, native and non-native fauna can provide constraints to pipeline activities.

Management of native and non-native fauna is based on the principles of avoidance and minimisation of harm and risk management.

An essential part of the environmental risk management process is gaining an understanding of the types of fauna species and communities in the vicinity of an activity – especially listed or protected species. Planning, including preliminary desktop assessments and site ecological surveys are critical to determine the most appropriate locations and design basis of planned development works. The identification and implementation of appropriate fauna impact management controls are essential to limit environmental impacts during all phases of the pipeline lifecycle. A commitment to implementing fauna controls can be a requirement for obtaining approvals. Fauna approval conditions and commitments can vary significantly between regulatory authorities and approvals granted. Fauna controls may include the use of fauna shelters, earth plugs or access ramps at prescribed distances of open trench as well as daily fauna trench checks of open sections of trench and bell holes at a prescribed number of times and certain time of day. Seasonal variations may impact the effectiveness of fauna controls used and the fauna capture and fatality rates can also vary from a number of factors. The length of open trench should also be minimised where practical to reduce the number of trapped fauna and the resources required.

Suitably experienced fauna handlers with the appropriate qualifications (ie venomous snake handling) should be used at all times who hold (or are authorised) under the appropriate wildlife handling licence for the applicable jurisdiction. It is prudent that adequate planning for resources is to be considered to meet contractual requirements and approval conditions around fauna spotting, predominately during clearing and trenching.

Figure 5: Fauna Spotter Catching during pipeline construction (CNC Project Management)

5.3 Biosecurity

Biosecurity is defined as the protection of the environment, economy and public health from negative impacts associated with pests, diseases and weeds. Pests, diseases and weeds can create an ecological imbalance resulting in environmental, social or economic harm or nuisance.

Pipeline activities pose a risk of introducing or exacerbating the risk of biosecurity hazards on the environment and community. Management of biosecurity hazards are based on the principles of avoidance, minimisation and control.

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.

A common activity which heightens the risk of biosecurity issues (especially for weeds and diseases) is the movement of plant, machinery and vehicles. A common and effective biosecurity mitigation method to address this activity is clean downs and inspections.. Clean downs include methods by wash down (e.g. use of high pressure water) or blow down (e.g. use of an air compressor). Planning of activity access routes and maintaining vehicle hygiene in an appropriate way minimises and avoids interaction with biosecurity hazards.

The objective of clean downs is to remove any plant, soil or organic matter from a vehicle (generally the undercarriage) prior to entering a susceptible environmental area (e.g. a nature reserve) or when leaving an area where weeds may be present (e.g. a paddock or known infested area). The intention of a clean down is to avoid the transport of weeds or disease on the vehicle, plant or machinery from one area to another. A blow down is one form of a clean down and may be just as effective and less costly as a wash down in dry conditions traversing between locations or jurisdictions with varying risk or requiring a new clean and weed hygiene inspection declaration. However, a blow down will likely not be effective for use in wet conditions when soil sticks to or in circumstances when vehicles or plant have hard soil clumps stuck in areas on the underbody. It may also not meet landholder or contractual requirements.

When, where and how a clean down is conducted is an important planning consideration. If conducted in an inappropriate fashion or location, a clean down can be counterproductive, in fact increasing biosecurity risks. For instance, if water used to wash-down a vehicle (then containing a disease or weed) is allowed to flow to a watercourse then environmental harm can occur.

5.3.1 Weeds

Noxious or declared weeds can be a significant problem in Australia in terms of agriculture and the conservation of native flora and fauna. Numerous noxious or declared weed species are known to exist in Australia, many of which are classified according to their potential threat to agriculture and/or the environment. 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 when their activities could result in biosecurity impacts.

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 (for instance, an infestation which results in cropping land being deemed unproductive).

Poor weed management heightens the risk of harm during the pipeline construction lifecycle phase, but also poses a risk during the pipeline operation and decommissioning lifecycle phases.

Following the pipeline construction lifecycle phase, the cleared pipeline easement (or equivalent right to access) can be subject 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, State or Territory 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.

5.4 Natural and historic heritage

Natural heritage refers to any natural features or places which are known, or suspected, to possess significant heritage value such as fossils, unique landforms and significant areas. Historic heritage refers to places or sites of non-indigenous buildings, infrastructure and commemorative locations.

Natural and historic heritage is classified as either:
- Registered Natural or Historic Heritage; or
- Unregistered Natural or Historic Heritage.

Registered natural and historic heritage includes objects, species or locations which are protected under Federal, State, Territory or local laws. Unregistered natural and built heritage includes objects, species or locations which are not protected under specific Federal, State, Territory or local heritage laws, or are of a known local significance and thus should be treated with adequate due diligence and respect.

Examples of natural and built heritage in Australia include:
- Great Barrier Reef
- Uluru
- North Head – Sydney
- Flemington Racecourse
- South Australian Old and New Parliament Houses
- Fremantle Prison (former).

Pipeline activities should apply all reasonable and practical measures to avoid disturbing natural and historic heritage and work in partnership with relevant stakeholders to achieve this.

Heritage surveys are important 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.
- Site-specific measures which permit the pipeline to be placed in close proximity to heritage sites while avoiding direct disturbance.
- Fencing and/or flagging of the features where culturally appropriate.

Awareness of the location of heritage is a useful tool to decrease the likelihood of accidental disruption.

5.5 Indigenous heritage

Indigenous or First Nations 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 and Torres Strait Islander people from before European settlement through to the present day.

Indigenous heritage items include both physical and non-physical elements:
- Physical Indigenous heritage include objects or effects created by traditional societies, such as stone tools, grinding grooves, culturally-modified trees, art sites and ceremonial or burial grounds.

- Non-physical, or intangible Indigenous heritage includes peoples' memories, storylines, ceremonies, language and 'ways of doing things' that continue to enrich local knowledge about the cultural landscape and facilitate local Indigenous people's connection with the land.

Figure 6: Ground edge axe (CNC Project Management)

Figure 7: Culturally modified tree (CNC Project Management)

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

Most States and Territories maintain registers of Indigenous heritage. The relevant contents of registers should be reviewed during the planning phase of all pipeline activities. 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.

Appropriate approvals must be obtained prior to any activity that will disturb or destroy Indigenous heritage. All staff and contractors should be made aware of the location and value of known Indigenous heritage 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).

Consultation
Consultation is an integral part of the assessment of Indigenous cultural heritage, as Indigenous stakeholders should be considered the primary source of information about their cultural heritage and how it is best identified, protected and conserved. Consultation should be carried out in line with the relevant State or Territory best practice guideline, information availability and in a way that respects the complex locations, history, kinship and custodial relationships. The aims of the consultation process are as follows:

- To identify groups and individuals with an interest in being involved in the ongoing consultation process.

- To provide First Nations representatives with the opportunity to participate in the field assessment process and to inspect and comment on the values of the study area.
- To encourage all First Nations 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 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.
- To integrate Indigenous heritage values and recommendations through the project lifecycle.

.
During ground-breaking activities, there is potential to uncover previously unrecorded heritage sites. In the event that this occurs, activities must proceed in compliance with any *unexpected finds* or escalation process, and applicable regulatory requirements and agreed to by all relevant stakeholders shall be followed.

5.6 Soil

Within Australia there is an immense variety of soils that support our natural, economic and social environments. Onshore pipelines traverse a large variety of soil types and areas.

Soil is an interface through which other types of environmental and/or community harm can occur. Soils influence water movement, land stability, and biodiversity distributions and have the potential to exacerbate a range of environmental management issues such as topsoil and subsoils, vegetation, fauna and third-party management.

Risks to and from soils include erosion, degrading soil structural integrity, salinisation, acid sulfate soils, declining ecosystem health and human health. Inappropriate management of soils during the pipeline lifecycle may also impact agricultural and livestock production or infrastructure asset integrity over the short and long term. These issues will vary depending on local environmental characteristics, soil types and business activities.

Erosion minimisation and sediment control is a specialist management area for soil. To avoid repetition, this Code recommends the use of the International Erosion Control Association Best Practice Erosion and Sediment Control (IECA BPESC) – Appendix P: Land based pipeline construction for the pipelines industry. Requirements to meet IECA BPESC Appendix P include the development and implementation of Erosion and Sediment Control Plans (ESCPs) specific to the infrastructure proposed for development. Progressive (site specific) ESCPs may also be required as well as a Primary (overarching) ESCP. IECA BPESC key principles are required to be implemented and design controls to be installed and maintained in accordance with applicable design standards. Regular monitoring and adequate resourcing are also fundamental in reviewing performance and meeting the standard's objectives.

It should be noted, however, other standards may require to be adopted and specific development approval requirements may be applicable, depending on the regulatory authority jurisdiction and approval conditions granted. Typical example conditions imposed by regulators may include requirements for ESCPs to be developed in accordance with IECA BPESC (or other standards) by a suitably qualified or Certified Professional in Erosion and Sediment Control (CPESC).

Key principles to be adopted include the following:

1. Appropriately integrate the development into the site;
2. Integrate ESC issues into site and construction planning;
3. Develop effective and flexible ESCPs based on anticipated soil, weather and construction conditions;
4. Minimise the extend and duration of soil disturbance;
5. Control water movement through and around the site;
6. Minimise soil erosion;
7. Promptly stabilise disturbed areas;
8. Maximise sediment retention on the site;
9. Maintain all ESC measures in proper working order at all times;
10. Monitor the site and adjust ESC practices to maintain the required performance standard.

Knowledge of the specific soil types is an important step for environmental management of pipelines. Field and laboratory testing (including geotechnical testing) are important processes to undertake prior to commencement of construction activities and to include in the development of ESCPs. It is important to undertake sampling and testing for soil management practices and any required amelioration, including from appropriate representative locations and soil depth, including topsoil and subsoil. Suggested analysis includes soil pH; soil texture; exchangeable sodium percentage (ESP); cation exchange capacity (CEC); and emersion aggregate test (EAT). A soil scientist or CPESC is recommended by IECA BPESC to be engaged to provide advice on soil sampling and data analysis.

Some important soil types are described below.

Figure 8: Erosion controls (berms and sediment fences) at a watercourse crossing. (W. Mathieson)

Figure 9: Erosion controls at a trench de-watering site. (Ecos Consulting)

5.6.1 Erosive soils (slaking and dispersion)

Soil characteristics and methodologies:

- Occurrence may be due to low organic matter, high sodium, high magnesium or low calcium: magnesium ratio.
- Highly erodible and structurally unstable in water, breaking down into their soil particles (sand, silt and clay).
- Causes high levels of turbidity in stormwater runoff.
- Tunnel erosion in backfilled/reinstated trenches, behind rigid (ie concrete) or semi-rigid (ie rock gabion) surfaces and rill erosion on slopes and drains.
- Caused by high, negative electro-static charge on the surface of the smaller clay and silt-sized particles.
- Derived largely by high levels of exchangeable sodium and excessive mechanical disturbance, particularly if the soil is wet.
- Hazard arising from exposure to water (with or without soil disturbance).
- Easily detected by visual observations and field tests (Emerson test, exchangeable sodium percentage (ESP)).
- Laboratory tests (ESP, emersion aggregate test (EAT), dispersion percentage (DP) and/or cation exchange capacity (CEC)) required to determine specifics including severity of dispersibility and identify management measures.
- Dispersion related to soil structure.
- Salt in the soil or water reduces the dispersive effects on soil particles.
- May be treated (i.e. gypsum) or buried under a layer of non-dispersive soil (minimum 100mm layer recommended) depending on environmental features.

5.6.2 Acid sulfate soil (potential and actual)

The National acid sulfate soil sampling and identification methods manual (2018) is recommended to be used to provide guidance on technical and practical management and identification and sampling of acid sulfate soils (ASS). Guidance materials and regulations applicable to the relevant jurisdiction should also be referred to and followed.

Soil characteristics and methodologies:

- Occur naturally and are harmless when left in a waterlogged, undisturbed environment.
- Can occur in a range of environment settings, not just coastal, low elevations.
- Can result in long-term environment degradation and damage to infrastructure.
- Potential acid sulfate soils (PASS) are benign, anaerobic subsoils in their natural state.
- Exposure (oxidisation) leads to production of H2SO4 (sulfuric acid) in the soil (actual acid sulfate soil: AASS).
- ASS releases acid and dissolved metals.
- Field testing (pH test of runoff, ponds or puddles) may be used as a guide, with laboratory testing required to identify PASS and ASS.
- Avoid exposure of PASS to air where oxidisation may occur by soil mapping, route selection avoidance, Horizontal Directional Drilling (HDD) or similar techniques.
- Treat exposed soils with agricultural lime in line with a dedicated site assessment and plan.

5.6.3 High shrink/swell soils

Soil characteristics and methodologies:

- Typically, Vertisol soil types in either brown, grey or black in colour and crack open when dry.
- These soils have high clay content and mineralogy.

- Soils shrink and swell dependent on moisture content and have a high water-holding capacity.
- Vegetation communities are a useful surface indicator.
- Contain a high soil fertility and ability to supply plant nutrients.
- Gilgai micro-relief (small ponding of water) common on these soils.
- Infrastructure on and in the ground can be at risk.
- Treatment methods including cultivation or ripping for water repellence.

5.6.4 Saline soils

Soil characteristics:

- Any soil type can become affected.
- Can be detected by EC meter in the field, with extent to be confirmed by laboratory 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.

5.6.5 Soils in dry/desert environments

Terrain characteristics and methodologies:

- Varied soil types encountered.
- Many areas devoid of vegetation.
- GIS for identification (isohyets and vegetation communities).
- Soil and vegetation management important to ensure maximum use of unpredictable moisture.
- Timing construction works ideally in dry season prior to wet season for revegetation.
- Use of cleared vegetation and rock material for erosion protection and stabilisation.
- Establishment improved with supplementary irrigation.
- Soil seed reserves often limited, therefore topsoil management critical.

5.6.6 Wetland soils

Soil characteristics:

- Hydrosols, 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 used for identification.
- Can contain PASS.

5.6.7 Soils with pH extremes (high and low)

Soil characteristics and methodologies:

- 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), then broadly confirmed with field tests, with lab analysis needed to quantify ameliorants if required.

- Can alter the availability/toxicity level of nutrients.
- Limits establishment and persistence of vegetation, can corrode infrastructure and can reduce the efficiency of cathodic protection measures.
- Soil management important to ensure topsoil and subsoil stored separately and reinstated in order.
- Treatment using lime (i.e. aglime) for soils with a very low pH (strongly acidic) or a fertiliser with ammonia and nitrogen for soil with a high pH (strong alkaline level).

5.6.8 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. Imported soil must be free from contamination.
- Reinstatement of rock material as a mulch will help reduce erosion and provide temporary ground cover.

5.7 Water

A watercourse is anywhere, natural and artificial, where water flows or water is contained either permanently, semi-permanently or periodically. Water and watercourses include surface and groundwater resources and can be natural or unnatural. Unnatural watercourses are manmade (artificial) structures or systems which store or transport water (such as stormwater drains).

Watercourses are of major environmental, social and economic value to Australia, and if water quality becomes degraded this resource will lose its value. Watercourses link together other environmental aspects such as native vegetation, fauna and heritage.

Watercourses are an interface through which environmental and/or community harm can occur and is a high-risk environmental area of pipeline activities across all lifecycle phases. Watercourse risks and hazards include sedimentation, flow rate change, fish passage management, recharge disruption and pollution/contamination.

Pipeline activities can be impacted by watercourses; equally, pipeline activities can have an impact on watercourses. This is predominantly through open cut excavations and trenching through watercourses, and resulting impacts to ongoing flow, or in areas which may lead to impacted stormwater run-off, via spills or sediment, but also through water extraction for construction activities. Ineffective management of watercourses can breach regulatory licences and social licences, damage assets and reputation.

Water quality conditions outlined in regulatory approvals may include water quality sampling analytes and criteria limits (field and laboratory) for dust suppression, dewatering and potable water, as well as hydrostatic testing requirements. Treatment measures may be required prior to the use (i.e. from high saline bores) or prior to release of water to meet discharge criteria limits. Dewatering set-up methods may include appropriately sized hoses and pumps to prevent ponding, hose intake protection for sediment and aquatic fauna, diffusers and scour protection to prevent erosion and soil loss. Water consumption and use should be tracked to meet contractual and regulatory requirements, which may include potable water, hydrostatic test water, discharged water, construction water and dust suppression as well as septic wastewater.

The pipeline industry should strive to manage watercourses to maximise benefits and minimise risks to the environment, community and the business. The management of watercourses is based on the principles of avoidance, minimisation, mitigation and adaptive management.

5.8 Waste

Waste can be identified as unwanted or unusable materials after its primary use. However, waste can and should be re-used, recycled or recovered after its primary use where possible. Waste comes in a variety of forms and can present different environmental risks depending on the chemical makeup and physical state. Defining waste and types of waste should be determined under the applicable state regulatory legislation and as a waste type may not be classified as such in other jurisdictions. Wastes may be manufactured or natural (ie spoil or rock) and may be re-used on site (if permitted by the regulator) if unable to be reduced or avoided in accordance with the Waste Hierarchy.

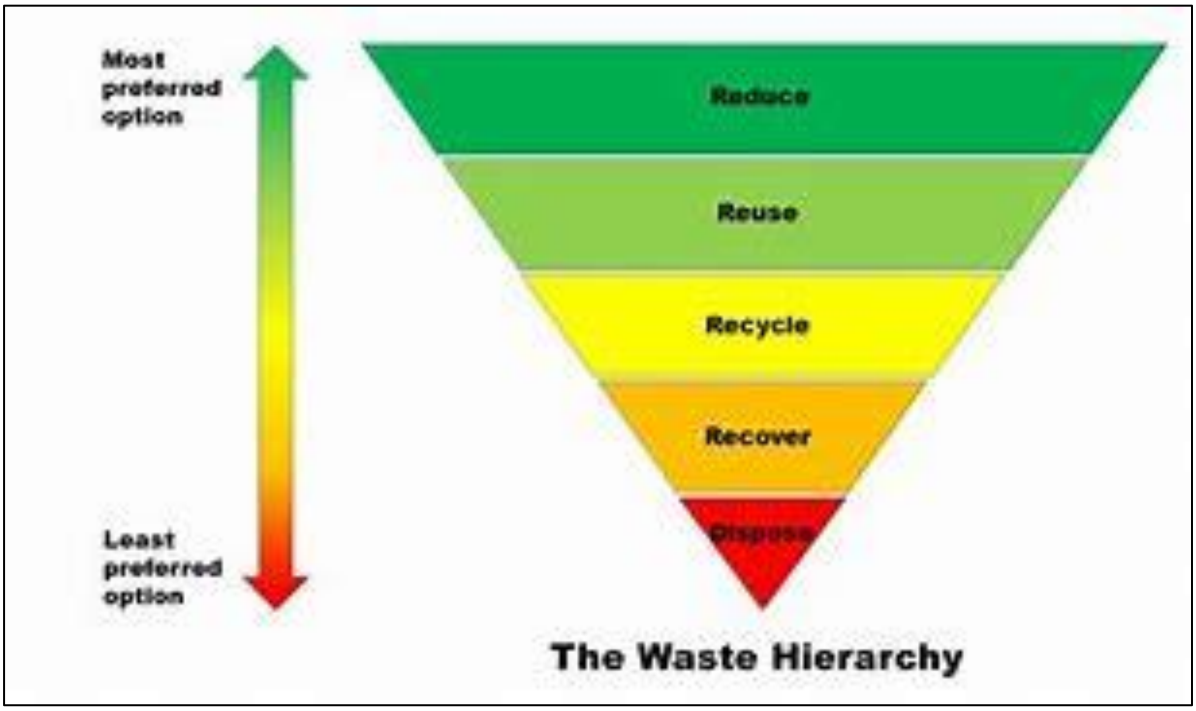


Figure 10: The Waste Hierarchy

Broadly, there are three different types of waste:

1. General waste

General waste is any solid waste which is not identified, regulated or governed by State or Territory waste laws, permits or approvals. General waste is usually inert substances or items which pose little or no immediate risk to the environment, community or human health. General waste may include construction materials such as conduit, signage, survey tape, flagging, material off-cuts, packaging materials or food and drink waste materials.

However, in large quantities and/or over time, general waste products can present hazards to the environment and community. For instance, waste generation, transport and disposal associated with pipeline activities can result in ground or water contamination, negative aesthetic impacts, attraction of pest species and an unfavourable business reputation.

Spoil needs to be considered carefully, under a risk-based approach and in line with specific State or Territory legislation to determine whether it is either waste, contaminated and therefore regulated (see below) or suitable for reuse.

2. Regulated waste

Regulated wastes are high-risk waste types that are subject to regulatory oversight and specific requirements. These requirements apply to the handling, storage, transport and disposal of regulated wastes and are different in each Australian State or Territory. This is due to the higher risk that regulated wastes can pose to humans, the community and the environment. These can also be referred to under different terms, depending on the State, for example as hazardous or priority wastes.

If managed inappropriately, regulated wastes can pose compliance and reputational risks to businesses and result in environmental and community harm. When planned for, minimised and managed appropriately, the risks associated with regulated waste can be significantly minimised and hazards controlled.

- Asbestos is a common type of regulated waste and can be common in the pipelines industry. 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. Materials that exceed the State jurisdiction threshold limit of asbestos by volume should be regarded as asbestos material. Any potential exposure to asbestos including repair or disposal of pipe coating or maintenance works for example, should be managed accordingly, and appropriate safety measures and waste management protocols for asbestos handling and disposal shall be applied.

- Naturally Occurring Radioactive Materials: Consideration needs to be given to Naturally Occurring Radioactive Materials (NORMs) which can occur within gas streams. This waste requires separate classification and licencing to other regulated waste streams, in line with various Radiological Councils, EPA or equivalent departments, as well as close pairing with health and safety professionals around exposure in line with Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) RPS15 Safety Guide for the Management of Naturally Occurring Radioactive Material. Controls to manage NORMS may include dust sampling, employee training, radiation monitoring programs, implementing radioactive management plans and waste management.

3. Wastewater

Wastewater is used water from an activity any non-potable water which may or may not be contaminated. In some instances, wastewater has the potential to pose significant hazards to the environment, community and human health. If uncontained, wastewater is particularly mobile and can quickly cause contamination of large areas.

Pipeline associated activities including ground disturbance, temporary facilities and hydrotesting for example, can result in wastewater from both domestic and industrial activities (i.e. stormwater runoff, septic water and greywater). Management requirements for wastewater will vary depending on the source of the wastewater, the method of treatment, level of contamination and the quality required for end use of treated water. Mitigation controls can include re-use, recovery, treatment, planning, timing or staging of activities for example.

5.9 Emissions

In all Australian jurisdictions, some form of emissions is regulated via environmental and planning laws to ensure the emissions resulting from business activities do not cause undue harm to the public or environment.

Pipeline activities, such as purging and venting, can emit emissions, therefore, managing the activities which may cause or increase these emissions is important to minimising nuisance and achieving environmental compliance. Emissions types include greenhouse gases, noise, vibration, dust and light.

Emissions can result in claims of nuisance from the public. Nuisance means causing annoyance, inconvenience or discomfort to a stakeholder/s as a result of conducting pipeline activities. Nuisance is also a legal term which means the unreasonable, unwarranted and/or unlawful use of property, which causes inconvenience or damage to others, either to individual landowners and/or to the general public.

5.9.1 Greenhouse gas emissions

Pipeline activities can emit greenhouse gas emissions as a planned or unplanned function of an activity, either via operation of plant and equipment (fuel burning) or venting and purging during normal operations. Designated operational control is required to be determined between constructors, operators and subcontractors for the purposes of greenhouse gas reporting.

Greenhouse gas emissions are regulated at a Federal level under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act). This Act tracks the quantity of greenhouse gases emitted annually because their accumulation can cause indirect harm via pollution.

Greenhouse gas emissions may result from:

- 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.

5.9.2 Noise and vibration emissions

Pipeline activities – especially construction activities – can cause temporary increases in local noise and/or vibration levels. These types of emissions, especially in metropolitan areas, can pose a hazard or nuisance to the public or the environment.

Noise and/or vibration 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 above-ground sites
- gas vented from pressurised equipment
- equipment noise at above-ground sites.

Noise and/or vibration 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 and Territory noise regulations and *Australian Standard AS 1055 – Acoustics*.

5.9.3 Dust emissions

Dust can pose a direct hazard to human health and impact air quality, including the surrounding environment, heritage features or, more generally cause a nuisance to nearby landowners. These types of emissions, especially in metropolitan areas, can pose a hazard or nuisance to the public or the environment.

Pipeline activities like those involving earthworks, plant and equipment can cause or increase dust emissions. Dusty conditions result from the exposure of soils, therefore many control measures relevant to erosion and sediment control are also relevant to dust control. Common controls implemented include dust suppression by water trucks, reduced speed limits, material capping, planning of works, weather monitoring and minimising ground disturbance.

5.9.4 Light emissions

Light emissions can cause a nuisance for third parties, have impacts on native fauna (e.g. breeding patterns and migration) and increase the risk of biosecurity impacts (e.g. attracting pests).

Light emissions are generally regulated at a council or shire level in Australia and are a pertinent risk in metropolitan areas. They are also a consideration in rural areas, both for the communities who live there, but also for light sensitive fauna.

The following factors should be considered to avoid or minimise light emissions:

- necessity for lighting
- hours of necessary lighting
- type of lighting used
- positioning of light sources
- nearby sensitive receptors (such as houses, workplaces, protected environmental areas).

5.9.5 Odour emissions

As odorant is commonly added to the sweet-smelling natural gas stream for safety and identification purposes, gas release, or odorant dosing activities can result in third party / community or stakeholder concerns. As the mercaptan products used are highly potent, small releases can lead to widespread concern around gas leaks, which are commonly associated with the smell. It is important to ensure these risks are considered and appropriate awareness and notifications are provided to customers and the community prior to higher risk odour inducing activities.

5.10 Stakeholders

Stakeholders are people, landowners, businesses, third parties and groups who are external to a company but either have a vested interest in, or could be impacted by, the activities of a company.

Third parties are an important type of stakeholder for the pipelines industry not just because pipelines interact with so many third parties nation-wide, but because often pipelines share common land (easements etc) with third parties. This means that there is often a common responsibility and vested interest in managing that land.

Public landholders are a type of third party that manage special types of lands on behalf of the community. Differing tenure arrangements mean that activities associated with the construction, operation and decommissioning of pipelines on their land may be subject to conditions of public landholders.

Third party management begins by recognising that pipeline activities do not occur in isolation and that one of the environmental impacts that can result from activities is a loss of a third party's utility.

Landholder or third-party agreements or deeds are a commonly used management tool to include the special agreed conditions to undertake the approved works in accordance with. Conditions may vary and can include biosecurity hygiene, fencing, gate and grids details, survey and notification requirements, reinstatement conditions, compensation details, waste and materials as well as third party representatives in attendance, etc.

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

While visual amenity is not a direct, legally managed area under environmental law, for businesses and the public it is an important part of an activity. Furthermore, poor visual amenity can be an indicator of other uncontrolled environmental risks such as waste management.

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.

5.11 Chemical and contamination

5.11.1 Chemical

A 'chemical' is a general term for a range of substances which are classified according to the type or magnitude of hazard they present. This includes, but is not limited to: 'dangerous goods', 'combustible liquids', and 'hazardous materials'. Collectively, these are chemicals which, because of their chemical, physical or biological properties, can cause harm to people, property or the environment.

Chemicals present a hazard to the environment because environmental harm occurs or may occur when chemicals become uncontained (a chemical spill). The type of environmental harm varies according to sphere (land, air, water), spatial scale (local to regional), toxicity of chemical, type of exposure to receptors and temporal scale (short, medium and long timeframes).

Chemical use during pipeline activities includes fuel and other materials for plant and equipment operations and maintenance, as well as for supporting ancillaries such as camps, offices and pipeline infrastructure such as compressors. These are generally required to be bunded wherever possible and maintained in working order to lower the risk of spills.

Because of the immediate and/or cumulative impacts to the environment and community that result from chemical spills, actions to be taken and the notification processes in the event of a spill are generally regulated in Australia under Federal, State and Territory laws.

5.11.2 Contaminated land

Contaminated land, in relation to land, water or a site, means having a substance present in or on that land, water or site at above background concentrations that presents or has the potential to present, a risk of harm to human health, the environment or any environmental value. While many contaminated sites are a legacy of historical practices, new contaminated sites continue to be created from current practices.

Due diligence assessments for the historical and contamination status should be undertaken prior to acquisition of land for the development works. The assessment results will also provide background and baseline data for future and long-term management of the land and asset(s).

Contaminated land is regulated by each State and Territory according to the relevant State/Territory laws, which should be consulted. The process for reporting contamination to the regulator varies. When conducting due diligence investigations to determine whether contamination is a relevant issue for a project, information should be sought on reported contaminated sites. However, contamination may be present that has not been reported. The potential for unreported contamination may be addressed through desktop investigations and site inspections or a protocol for unexpected finds. Failure to address contamination early on can lead to lengthy and expensive delays to a project if investigations and remedial work are required.

Contaminated land is an important issue because of the risks it can pose to the environment, communities and businesses and is regulated in all Australian States and Territories.

Liability for remediating contaminated land is usually determined in accordance with the 'polluter pays' principle. In certain circumstances, the liability may be transferred to the owner, occupier or developer of the land.

6 Pipeline Lifecycle Phase: Planning and Asset Acquisition

Planning for an activity is a common process across all pipeline lifecycles phases. While the level of detail that a given planning process will include varies depending on the intricacy associated with an activity, planning in some form should always expect to be iterative and be initiated well in advance of work.

For this reason, the pipeline planning phase is the most important phase of all lifecycle phases for environmental risk management because this is the point at which an activity can be modified to avoid or minimise environmental harm. As highlighted above, this process may take several iterations to achieve a level of risk management that is acceptable in satisfying regulatory, stakeholder and commercial expectations.

Asset acquisition does not (generally) involve any physical works being conducted – rather it is the strategic purchase of an asset. The role of environmental management in asset acquisition centres on the identification and assessment of both existing and potential environmental risk. The central contribution of environmental management in relation to asset acquisition is to ensure that relevant material risks associated with the future lifecycle activities of an asset purchase are known, considered and communicated, as well as being appropriately weighted during the decision-making process associated with asset acquisition.

Planning and asset acquisition phases are applied, multidisciplinary processes that require diverse specialist resources. Such resources include: engineers; surveyors; draftspersons; planners; GIS specialists; marketers; environmental practitioners; legal advisers; commercial negotiators; land use advisers, and community relations specialists.

In addition, planning and acquisition requires the establishment of a relationship with regulatory authorities and community stakeholders towards optimising the planning process.

This section of the Code outlines the following:

- The activities which typically occur during the planning and asset acquisition phase(s);
- A list of key environmental risk areas / aspects applicable to each activity; and
- Suggested environmental management methods to minimise or avoid the associated risk(s).

Figure 11: Welding crew operating on the pipeline right of way (Spiecapag Australia)

6.1 Activity description: Design and engineering assessment

The most pertinent environmental risk to pipeline planning and asset acquisition is a failure to identify environmental risk. For this reason, a comprehensive environmental information interrogation, conducted by a suitably qualified environmental professional, is needed early in this activity. The purpose of this is to determine both the physical existence and expression of environmental receptors as well as the legal implication and constraints applicable to the pipeline activity or asset acquisition.

It is accepted in the industry that failure to adequately consider environmental risks in pipeline planning and asset acquisition can lead to protracted planning and approval timings that may influence or introduce sub-optimum design or construction methodology choices, particularly over the long term. For instance, a corridor width that is too narrow, or the placement of the trench line too close to the corridor boundary, can inhibit appropriate soil-type separation during construction or operational excavation activities. Further, inadequate pre-construction assessment of subsoil conditions may fail to identify contaminated soils including asbestos, acid sulfate soils and other site-specific contaminants. This may result in unexpected or unplanned remediation, treatment or disposal costs and likely implications for schedule works programs. This, in turn, can lead to breaches and non-compliance of environmental approvals and/or the inability to maintain safe access or failed rehabilitation and timely restoration of land use.

On this basis, it may also be prudent to incorporate an early works component to project planning to combine environment, design, engineering and constructability into the development of optimised environmental risk mitigation measures.

The work area available for pipeline construction is generally reliant on the width of easement or corridor and associated extra work areas developed during the planning phase and subsequently specified in the planning approval conditions. The work area needed can be justified by analysis of the following aspects:

- Maintaining appropriate safety standards;
- Requirements for construction equipment and vehicle access;

- Environmental sensitivities;
- Geography, terrain, subsoil contamination, groundwater and geotechnical constraints;
- Pipeline diameter and depth of cover required;
- The number of pipelines being installed;
- Proximity to existing infrastructure and utilities;
- Maximising construction productivity; and
- Minimising risk to adjacent land uses or users.

The standard working width in Australia for a major pipeline is between 20-40 metres, however, this parameter is dependent on the abovementioned details (as well as on any project or sites specific considerations). Projects should plan to ensure the construction right-of-way is minimised wherever practicable to ensure adequate buffers to environmental and community sensitivities as well as reducing the disturbance footprint overall in providing sustainability outcomes.

It is a common requirement of regulators to reduce working widths in areas of environmental and community sensitivity. This requirement can necessitate an adjustment in construction methodology which may include trenchless options to avoid surface sensitivities completely. Reduced working width should be considered on a case-by-case basis and be based on a risk assessment of the environmental sensitivities, indirect impacts and associated construction, stakeholder and commercial constraints. This is necessary to:

1. Minimise disturbance to native vegetation;
2. Minimise impacts on fauna;
3. Minimise impacts to human health (ie noise, dust, contamination)
4. Minimise disturbance to landform and impacts on soil and water;
5. Minimise impacts on visual amenity;
6. Minimise impacts on sites of heritage significance;
7. Minimise impacts to community, third parties, land use;
8. Optimise asset creation or acquisition; and
9. Optimise rehabilitation success.

6.1.1 Environmental impact assessment

Detail of the environmental impact assessment (EIA) process for proposed pipelines varies between the Commonwealth, States and Territories. Nevertheless, some form of formal review of any given project's potential environmental impacts is a common requirement. Consideration should be given to how impacts change in line with the landscape and if, and how, the pipeline approval process requires the proponent to consider, identify and assess temporary, permanent, indirect and cumulative environmental impacts on the existing environment as well as to provide details of proposed management measures to ensure there are no unacceptable impacts resulting from the development.

A proposed pipeline which crosses more than one jurisdiction requires a coordinated approvals process which, by extension, will involve the satisfaction and associated timings in meeting the statutory requirements of each jurisdiction.

The general process for EIA is described below.
Insert diagram of the EIA process
Steps include:

1. *Preparation of EIA or similar*

2. *Public exhibition and comment*
3. *Regulator directive in relation to matters to be included in response to public and stakeholder submissions*
4. *Preparation of response to public and stakeholder comments/submissions*
5. *Regulatory assessment*
6. *Regulatory assessment report and recommendation – Approval/Refusal*
7. *Ministerial Approval – where required*

An EIA (or similar) may include:

- A detailed project description;
- Project justification;
- An evaluation against terms of reference or statement of environmental assessment requirements;
- An evaluation of project alternatives;
- An evaluation of the project against the principles of ecologically sustainable development;
- A detailed description of the existing environmental risk areas / aspects;
- Identification and assessment of potential environmental impacts;
- Identification of environmental mitigation measures;
- Identification of environmental offset arrangements where required
- Public participation through community and stakeholder consultation including public exhibition; and
- Presentation of a draft environmental management plan (or equivalent), which includes the impact mitigation measures and commitments developed in the previous EIA sections.

The assessment process evaluates the environmental risk (including social risk) that the proposal represents to the existing environment. Major points for consideration include each environmental risk areas / aspects.

Preliminary investigations during the project feasibility stage, including desktop assessments by subject matter experts, as well as consultation with all relevant stakeholders will assist in scoping the studies required for the assessment.

6.1.2 Cumulative impacts

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.

Assessing cumulative impacts involves an evaluation of the level of impact on resources, ecosystems and communities caused by existing and proposed land use activities within the wider landscape. Such a process will also involve 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 or ERA for the activity.

The physical characteristics of a pipeline corridor should be subjected to a constraints analysis (or similar), using route selection criteria to develop an optimal pipeline alignment that minimises the disturbance of landform and land use during construction, operation and decommissioning phase (if applicable). It is important to note that during the route selection phase other factors, such as political or community focussed issues, and commercial drivers (such as cost and delivery timeframes) can have a major bearing on any alignment corridor. Such factors must be included alongside analysis of physical, environmental, heritage and regulatory constraints.

6.2 Activity description: activity approvals

Pipeline developments require a range of government approvals. This can be in the form of an overarching and inclusive primary approval or a primary approval for some aspects of the project with secondary approvals being required for other activities and impacts. The environmental risk assessment (or similar) prepared by a proponent will be considered by relevant government authorities prior to a decision being made in relation to an approval.

For major projects, the public exhibition of an environmental impact assessment (EIA) forms part of the planning process. This allows regulatory authorities and members of the public to review and submit comments on the proposal. During the assessment process, every effort should be undertaken to understand regulatory expectations and environmental assessment requirements applicable to the proposed works. This will avoid the need for providing supplementary information or additional environmental assessments to demonstrate that proposed impacts have been adequately addressed. Additional studies and preparation of supplementary assessment materials will increase the duration of the approvals timeline and prolong project commencement. It is worth noting that an EIA is not necessarily undertaken by the same government department because multidisciplinary engagement is often required to progress an approval.
In some instances, Ministerial approval may also be required over that recommended by the consent authority. Further, the regulatory requirement for public participation and associated timing during the assessment and approvals phase should be factored into planning and project schedules.

In the planning and asset acquisition phases, an approval may be required for:

- Works to construct an asset;
- Removal of native vegetation;
- Handling and/or relocation of fauna;
- Environmental offset of removal of threatened flora, fauna habitat, or communities;
- Works within, or interfering with waterways;
- Taking of water;
- Erosion and sediment controls and associated plans;
- Interference or disturbance of a known cultural heritage site;
- Installation of camps, buildings and the associated septic systems;
- Operation of septic systems; and
- Land access, including communications protocols (engagement strategies) and erection of fencing and tracks.

6.3 Activity description: third party consultation

The pipeline industry recognises the need for effective stakeholder and community consultation as a key component of planning. Third-party consultation is an important contributor to regulatory approvals and is generally a statutory requirement for EIA. Third-party consultation, especially with the community, should continue beyond the planning phase and continue throughout operations for the design the life of a pipeline. This is necessary to ensure a proper understanding of the pipeline and its performance.

In response to growing community expectations and increased regulatory requirements, APGA has developed its own APGA Stakeholder Engagement Guidelines. The Guidelines should be referenced for further detailed information on stakeholder and community engagement methods.

6.4 Planning and asset acquisition lifecycle phase: activity environmental risk profiles

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management controls
Design and Engineering Assessment	1. Native Vegetation; 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or built heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate); 7. Water (hydrology, watercourses and groundwater) 8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise and vibration; gas, venting and chemical release) 10. Third parties (nuisance) 11. Chemical and contamination.	Failure to identify or assess environmental risks	• Conduct an Environmental Risk Assessment. • Conduct an environmental impact assessment. Conduct a constraints analysis. • Acquire knowledge of the likely presence of legislated listed species and ecosystems and avoid as far as possible. • Generally conserve native terrestrial and aquatic flora and fauna. • Minimise impacts on habitat and ecosystem integrity. • Develop an environmental offsets strategy. • Minimise impacts on surface and ground water quality. • Conserve soils and protect land surface stability. • Minimise impact on existing and future land use. • Apply sustainability assessment such as ISC (refer to Section 1.2.5) • 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 land users, adjacent residents and existing/proposed infrastructure.
Activity Approvals	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or built heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses and groundwater) 8. Waste (hazardous; non-hazardous)	Route selection	• Identify applicable environmental legislation, regulatory policies and strategies. • Establish location of environmentally sensitive areas/protected areas and features. • Avoid known environmentally sensitive areas/protected areas and features. • Establish permissibility within planning context. • Identify, avoid and minimise impacts on regulatory planning constraints. • Undertake review of regulatory timeframes against identified time targets. • Consider relevant Federal/State/Territory environmental offset policies.

	9. Emissions (dust; noise and vibration; gas, venting and chemical release) 10. Third parties (nuisance) 11. Chemical and contamination.		

7 Pipeline Lifecycle Phase: Construction

Onshore pipeline construction involves the building of a pipeline or associated pipeline infrastructure. This process involves a range of specialist tasks executed in a defined construction corridor area. In addition, the process can include the refurbishment or upgrade of an existing piece of infrastructure. Primary and secondary approvals should be submitted and granted at the earliest opportunity to avoid potential delays for commencement of activities. Early contractor involvement can assist with the timeline for the identification and submission of required approvals.

Commissioning (e.g. completion) of a constructed pipeline is generally carried out during, or as a part of, the construction pipeline lifecycle phase. Activities undertaken during commissioning may also be completed once the operation pipeline lifecycle phase has commenced.

This section of the Code outlines:

- The typical activities which occur during the construction lifecycle phase;
- A list of key environmental risk areas / aspects applicable to those activities; and
- Suggested environmental management methods to minimise or avoid the associated risk(s).

This section applies to all pipeline related construction activities, whether construction is for a new pipeline or the looping (or extensive replacement of) an existing pipeline.

Reference should be made to AS 2885.1, for specific guidance on construction of pipelines.

7.1 Activity description: site access

During construction, access to areas (such as pipeline right of ways, laydown areas and campsites) is required on a regular basis by transport, construction, proponent and regulatory personnel. Access may also be required across areas, in order to facilitate the continuation of land use practices, such as farming.

For looping or replacement projects, access to the pipeline easement for ongoing operation of the existing line may also be required.

Figure 12: Temporary vehicle crossing across watercourse. (Ecos Consulting)

Access is generally demarcated to the pipeline corridor right of way but can also include the installation or upgrade of temporary or permanent access tracks. In addition, temporary access is often required over watercourses.

Additional areas including extra work spaces and turn arounds may also be required, and preferably located in less constrained or sensitive areas. These locations should be considered during the planning phase and may require additional approvals.

Activities undertaken at this stage commonly include survey set-out (pegging of pipeline and additional work areas), installation of signage, demarcation of significant flora, weeds species and cultural heritage no go zones, installation of fence gates or grids, and weed treatment (spraying or removal).

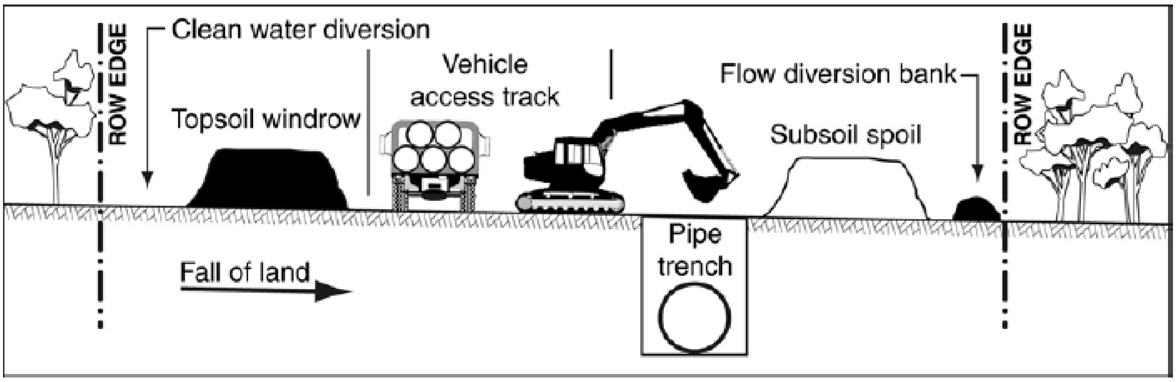


Figure 13: Typical construction corridor layout for large diameter pipeline construction (sourced IECA Appendix P)

7.2 Activity description: vegetation clearing

Pre-clearance surveys are undertaken by experienced ecologists or fauna handlers prior to commencement of clearing activities and includes identification of weeds and significant flora (and demarcation), identification of habitat features and providing survey reports. Reference to ecological documentation and approval requirements should be undertaken for construction planning, prior and during pre-clearance surveys. Clearing of the pipeline construction area involves trimming or removal of trees, shrubs, stumps and other vegetation, in order to provide unobstructed and safe construction workspace and access. Disturbance to native vegetation and wildlife habitat should always be avoided or minimised to the greatest extent practicable. Avoiding impacts to native vegetation can be achieved through careful route selection during the planning phase.

Figure 16 Trimming overhanging vegetation on a pipeline corridor as part of clearing activities (Ecos Consulting)

Native vegetation clearing is a highly regulated environment area in all jurisdictions. A native vegetation clearing permit is usually required prior to clearing vegetation.

7.3 Activity description: grading

Grading involves the removal of topsoil and, in some instances, sub-soil. Topsoil is the surface soil layer and is rich in organic and mineral matter. Topsoil can have high environmental value as it contains both nutrients and native seed stock that can germinate following reinstatement. Topsoil is an important contributor to effective rehabilitation following reinstatement of a pipeline corridor post-construction.

Grading is often required where:

- Construction works are likely to 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; or

- The soil conditions cannot accommodate construction activities.

Generally, topsoil is removed to the next soil layer (i.e. sub-soil). The extent and depth of topsoil removal from the pipeline construction area (e.g. full stripping or partial stripping) should be determined in consultation with landowners, relevant regulatory authorities and/or soil experts, as appropriate. Topsoil stripping is generally a minimum of 100mm, and can be to the visible subsoil layer.

Removal of topsoil from the entire pipeline construction area is common industry practice. However, the soil type and condition may require alternative methods to be employed, such as:

- Restriction of topsoils stripping to the trench line (such that acidic or erodible soils are not exposed);
- Lessening the time between stripping and reinstatement to prevent wind erosion of lighter soils.

Prior to the commencement of grading activities, appropriate topsoil management techniques should be determined in consultation with the proponent/asset owner, affected landowners, as well as with relevant regulatory authorities, as required. It may be necessary to vary application of the techniques listed below on a site-by-site basis.

Topsoil material handling should be minimised as much as possible and ideally used as temporary drainage controls (ie windrows or bunds) within the localised area during construction activities prior to reinstatement. Topsoil stockpiles should be stored in suitable areas away from watercourses and drainage features, preferably upslope in flat areas where possible and with appropriate ESC measures. Stockpiles should ideally be less than 2m in height or as prescribed in the regulatory approval or contractual requirements.

Figure 14: Grader operating during clear and grade (Spiecapag Australia)

Figure 15: Vegetation clearing and stockpiling (Spiecapag Australia)

7.4 Activity description: stringing, coating, jointing and testing

7.4.1 Stringing

The term stringing is used to describe laying lengths of pipe alongside the surveyed or prepared trench-line in preparation for welding the pipe into continuous lengths. Polyethylene (PE) pipe may be delivered to site in lengths or in rolled spools. 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 include provisions for gaps at crossing points for project and land-user access.

7.4.2 Joining

Joining is the process of connecting the strung pipe. 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.

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.

In the case of steel or ductile iron, pipe joins are welded.

7.4.3 Testing

Once completed, each weld is tested by visual inspection and via 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.

7.4.4 Coating

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.

7.4.5 Associated waste products

Waste products generated by pipe stringing, coating and jointing (including testing) 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; welding residue (such as welding rod scraps, welding stubs, electrode butts); and radiography chemicals and packaging. Recycling opportunities and the appropriate disposal of generated waste (including hazardous substances) should be used whenever possible.

Figure 16: Mainline coating being undertaken (Spiecapag Australia)

Figure 17: Welded pipeline ready to be lowered into the open trench (Spiecapag Australia)

7.5 Activity description: trenching

Trenching is the removal of earth for placement of pipe. Trenching may be undertaken either prior to, during, or after, pipe stringing. Trench excavation depth varies depending on the:

- Product being transported;
- Maximum operating pressure of the pipeline;
- Nature of the terrain;
- Proximity to infrastructure and buried utilities; and
- Land use and the potential risk of third-party interference.

Trench depth parameters are specified in Australian Standards, while site-specific requirements will be obtained from infrastructure owners and engineering requirement.

Figure 18: Trenching machine in operation (Spiecapag Australia)

7.5.1 Activity description - blasting

When the use of conventional excavation, trenching or ripping equipment is not possible, it is common to use pre-drilling (to identify and confirm rock areas) and rock breaking methods (ie rock hammer attachments), or controlled blasting, where necessary and permitted. The handling, storage and use of explosives is governed by prescriptive State and Territory legislation. Blasting can cause noise and vibration emissions and create regulated wastes.

Consideration of sensitive areas and third parties should be identified and mitigated in the planning stages and for inclusion in regulatory approval submissions and management plans.

7.5.2 Activity description: trenchless technology

Trenchless technology is a collective term that includes tunnelling, thrust boring, horizontal directional drilling (HDD) and the plough-in method. Trenchless technology can be a viable alternative where there are significant surface constraints that limit or exclude standard open-cut trenching as a construction methodology.

Trenchless technologies can cause less disruption to the surface environment. For this reason, they are ideal for areas in which there are environmental sensitivities, heritage constraints or where existing infrastructure cannot be passed by trenching.

Planning to use a trenchless technology requires an understanding of the proposed technology, the environmental and technical issues and cost. These factors should be assessed during the initial design and planning stages. Geotechnical analysis is required to inform this risk assessment as well as to confirm the appropriateness of the trenchless technology proposed.

An overview of risks and management methods associated with various trenchless technologies can be seen in Table 3 and Figures 20 and 21.

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/).

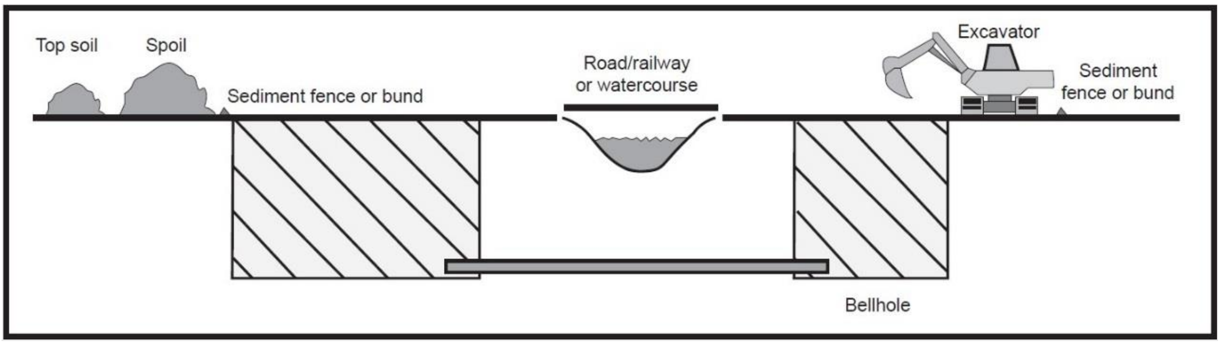


Figure 19: Thrust boring - Schematic profile of a bored crossing

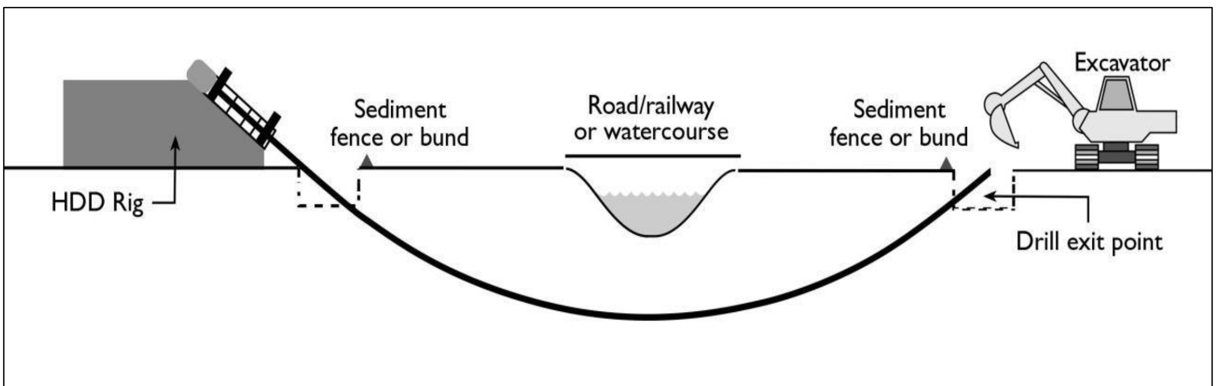


Figure 20: Directional Drilling - Schematic profile of horizontal directional drilling

Figure 21: Thrust Boring under highway (Spiecapag Australia)

Figure 22: HDD Exit Side Pipe Pull Back operation (Spiecapag Australia)

Table 3 - Trenchless Technology Descriptions

Trenchless technology	Overview	Benefits	Limitations	Potential environment	Environmental management methods
Micro tunnelling	Microtunnelling is a form of trenchless construction that uses a remotely operated microtunnelling machine that is guided between two pits or shafts. Once the microtunnelling 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.	• Can avoid surface disturbance across road and rail corridors and at other sensitive locations. • Allows deep installation under existing utilities (fibre optic, gas pipelines, water pipelines). • Is able to penetrate groundwater tables without a requirement for dewatering. • Can also be used through contaminated soils. • Can be a cost-effective option in above instances.	• Can take place only on a relatively flat and constant grade surface. • Requires the sinking of pits or shafts, which can be expensive. The technique cannot be used to negotiate tight vertical or horizontal curves. • Technically elaborate process and is relatively slow. • Factors listed above contribute to cost such that technique can be relatively expensive.	• Surface settlement caused by disturbance to the sub-surface geology following installation of the pipe. • Issues can arise from mismanagement of excavated topsoil and spoil from each service shaft or pit. • Noise and vibration. • Interference with, spread or generation of contaminated material. • Impacts to water table. • Fauna entrapment. • Ineffective control of waste.	• 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 micro tunnelling 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 proponent and relevant stakeholders/regulators prior to commencement of works. • Stockpile areas should be located away from sensitive locations.

Trenchless technology	Overview	Benefits	Limitations	Potential environment	Environmental management methods
					• Dewatering of bell holes should be managed as waste.
Thrust boring	Thrust boring is a low-impact technique involving drilling short distances to join two enlarged trenches, or bell holes, located within the pipeline construction area. A bell hole is required on each side of the proposed crossing (e.g. road, railway or watercourse). One bell hole will be the entry bell hole (containing the thrust bore rig) while the other is used as the receiver. The entry bell hole is typically 25m or longer 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.	• Commonly applied to install pipelines beneath infrastructure such as roads, railways, buried utilities (e.g. fibre optic cable) and, in some circumstances, for watercourse crossings. • Can be used in areas of environmental, heritage and social significance where surface impact is not acceptable.	• Limited by site conditions, including geology, landform, soil type, soil depth and width of the required bore. • Works best in soils that are above the water table, with special dewatering measures needed when groundwater is encountered. • Not suitable over long distances (risk of failure).	• Potential mismanagement of excavated topsoil and spoil from each bell hole. • Fauna/livestock entrapment. • Ineffective control of waste. • Risk of a significant rainfall event filling the bell holes leading to runoff with an unacceptable sediment level. • Noise and vibration. • Interference with, spread or generation of contaminated material. • Impacts to water table.	• 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 area. • Fauna management should be undertaken. • Spoil and topsoil stockpiles shall be managed. • Waste management and management of drilling muds should be undertaken. • Dewatering of bell holes should be managed as waste.
HDD	The installation of the pipeline by horizontal directional drilling (HDD) involves drilling a hole at a shallow angle beneath the surface, then pulling the	• Decreases the risk of impact to areas where surface disturbance avoided as far as possible.	• Feasibility of using HDD is strongly limited by site conditions such as soil stability, slope, access, available workspace and the	• Waste management. • Failure of the HDD, resulting in the release of drilling muds and/or collapse of the pilot drill hole, is a risk which	• As part of determining if HDD is the most suitable method of construction, geotechnical analysis should be undertaken, together with a review of

Trenchless technology	Overview	Benefits	Limitations	Potential environment	Environmental management methods
	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 on 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.	• Generally used to cross major watercourses or at sites where standard open cut methods are not feasible or appropriate. • 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).	nature of subsurface rock. • Directional drilling is costly in comparison to conventional trenching.	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. • Noise and increased duration of construction and workforce numbers.	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.
Plough-in	Plough-in construction is an emerging technique predominantly applied to the installation of small diameter gas and water	• Plough-in methodology can prove to be a lower cost, lower impact and faster form of	• Plough-in construction is not suitable for terrain containing a lot of sub-surface rock. In addition, currently there	• Soil erosion or contamination. • Fauna/livestock entrapment.	• Geotechnical analysis should be undertaken during planning to determine if plough-in is a

Trenchless technology	Overview	Benefits	Limitations	Potential environment	Environmental management methods
	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 cutting. Bell holes are required at regular intervals to join spools of pipeline together, with their spacing dependent on the length of PE rolls being installed.	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.	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.	• Ineffective control of waste. • Risk of a significant rainfall leading to runoff with an unacceptable sediment level.	suitable construction methodology. • Spoil and topsoil stockpiles shall be managed. • Fauna management should be undertaken. • Waste management and management of drilling muds should be undertaken.

7.6 Activity description: pipe laying and backfilling

Pipe laying is the lowering of the joined pipe string into the trench using side-boom tractors or excavators. Prior to pipe laying, it may be necessary to dewater the trench if rainwater or groundwater has accumulated. This is because the presence of excess water will impact on the pipeline stability.

Padding machines may be used, (as an alternative to imported bedding materials,) to sift the excavated subsoil, remove rock and provide fine material to pad beneath, beside and above the buried pipe – to protect the pipe coating. In some situations, 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 applied to minimise settlement or slumping (subsidence) following construction.

Figure 23: Mainline lower and lay (Spiecapag Australia)

Figure 24: Backfill padding (Spiecapag Australia)

7.7 Activity description: 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 should be sourced from existing borrow pit sites. If a new borrow pit is required it should be accessed, located, operated and restored in accordance with the relevant State or Territory jurisdictional laws.

7.8 Activity description: construction camps and worksites

Pipeline construction involves housing a wide range of personnel. Campsites become a preferred option for housing a construction workforce when a 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 various commercial and safety benefits as well as:

- 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 (i.e. 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; and
- Economic benefit to landowners on whose land camps are located.

Additional construction worksites, such as site offices, directional drilling sites, pipe storage areas and machinery and equipment lay down yards may also be required. Planning got these sites are generally treated in a manner similar to campsites.

Construction camps and worksites are subject to regulatory approvals. Such approvals include but are not limited to: landowner consent; cultural heritage surveys; and clearing permits.

During the planning process, it is important to establish how camps, site buildings or other off-easement developments are considered under the local planning procedures. It should be determined whether they require their own approval or if they are included under an umbrella project planning approval.

7.9 Activity description: watercourse crossings

A watercourse crossing is where a pipeline must cross a river, stream or other watercourse type.

The preferred crossing technique should be identified by conducting a comprehensive risk assessment. This assessment should take into consideration 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; retrieval sites, and; cost.

A range of pipeline construction methods are available for watercourse crossings. Below-ground options include standard trenching, watercourse flow diversion or [trenchless technology](#).

Some typical above ground methodologies are:

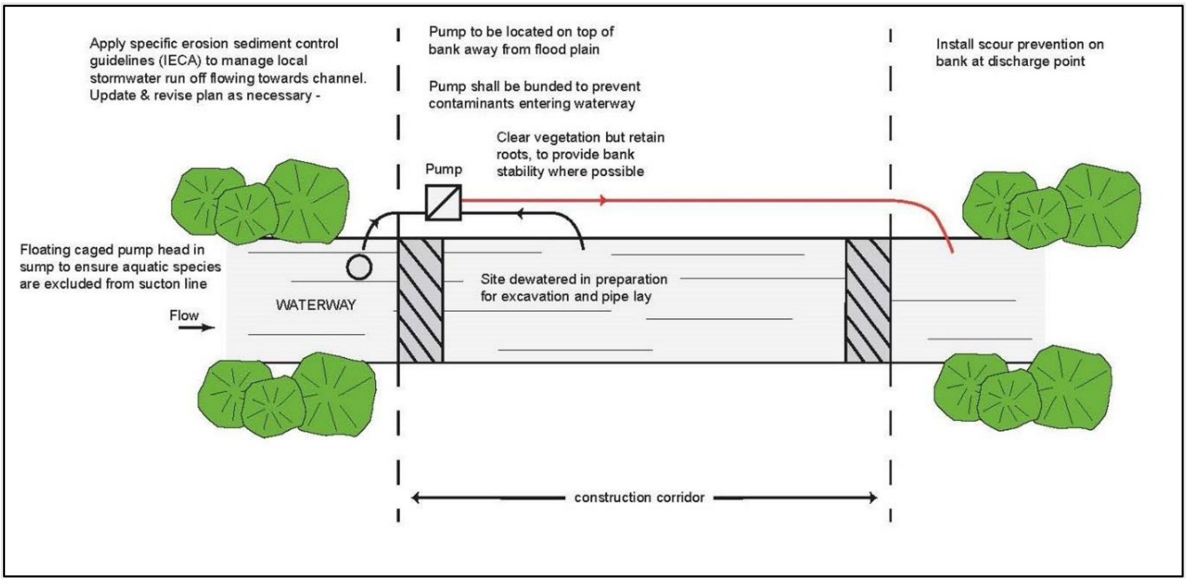
Aerial crossings are applied intermittently on water pipelines and have been successfully used for hydrocarbon pipelines. They involve strapping the pipeline to existing or purpose-built pilings or bridge infrastructure. A key engineering and environmental consideration is the risk associated with the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

Standard 'open cut' trenching involves in-stream excavation of a trench. Excavators or backhoes are generally used for this technique, enabling trench spoil to be stockpiled away from the streambed. 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 on 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.

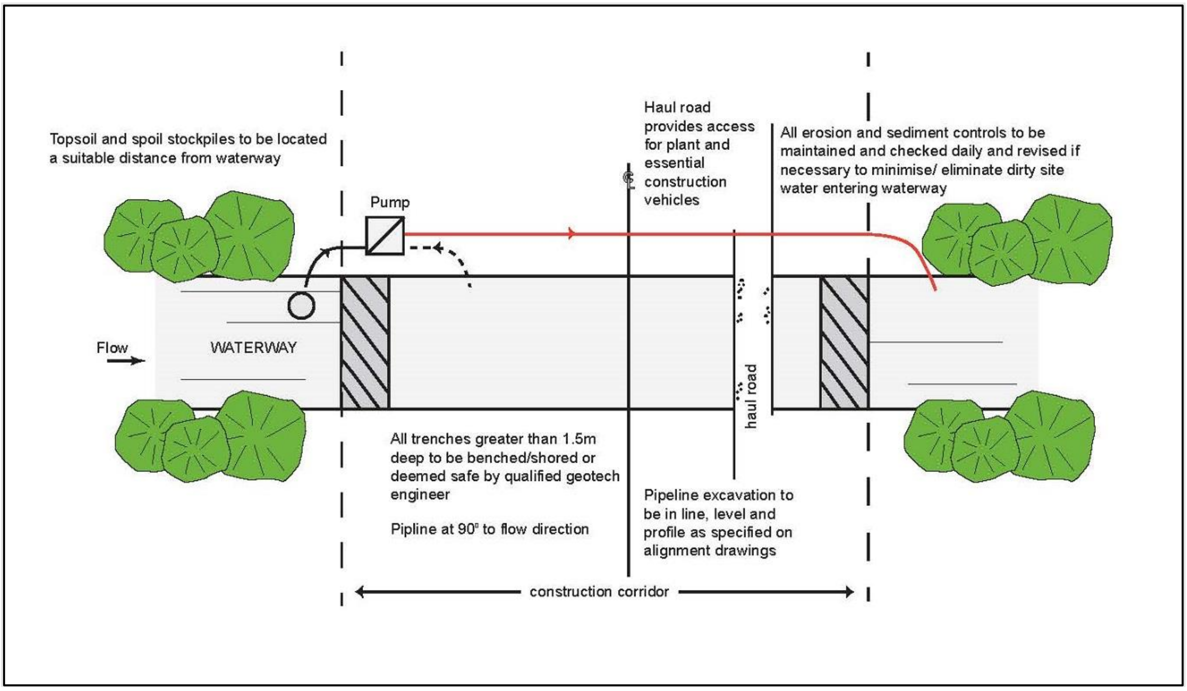
Diagrammatic representation of a typical open cut water crossing

Step 1



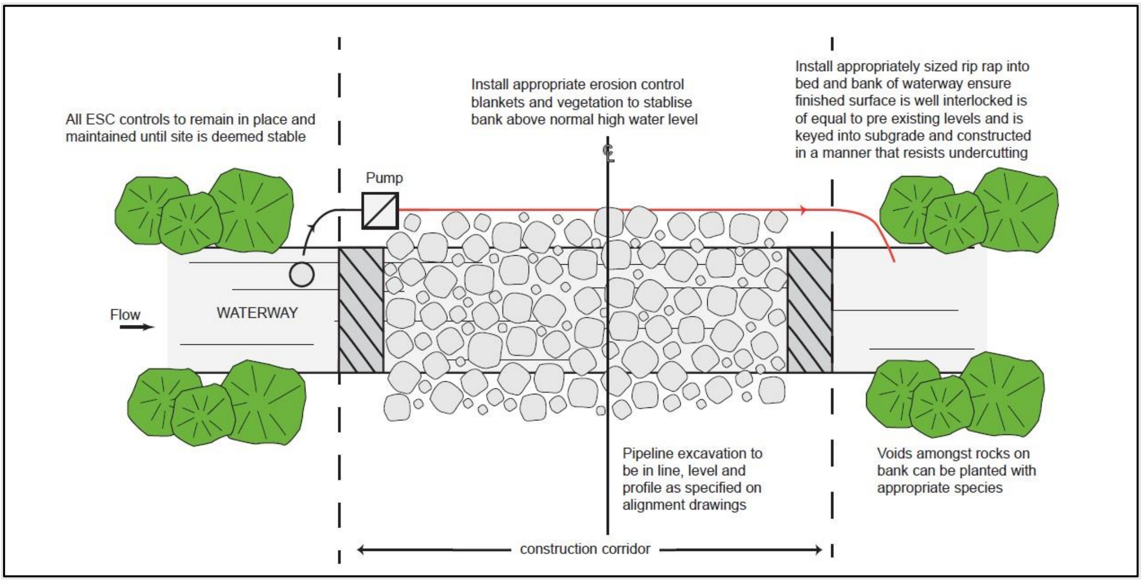
Apply specific erosion sediment control guidelines (IECA) to manage local stormwater run off flowing towards channel. Update & revise plan as necessary -
Pump to be located on top of bank away from flood plain
Pump shall be bunded to prevent contaminants entering waterway
Install scour prevention on bank at discharge point
Clear vegetation but retain roots, to provide bank stability where possible
Pump
Floating caged pump head in sump to ensure aquatic species are excluded from sucton line
WATERWAY
Flow
Site dewatered in preparation for excavation and pipe lay
construction corridor

Step 2

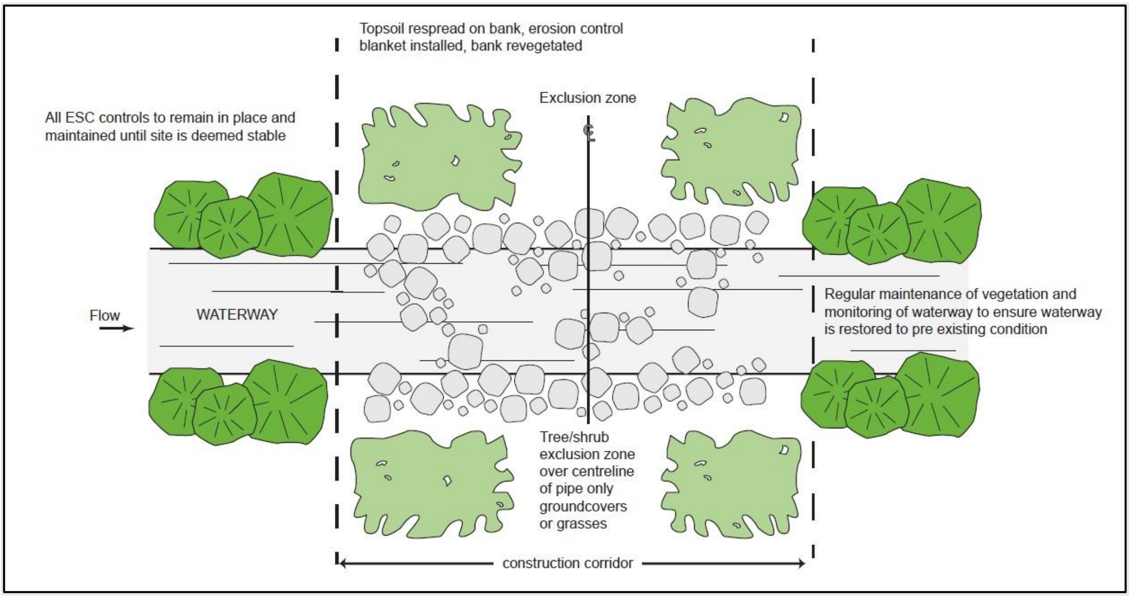


Topsoil and spoil stockpiles to be located a suitable distance from waterway
Haul road provides access for plant and essential construction vehicles
All erosion and sediment controls to be maintained and checked daily and revised if necessary to minimise/ eliminate dirty site water entering waterway
Pump
Flow
WATERWAY
haul road
All trenches greater than 1.5m deep to be benched/shored or deemed safe by qualified geotech engineer
Pipline at 90° to flow direction
Pipeline excavation to be in line, level and profile as specified on alignment drawings
construction corridor

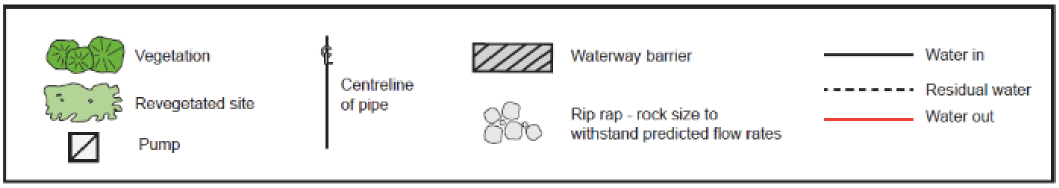
Step 3



Step 4



LEGEND



7.10 Activity description: pipeline cleaning, testing and commissioning

Cleaning, testing, commissioning, regulatory notification and licensing by the relevant authority is required prior to a pipeline being commissioned and declared operational.

7.10.1 Hydrostatic testing

Hydrostatic testing (hydrotesting) involves pressure -testing pipelines with water or another suitable test medium (i.e. compressed air for HDPE poly pipe), to verify pipeline strength and detect leaks. For gas pipelines, this process firstly involves the temporary installation of test manifolds in sections of the newly constructed pipeline and filling the pipeline with the testing medium. Secondly, the pipe section is pressurised, allowing detection of any leaks and weak spots in the test section.

Figure 25: Hydrostatic testing a section of pipeline. (Ecos Consulting)

Integrity testing of joins is generally undertaken immediately following coating. Hydrostatic testing is normally undertaken on pipelines at the completion of backfill operations, prior to commissioning and safety and operational tests as well as after the line has been cleaned.

Prior to hydrostatic testing, the inside of the pipeline is cleaned with foam and brush pipeline inspection gauges (PIGs) to allow for the removal of waste products and internal debris. This process allows the test medium (generally water) to remain uncontaminated (and therefore potentially be reused).

Chemical additives including (but not limited to) oxygen scavengers and biocides may be required to be used to protect the pipe integrity, which may cause impact to the receiving environment when discharged.

It is important the water is sampled and analysed prior to hydrostatic testing to determine the water quality for use and discharge. Water quality criteria analytes and limits as well as discharge and reporting requirements require to be met as outlined in the regulatory approvals and applicable management plans.

Following hydrostatic testing, the pipeline will require final cleaning, gauging and drying. This is particularly the case for hydrocarbon pipelines. This final stage of cleaning is achieved through a similar process in which air pressure is used to push cleaning and drying PIGs through the pipeline to remove residual water, as well as remaining welding slag and sediment. Issues may be encountered with access to defect pipe sections, involving dig-ups for repairs or replacement where the pipe has been buried.

Re-use of hydrostatic test water as dust suppression or construction water is the preferred option, however, discharge to land may be required, this method involves increased resourcing to set up (i.e. equipment including pumps, hoses, diffusers, scour protection) as well as ongoing monitoring during discharge.

7.10.2 Pipeline purging: gas

At the commissioning stage of a gas pipeline, it is necessary to purge the pipeline of air to ensure the safe operation of the pipeline. This is necessary to ensure that the initial gas flow 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). Records of amounts of gas purged should be maintained for reporting purposes.

7.10.3 Pipeline purging: water or slurry pipelines

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. Consideration of location and design should be undertaken during planning and incorporated into the regulatory approval submissions. Further third-party approvals may be needed (ie if located within mapped watercourses).

7.11 Activity description: installation of above-ground facilities

Construction or upgrade of the above-ground facilities is often a separate, or sub-scope, of the overall pipeline construction process. Above-ground facilities works are specialised, refined to a significantly smaller works area and include large parts of prefabricated equipment.

7.12 Activity description: reinstatement and rehabilitation

Reinstatement and rehabilitation are the final major activities of pipeline construction.

Reinstatement is the process of reinstalling or replacing infrastructure in combination with re-establishing pre-construction landforms such as soil profiles. Erosion protection, sediment and drainage controls are commonly required as part of the reinstatement and rehabilitation process and may include erosion control blankets or polymers (soil binding agents), re-spread vegetation and mulch, replacement of rock material, installation of permanent cross diversion banks, and biodegradable sediment controls.

Rehabilitation is the combination of reinstatement and revegetation. Revegetation, a part of rehabilitation, is the process of replacing vegetation such that this is consistent in species composition and density with that of the pre-construction state. Revegetation may include ameliorants (such as gypsum, fertiliser and/or aglime) and seeding where determined as required or prescribed in regulatory or landowner approvals. Revegetation could be limited directly over the top of the pipe to maintain access and line of sight along the easement. However, groundcovers and shrubs should still be used in these cases. Progressive rehabilitation is standard practice following pipeline construction, generally commencing as soon as all pipeline infrastructure is in place and continuous access along the easement is no longer required.


Figure 26: Watercourse reinstatement with access track (Spiecapag Australia)


Figure 27: Creek reinstatement (Spiecapag Australia)

7.13 Activity description: completion and handover

On completion of all contracted tasks, the pipeline is to be handed over from the contractor to the client, and as part of this process the pipeline moves from construction into operation. Final inspections are held where items not satisfied as completed or are defective, are identified as punch list items for completion.

The exact timing of completion and handover may vary from project to project, as well as from State to State, depending on the legislative definitions of construction, commissioning and operation. In addition, certain aspects of the pipeline may be handed over, while others are continuing to be completed (ie identified punch list items). Defect liability periods are commonly required where the contractor may need to rectify identified defects within the defined period.

It is imperative that all required environmental data is handed over to those responsible for operation to allow for ongoing management of environmental risk and compliance. Many conditional permits and plans acquired for construction have ongoing operational environmental commitments. Data which is often required to be handed over is:

- Ecological and cultural heritage survey data and mapping;
- Vegetation clearing data and fauna monitoring records;
- Any confirmed or identified soil contamination or (P)ASS;
- Waste data;
- Water use and dewatering data;
- Rehabilitation requirements and results to date;
- Monitoring reports and registers; and
- Permits and approvals with ongoing requirements.

This information is required to be used during environmental risk assessment for the operations phase. Further to this, such information will dictate the management measures as well as monitoring and assurance regimes.

7.14 Construction lifecycle phase: activity environmental risk profiles

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Site access: planning and design	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. bookmark://_Aboriginal_Heritage/ Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Emissions (dust; noise and vibration; gas) 9. Third parties (nuisance).	• Disturbance of significant flora or wildlife habitat. • Introduction of pests, disease, weeds. • Disturbance to or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Access planning shall include: ○ Documentation of: - proposed temporary and permanent access locations in environmental planning documentation - 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. ○ Notification to landowners of the scheduled works prior to site access. • Development and approval of erosion and sediment control plans (ESCPs) including site access works • 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. • Access must be designed and maintained to accommodate the intended traffic volume.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses. • Degradation of existing road infrastructure. • Unauthorised access track proliferation.	• 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, State and Territory government authorities for access installation and of the construction standard required for access intersections and turning lanes from existing roads.
Site access: construction access	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage; 5. bookmark://_Aboriginal_Heritage/Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Emissions (dust; noise and vibration; gas) 9. Third parties (nuisance).	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Disturbance to or loss of heritage values. • Soil compaction, erosion and sediment release to land and water.	• The width of the access track shall be kept to the minimum practicable 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. • Signage and demarcation installed and maintained. • 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).

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses. • Degradation of existing road infrastructure. • Unauthorised access track proliferation.	• 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. • Gates should 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 to enable safe vehicle movement (generally maximum of 4m). • Erosion and sediment control devices installed and maintained in accordance with the ESCP. • Dewatering and water quality monitoring to be undertaken where required (ie water features or pooled areas) • Ensure vehicle and machinery are maintained and in good working order as per OEM (original equipment manufacturer) requirements.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Site access: reinstatement of access	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Soil (erosion; acid sulphate) 5. Water (hydrology, watercourses) 6. Waste (hazardous; non-hazardous) 7. Emissions (dust; noise and vibration; gas) 8. Third parties (nuisance).	• Disturbance of significant flora or wildlife habitat. • Introduction of pests, disease, weeds. • Disturbance to or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners	• 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. • Access across watercourses to be reinstated with additional permanent stabilisation as required. • Dust suppression available. • Rehabilitation procedures should include: ○ Removal of any temporary fencing or signage. ○ 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. • Long-term stockpiles with potential habitat should be assessed for fauna prior to disturbance. • Certified clean procedures should be employed for reinstatement to ensure no weed spread. • Areas should be monitored for weed proliferation.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		(access, noise and dust). • Damage to agricultural production or other land uses. • Degradation of existing road infrastructure. • Unauthorised access track proliferation.	

Vegetation Clearing: planning	1. Native vegetation
	2. Fauna
	3. Biosecurity (pests, weeds, disease)
	4. Natural or historic heritage
	5. bookmark://_Aboriginal_Heritage/Indigenous heritage
	6. Soil (erosion; acid sulphate)
	7. Water (hydrology, watercourses)
	8. Emissions (dust; noise and vibration; gas)
	9. Third parties (nuisance).
		• Disturbance or removal of significant flora or wildlife habitat.
		• Habitat fragmentation.
		• Loss of fauna individuals.
		• Introduction of pests, disease, weeds.
		• Disturbance to sites, or loss of heritage values.
		• Soil compaction, erosion and sediment release to land and water.
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• 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. These areas should be marked in a site plan for management purposes.
			  ○ If this is not possible specific environmental management procedures should be adopted to minimise environmental impacts.
			  ○ 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.
			• The pipeline proponent shall specify the pipeline construction working width for the entire length of the pipeline.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust). • Potential impacts to visual and aesthetic amenity. • Unauthorised third-party access to previously inaccessible areas.	- Note: while the main clearing area is generally 20 - 40m; turn-around, working areas, bell holes, corners and deep crossing may need to be wider. • Areas where additional workspace is required should be identified early and located in pre-disturbed areas of low or no vegetative value wherever possible. Locations and level of clearing may need to be negotiated with the relevant landowner. • Clearing boundaries shall be delineated on project drawings and in the field to define the extent of authorised clearing. • Measures shall be employed which identify, make safe and protect other third-party infrastructure within the vicinity of the clearing works. • Necessary approvals and permits should be obtained prior to commencement of clearing activities. A copy should be carried on site with clearing crews where possible. • Clear and grade crews should be inducted on the marking methods used to delineate work area widths and important environmental and cultural heritage features. • Coordination and consultation with traditional owner groups.
Vegetation Clearing: construction	1. Native vegetation 2. Biosecurity (pests, weeds, disease) 3. Natural or historic heritage	• Disturbance or removal of	• An environmental risk assessment should be conducted to identify and assess risk.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	4. bookmark://_Aboriginal_Heritage/Indigenous heritage 5. Soil (erosion; acid sulphate) 6. Water (hydrology, watercourses) 7. Emissions (dust; noise and vibration; gas) 8. Third parties (nuisance) 9. Chemical and contamination.	significant flora or wildlife habitat. • Habitat fragmentation. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Disturbance to sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses.	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Development of a construction environmental management plan • Development and approval of erosion and sediment control plans (ESCPs) including clearing activities. • ESC training should be provided to supervisors and operators. • Cultural heritage monitoring undertaken by traditional owner representatives where required. • 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. ○ Retention of tree canopy connectivity where practicable, particularly at watercourses and where there are roadside ecosystem remnants to minimise fragmentation. • Pre-clearance surveys are undertaken by experienced ecologists or fauna handlers prior to commencement of clearing activities. • In the case of protected or retained vegetation within (or adjacent to) the pipeline construction area, 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 retain roots in riparian zones and other sensitive areas where possible, to retain stability.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Temporary disruption to landowners (access, noise and dust). • Potential impacts to visual and aesthetic amenity. • Unauthorised third-party access to previously inaccessible areas.	• Slashing may be undertaken as a means of vegetation clearing, particularly in sown pastures or at watercourses. • Where possible, salvage suitable vegetation/mulched vegetation and habitat features for re-use during rehabilitation.
Grading: planning	1. Biosecurity (pests, weeds, disease) 2. Natural or historic heritage 3. Indigenous heritage 4. Soil (erosion; acid sulphate) 5. Water (hydrology, watercourses) 6. Emissions (dust; noise and vibration; gas) 7. Third parties (nuisance).	• Introduction of pests, disease, weeds. • Disturbance to heritage sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Soil analysis prior to construction should be undertaken to determine the pre-existing soil profile and structure, contamination status to allow effective management. • Development and approval of erosion and sediment control plans (ESCPs) including all disturbance works. • ESC training should be provided to supervisors, operators and field personnel installing controls. • Activities should be scheduled to minimise the length of time between ground disturbance and reinstatement. • Topsoil stockpile heights should be capped (2m). • Topsoil may be covered with a stabiliser such as geotextile material, temporary seed cover, polymer or equivalent.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust).	• 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. • Heritage controls such as: ○ Engagement of Aboriginal monitors; ○ Use of cultural heritage management plans (CHMPs); ○ Having in place discovery protocols (for use in the event of uncovering sites, objects or remains).
Grading: construction	1. Native vegetation, 2. Biosecurity (pests, weeds, disease) 3. Natural or historic heritage 4. Indigenous heritage 5. Soil (erosion; acid sulphate) 6. Water (hydrology, watercourses) 7. Emissions (dust; noise and vibration; gas) 8. Third parties (nuisance) 9. Chemical and contamination.	• Introduction of pests, disease, weeds. • Disturbance to heritage sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Cultural heritage monitoring undertaken by traditional owner representatives where required. • Topsoil should be graded and stockpiled separately to subsoil and should not be compacted or otherwise impacted during construction. • Re-use topsoil where possible for diversion berms (windrows) as drainage controls. • Weather conditions (rainfall) should be considered in terms of soil management prior to and during construction. • Graded soil shall not be stockpiled in water features or 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).

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust). • Unauthorised third-party access to previously inaccessible areas.	• Topsoil containment measures (e.g. berms and sediment fencing) shall be used as necessary. Grading and stockpiling of soil and windrows shall not 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. • Disturbance works to watercourse beds and banks should be avoided in times of flow and planned for works in the dry season where possible. • Erosion and sediment control (ESC) measures are to be installed and maintained in accordance with the ESCP. • Dust generated is to be minimised as much as possible and appropriate measures undertaken, including visual monitoring, use of water trucks, driving to conditions or speed limits, and monitoring of weather.
Stringing, coating and jointing: planning	1. Fauna 2. Waste (hazardous; non-hazardous) 3. Emissions (dust; noise and vibration; gas) 4. Third parties (nuisance) 5. Chemical and contamination.	• Loss of fauna individuals. • Temporary disruption to landowners (access, noise and dust). • Unauthorised third-party access to previously inaccessible areas. • Release of hazardous	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Consultation shall be undertaken with relevant landowners and regulatory authorities about locating pipe storage laydown and worksites. • Ensure appropriate waste receptacles and processes are in place to capture coating waste.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		substances (coating materials). • Generation of general and hazardous waste streams.	
Stringing, coating and jointing: pipe stringing	1. Fauna 2. Waste (hazardous; non-hazardous) 3. Emissions (dust; noise and vibration; gas) 4. Third parties (nuisance) 5. Chemical and contamination.	• Loss of fauna individuals. • Temporary disruption to landowners (access, noise and dust). • Release of hazardous substances (coating materials). • Generation of general and hazardous waste streams.	• Pipe strings are to be strung on to areas of the RoW where clearing and grading is complete, unless otherwise agreed. • Where possible pipe strings are to avoid impeding third-party use of the land. • Pipe end caps are to be in place on all strings to prevent fauna entering. • Any waste should be disposed of in the appropriate receptacle at the end of each day.
Stringing, coating and jointing: pipe jointing	1. Fauna 2. Waste (hazardous; non-hazardous) 3. Emissions (dust; noise and vibration; gas) 4. Third parties (nuisance) 5. Chemical and contamination.	• Temporary disruption to landowners (noise and dust). • Release of hazardous	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		substances (coating materials). • Generation of general and hazardous waste streams.	• All waste to be appropriately contained and disposed of at a licensed facility. • Spill kits onsite with coating trucks.
Stringing, coating and jointing: abrasive blasting	1. Water (hydrology, watercourses) 2. Waste (hazardous; non-hazardous) 3. Emissions (dust; noise and vibration; gas) 4. Third parties (nuisance) 5. Chemicals and contamination.	• Temporary disruption to landowners (noise and dust). • Release of substances (blasting materials). • Generation of general and hazardous waste streams.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Abrasive blasting shall be conducted in accordance with applicable codes of practice and regulatory conditions. • Use of blasting material should be minimised and conducted in accordance with the applicable national standards, with blasting wastes handled in a manner appropriate to the medium used. • All associated waste to be captures and removed.
Stringing, Coating and Jointing: (including Joint Testing) - Pipe Welding	1. Native vegetation 2. Fauna 3. Natural or historic heritage 4. Indigenous heritage 5. Waste (hazardous; non-hazardous) 6. Emissions (dust; noise and vibration; gas) 7. Third parties (nuisance) 8. Chemical and contamination.	• Fire leading to loss of significant flora. • Fire leading to loss of fauna individuals. • Temporary disruption to landowners	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • All welding, welding procedures, welder qualifications, the use of welding consumables, and the removal of weld defects shall conform to relevant Australian Standards, particularly AS 2885.2.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		(access, noise and dust). • Release of hazardous substances (coating materials). • Generation of general and hazardous waste streams.	• 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. • Welding to be conducted within wider cleared areas. • Fire response equipment onsite with welding works. • Non-destructive testing to be carried out be specialist contractors. - Ensure wash water from NDT film development is disposed of as regulated waste.

Trenching: Planning	1. Fauna
	2. Natural or historic heritage
	3. Indigenous heritage
	4. Soil (erosion; acid sulphate)
	5. Water (hydrology, watercourses)
	6. Waste (hazardous; non-hazardous)
	7. Emissions (dust; noise and vibration; gas)
	8. Third parties (nuisance);
	9. Chemical and contamination.
		• Loss of fauna individuals (native and stock).
		• Disturbance to sites, or loss of heritage values.
		• Soil erosion, mixing, and sediment release to land and water.
		• Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils.
		• Potential modification to
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• Assess trenchless technologies as well as the most appropriate equipment where applicable.
			• Minimisation of trench open such that can be inspected by fauna spotter catchers.
			• Ensure trenching is within cleared areas, with additional area allocated for bends and bell holes as required.
			• Trenching through watercourse areas:
			  ○ Should occur over the minimal possible timeframes.
			  ○ Shall be scheduled during dry or low flow periods and shall avoid periods of fauna sensitivity (e.g. fish migration periods).
			• Third party infrastructure, including pipelines, fibre optic cables and private infrastructure shall be identified, and

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

		surface water flows (drainage lines and streams).
		• Potential for site run-off into drainage lines and watercourses.
		• Temporary disruption to landowners (access, noise and dust).
			relevant impact management measures applied prior to commencement of trenching activities.
			• Gaps to be maintained in line with surrounding land use requirements.
			• Coordination and consultation with traditional owner groups.
			• Minimise the exposure of erosive soil layers and stabilise any as soon as possible.
			• Do not mix subsoils, and topsoil or vegetation.
			• Specific ASS management in impacted areas:
			  ○ Backfill to commence immediately following pipelay.
			  ○ Ensure minimal oxidation of stockpiles (i.e. minimal time between trench and backfill, cover with a membrane, irrigate to keep wet/saturated).
			  ○ Base pH buffering treatment rates on laboratory analyses.
			  ○ Plan validation testing of treated ASS to be used as fill material.
			  ○ Ensure adequate neutralising material is readily available (AgLime).
			  ○ In AASS areas, all runoff, including trench water, should be tested and treated as required to achieve a pre-determined acceptable pH.

Trenching: construction	1. Native vegetation 2. Fauna 3. Natural or historic heritage 4. Indigenous heritage 5. Soil (erosion; acid sulphate) 6. Water (hydrology, watercourses) 7. Waste (hazardous; non-hazardous) 8. Emissions (dust; noise and vibration; gas) 9. Third parties (nuisance)	• Loss of fauna individuals (native and stock). • Disturbance to sites, or loss of heritage values. • Soil erosion, mixing, and	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Ensure trench spoil is contained with the cleared work area. • Subsoil shall not be mixed stockpiled topsoil or vegetation. • Measures shall be adopted to prevent fauna entrapment within the pipeline trench, such as:

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	10. Chemical and contamination.	sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust).	○ Minimising the time the trench is open, particularly in fauna habitat areas. ○ Constructing trench plugs with slopes less than 45 degrees 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. ○ Regular surveys of open trenches, by appropriately certified personnel to remove trapped fauna as required. • Provisions should be made for disposal of trench water (including ESC). ○ Cease trenching in wet conditions. ○ Obtain required permits. ○ Ensure release in line with quality standards / parameters. ○ Applying inlet filters or screens on water uptake hoses. ○ Supporting the inlet hose above the sediment layer in the water. ○ No discharge directly to waterways without express permissions/ permits. ○ Allowing for sufficient settlement to occur before discharging water. ○ Consideration of adding a flocculent and a filter or settlement basin. ○ 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

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			◦ 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 through sediment filters (e.g. hose outlet filters, geotextiles or straw bales) to remove solids. ◦ Discharging to holding or settling ponds to avoid erosion and permit sediment to settle out of the water column. ◦ Discharging to stable land through flow diffusers (e.g. spray bars) and energy dissipaters (e.g. rock rip-rap or geotextile filters/fabrics).
Trenching: alternative techniques	1. Native vegetation 2. Fauna 3. Soil (erosion; acid sulphate) 4. Water (hydrology, watercourses) 5. Waste (hazardous; non-hazardous) 6. Chemical and contamination.	• Loss of fauna individuals (aquatic). • Disturbance to sites, or loss of heritage values. • Soil erosion, mixing, and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Boring or HDD should be used as required where the pipeline crosses sensitive areas, major watercourses or significant built infrastructure. • Drilling fluids shall consist of approved products, 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. • ESC shall be installed at drill pad sites together with clean water diversion. • Hazardous substances, including drilling fluids, shall be stored and, where practicable, handled within containment facilities such as bunded areas or over leak-proof trays.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Potential for contamination via fluid release. • Temporary disruption to landowners (access, noise and dust).	

Trenching: (blasting) - planning and design	1. Fauna
	2. Natural or historic heritage
	3. Indigenous heritage
	4. Waste (hazardous; non-hazardous)
	5. Emissions (dust; noise and vibration; gas)
	6. Third parties (nuisance).
		• Loss of fauna individuals.
		• Disturbance to sites, or loss of heritage values.
		• Potential for contamination via fluid release.
		• Generation of general and hazardous waste streams.
		• Temporary disruption to landowners (vibration, noise and dust).
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• Alignment selection shall minimise encounters with areas of rock that require blasting.
			• Blasting in ecologically sensitive areas shall incorporate appropriate precautions such as:
			  ○ Scheduling 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 used for wildlife habitat creation where possible.
			• 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.

Trenching: (blasting) - blasting operations	1. Fauna 2. Natural or historic heritage 3. Indigenous heritage 4. Waste (hazardous; non-hazardous)	• Loss of fauna individuals.	• 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	5. Emissions (dust; noise and vibration; gas) 6. Third parties (Nuisance).	• Disturbance to sites, or loss of heritage values. • Potential for contamination via fluid release. • Generation of general and hazardous waste streams. • Temporary disruption to landowners (vibration, noise and dust).	• Blasting program design shall conform to the appropriate noise, comfort and vibration criteria applicable in the relevant jurisdiction. • Advanced warning of blasting activities to be given to affected stakeholders. • Monitoring of noise, vibration and dust resulting from controlled blasts should be conducted in areas where sensitive receptors are impacted. • Blasting refuse, such as containers, cartridges, caps and wire, shall be retrieved for disposal at an approved waste depot. • Rock removed from the pipeline corridor shall be stockpiled in an adjacent works areas, and either re-used as rip-rap or removed for off-site disposal as appropriate.
Pipe laying and backfilling: planning	1. Fauna 2. Soil (erosion; acid sulphate) 3. Water (hydrology, watercourses) 4. Waste (hazardous; non-hazardous) 5. Emissions (dust; noise and vibration; gas) 6. Third parties (nuisance).	• Loss of fauna individuals (native and stock). • Disturbance to sites, or loss of heritage values. • Soil erosion, mixing, and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams).	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Prior to backfill, the open trench should be cleared of fauna. • 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. • Where a pipeline is planned through problematic soils, temporary and permanent impact management methodologies should be developed. • Separating rock material from soil may be required, with rock stockpiled for later reuse as mulch.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Potential for site run-off into drainage lines and watercourses. • Potential for contamination. • Generation of general and hazardous waste streams. • Temporary disruption to landowners (vibration, noise and dust).	○ Crushing of rock may be required for padding material. ○ Provision for the importation of padding material may be required.
Pipe laying and backfilling: pipe laying	1. Fauna 2. Emissions (dust; noise and vibration; gas) 3. Third parties (nuisance).	• Loss of fauna individuals (native and stock).	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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. • Dust suppression should be available.
Pipe laying and backfilling: backfilling	1. Fauna 2. Soil (erosion; acid sulphate) 3. Water (hydrology, watercourses) 4. Emissions (dust; noise and vibration; gas) 5. Third parties (nuisance) 6. Chemical and contamination .	• Loss of fauna individuals (native and stock). • Disturbance to sites, or loss of heritage values.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Minimise the time that the trench is open at any one location. • Trench shall be checked for fauna prior to backfill.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

		• Soil erosion, mixing, and sediment release to land and water.
		• Potential modification to surface water flows (drainage lines and streams).
		• Potential for site run-off into drainage lines and watercourses.
		• Potential for contamination.
		• Temporary disruption to landowners (noise and dust).
			• 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.
			• 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.
			• If fill must be imported from off-site, it should be certified, or inspected to ensure it is free of weeds or their seeds.
			  ○ Fill should be sourced from as close to the trench as possible.
			• Where demarcations in soil horizons exist, replace in order of excavation.
			• Alignment with any specific soil re requirements:
			  ○ ASS; buffering rates and applications.
			  ○ Soils with pH extremes; Add ameliorants to top of reinstalled subsoil (i.e. similar to rooting depth of vegetation).
			• Dust suppression should be on hand during backfilling.

Borrow pits: planning	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Emissions (dust; noise and vibration; gas) 9. Third parties (nuisance)	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	10. Chemical and contamination.	• Disturbance to sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust). • Potential impacts to visual and aesthetic amenity.	• 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 pits should avoid known sites of natural, scientific, or heritage significance. ○ Proposed sites shall be included as part of the CHMP assessment. • Where present, topsoil and vegetation shall be removed from the excavation site and stockpiled separately in an adjacent area for use in rehabilitation. • No ASS, sodic, salty, high shrink/swell soils etc. to be used as fill material. • Drainage, erosion and sediment controls will be implemented in accordance with the borrow pit layout plan and site specific ESCP and monitored regularly to ensure that control measures are operating effectively. • Borrow pits to be located away from recharge zones (hydraulic conditions) to prevent damage to groundwater sources. • 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Borrow pits: borrow pit operation	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise and vibration; gas) 10. Third parties (nuisance).	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Disturbance to sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Where significant quantities of padding or rubble material are required from a single borrow pit, a progressive shallow strip-mining technique should be adopted. • Erosion and sediment control measures shall be installed and monitored at the borrow pit site. • Should unexpected materials be uncovered (contaminated, ASSS or heritage materials) works should be stopped for investigation by an appropriately qualified subject matter expert. • Fauna egress to be installed for the life of the pit.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Generation of general and regulated wastes. • Potential impacts to visual and aesthetic amenity.	

Borrow pits: rehabilitation	1. Native vegetation
	2. Fauna
	3. Biosecurity (pests, weeds, disease)
	4. Soil (erosion; acid sulphate)
	5. Water (hydrology, watercourses)
	6. Waste (hazardous; non-hazardous)
	7. Emissions (dust; noise and vibration; gas)
	8. Third parties (nuisance)
	9. Chemicals and contamination.
		• Introduction of pests, disease, weeds.
		• Soil compaction, erosion and sediment release to land and water.
		• Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils.
		• Potential modification to surface water flows (drainage lines and streams).
		• Potential for site run-off into drainage lines and watercourses.
		• Temporary disruption to
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• 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.
			• Borrow pit 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		landowners (access, noise and dust). • Potential impacts to visual and aesthetic amenity.	○ 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. ○ Re-spreading stockpiled topsoil, where present, over the rehabilitation area. ○ Respreading of vegetation particularly on slopes. Seeding, use of soil ameliorants and the use of geotextile materials may be appropriate. ○ Erosion control and site stabilisation measures such as, erosion berms, soil stabilisers and contour ripping on the borrow pit side slopes may be considered.
Construction camps and worksites: site planning and design	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise and vibration; gas) 10. Third parties (nuisance) 11. Chemical and contamination.	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Disturbance to sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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). • New sites shall be located at existing clearings or disturbed areas where practicable, and on well-drained land with all-weather access. • Sites shall be located 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust). • Potential impacts to visual and aesthetic amenity. • Generation of general and hazardous waste streams.	• Vegetation clearance should be minimised as far as practicable, with cleared vegetation being stockpiled separately, if required for re-spreading during reinstatement. • Topsoil cleared from any site shall be retained, kept in a viable state and used for rehabilitation of completed works. • Construct and manage to ensure erosive soils are either avoided or are left unstabilised for as short a time as practicable. • It is recommended that construction camps or worksites avoid ASS areas, unless the PASS is deep enough that it can be avoided and not require extra management considerations. • Where practicable, camps and worksites (excluding horizontal directional drilling sites and other water crossing construction sites) shall be located to not drain directly to major watercourses, creeks or other surface water bodies.
Construction camps and worksites: site construction	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage	• Disturbance of significant flora or wildlife habitat.	• An environmental risk assessment should be conducted to identify and assess risk.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise and vibration; gas) 10. Third parties (nuisance) 11. Chemical and contamination.	• Loss of fauna individuals. • Introduction of pests, disease, weeds. • Disturbance to sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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 campsite rehabilitation. • 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		(access, noise and dust). • Potential impacts to visual and aesthetic amenity. • Generation of general and hazardous waste streams.	

Construction camps and worksites: site management	1. Fauna
	2. Biosecurity (pests, weeds, disease)
	3. Waste (hazardous; non-hazardous)
	4. Emissions (dust; noise and vibration; gas)
	5. Third parties (nuisance)
	6. Chemicals and contamination.
		• Loss of fauna individuals.
		• Introduction of pests.
		• Temporary disruption to landowners (access, noise, smell and dust).
		• Potential impacts to visual and aesthetic amenity.
		• Generation of general and hazardous waste streams.
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• Appropriate putrescible waste management shall be applied during construction and may include:
			  ○ Regular collection and transportation to a landfill approved by the relevant regulatory authority (usually local government).
			  ○ On-site disposal at camp or work sites; only in line with required approval; generally, only in remote areas.
			  ○ Sufficient provision of contained / lidded bins on-site (to prevent fauna access).
			  ○ Inductions and toolbox meetings around waste management and housekeeping.
			• Sewage treatment facilities (and alike) to be operated by competent operators in line with legislative requirements.
			  ○ Recycled wastewater may be used for plant irrigation where water quality is within acceptable parameters for release.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

			• Adequate and properly maintained fire-fighting equipment shall be provided at camps and worksites.
			• Hazardous substances and chemicals:
			  ○ SDS should be available on-site for all chemicals stored and handled.
			  ○ Chemicals shall be stored and handled in accordance with their SDS and, where practicable, handled within containment facilities (e.g. bunded areas, leak-proof trays).
			  ○ The minimum practicable volume of chemicals should be used or stored on-site.
			• Servicing of machinery and equipment shall be undertaken at a facility / location that is able to correctly manage waste oils and filters.

Construction camps and worksites: site reinstatement and rehabilitation	1. Fauna 2. Biosecurity (pests, weeds, disease) 3. Soil (erosion; acid sulphate) 4. Water (hydrology, watercourses) 5. Waste (hazardous; non-hazardous) 6. Emissions (dust; noise and vibration; gas) 7. Third parties (nuisance) 8. Chemical and contamination.	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Disturbance to sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Disturbance of problematic soils	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Partial site rehabilitation may be acceptable where landowners and/or regulatory authorities may choose to retain the site in its cleared state for future uses. • Site reinstatement shall include regular progressive removal of temporary infrastructure and wastes from site. • Ensure all areas potentially exposed to hazardous substances (i.e. under wastewater treatment plants) are scraped with materials removed as hazardous.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		such as contaminated soils (e.g. from spills). • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust). • Potential impacts to visual and aesthetic amenity. • Generation of general and hazardous waste streams.	
Water course crossings: planning and design	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses)	• Disturbance of significant (riparian) flora or wildlife habitat. • Loss of fauna individuals.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Pipeline alignments shall be selected to minimise, where practicable, the number of watercourse crossings.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

	8. Waste (hazardous; non-hazardous)
	9. Emissions (dust; noise and vibration; gas)
	10. Third parties (nuisance)
	11. Chemical and contamination.
		• Introduction of pests, disease, weeds.
		• Disturbance to sites, or loss of heritage values.
		• Soil compaction, erosion and sediment release to land and water.
		• Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils.
		• Potential modification to surface water flows (drainage lines and streams).
		• Potential for site run-off into drainage lines and watercourses.
		• Temporary disruption to landowners (access, noise and dust).
			• 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.
			• 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.
			• 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.
			  ○ Survey details of the original contours of water crossings should be incorporated into the “As-Built” documentation for rehabilitation.
			  ○ Details: top and toe, invert, over bends, sags, bank slopes, watercourse substrata, position of the pipe.
			• For major crossings:
			  ○ Hydrology data captured (flow rates, catchment size) shall be used to develop a post-crossing reinstatement plan (rock size, type of erosion control matting, etc).
			  ○ Hydrological and hydraulic modelling should be undertaken to determine watercourse characteristics and to inform consideration of technology alternatives.
			  ○ Site layout plans detailing proposed drainage and sediment control measures shall be developed for significant waterway crossings.
			  ○ Understand surface and groundwater hydraulics to appropriately account for flooding events.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

		• Potential impacts to visual and aesthetic amenity.
		• Generation of general and hazardous waste streams.
			• Monitoring programs should be implemented, to quantify any effects on riparian, aquatic and water-dependant flora and fauna.
			• 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.
			  ○ Landowners should be consulted over the historic behaviour of the waterway in question.
			• The storage of fuels, chemicals and lubricants should be as far away as is reasonably practical from any waterway.
			• All equipment shall be on-site and in good working order.
			• The refuelling or maintenance of equipment, machinery and vehicles should be conducted as far away as is reasonably practical from any waterway.
			• Erosion and sediment controls:
			  ○ Should be installed and managed in accordance with IECA best practice guidelines.
			  ○ Shall be appropriately maintained.
			  ○ Shall be monitored for identification of required remedial action.
			• 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.
			• Heritage features will be assessed prior to commencement.

Water course crossings: vehicle access	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Soil (erosion; acid sulphate) 5. Water (hydrology, watercourses)	• Disturbance of significant (riparian) flora or wildlife habitat.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

	6. Emissions (dust; noise and vibration; gas)
	7. Third parties (nuisance)
	8. Chemical and contamination.
		• Loss of fauna individuals.
		• Introduction of pests, disease, weeds.
		• Disturbance to sites, or loss of heritage values.
		• Soil compaction, erosion and sediment release to land and water.
		• Potential modification to surface water flows (drainage lines and streams).
		• Potential for site run-off into drainage lines and watercourses.
		• Temporary disruption to landowners (access, noise and dust).
		• Potential impacts to visual and aesthetic amenity.
			• Designated crossing points should be used and the bed and banks maintained in a stable condition.
			• Stability of the easement and condition of watercourse bed, banks and riparian vegetation should be determined regularly.
			• 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. 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

Water course crossings: clearing at watercourses	1. Native vegetation
	2. Fauna
	3. Biosecurity (pests, weeds, disease)
	4. Natural or historic heritage
	5. Indigenous heritage
	6. Soil (erosion; acid sulphate)
	7. Water (hydrology, watercourses)
	8. Emissions (dust; noise and vibration; gas)
	9. Third parties (nuisance)
	10. Chemical and contamination.
		• Disturbance of significant (riparian) flora or wildlife habitat.
		• Loss of fauna individuals.
		• Introduction of pests, disease, weeds.
		• Disturbance to sites, or loss of heritage values.
		• Soil compaction, erosion and sediment release to land and water.
		• Potential modification to surface water flows (drainage lines and streams).
		• Potential for site run-off into drainage lines and watercourses.
		• Temporary disruption to landowners (access, noise and dust).
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• Mature vegetation shall be trimmed in preference to felling.
			• Additional for sediment basins, stringing of pipe or stockpiling excavated spoil or topsoil should be located outside of the riparian zone and in previously cleared or disturbed areas.
			  ○ Where the streambed consists of rocks, pebbles or coarse gravel overlaying finer material, this material shall be removed and stockpiled separately and replaced as part of reinstatement.
			  ○ 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 as an alternative to clearing.
			• 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.
			• Conduct regular, thorough biosecurity inspections and to maintain records.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Potential impacts to visual and aesthetic amenity.	

Water course crossings: pipe laying in watercourses	1. Fauna
	2. Biosecurity (pests, weeds, disease)
	3. Natural or historic heritage
	4. Indigenous heritage
	5. Soil (erosion; acid sulphate)
	6. Water (hydrology, watercourses)
	7. Third parties (nuisance)
	8. Chemical and contamination.
		• Loss of fauna individuals.
		• Introduction of pests, disease, weeds.
		• Disturbance to sites, or loss of heritage values.
		• Soil compaction, erosion and sediment release to land and water.
		• Potential modification to surface water flows (drainage lines and streams).
		• Potential for site run-off into drainage lines and watercourses.
		• Temporary disruption to landowners (access, noise and dust).
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• The pipe section designated for the crossing shall be fabricated prior to trenching or directional drill completion, to enable rapid installation.
			  ○ Crossings shall be completed as quickly as is reasonably practical.
			  ○ 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.
			• Appropriate measures, such as concrete coated pipe or bolt-on weights, shall be employed to anchor the pipeline in the trench as necessary.
			• Risk of erosion and sedimentation resulting from trenching adjacent to watercourses shall be mitigated by:
			  ○ Delaying grading of banks and slopes leading to watercourses until construction of the crossing is imminent, thus minimising erosion and sedimentation risk.
			  ○ Ceasing trenching on approaches to wet watercourses and leaving hard trench plugs in place for the maximum period possible pending pipe-laying.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Potential impacts to visual and aesthetic amenity.	○ Stockpiling excavated bank material at an appropriate distance from the watercourse or behind adequate stockpile berms. ○ 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.
Water course crossings: rehabilitation and revegetation	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Soil (erosion; acid sulphate) 5. Water (hydrology, watercourses) 6. Waste (hazardous; non-hazardous) 7. Emissions (dust; noise and vibration; gas) 8. Third parties (nuisance) 9. Chemical and contamination.	• Disturbance of significant (riparian) flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Disturbance to sites, or loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • A selection of the following stabilisation measures should be applied based on site-specific requirements (hydrology, soil type, rainfall, vegetation regeneration potential, land use, etc: ○ Restoring watercourse beds and banks to their original profiles and pre-existing conditions. ○ Re-spreading 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 should be taken to ensure that the material is replaced on the riverbed to a depth equivalent to the original conditions. ○ The application of stabilising materials such as hydromulch, soil stabiliser, jute or coir matting or other suitable geotextile materials. ○ Spreading light, stockpiled timber from pipeline construction clearing activities randomly over the pipeline construction area leading down to the watercourse crossing.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

		drainage lines and watercourses.
		• Temporary disruption to landowners (access, noise and dust).
		• Potential impacts to visual and aesthetic amenity.
			○ Revegetating banks (seed and/or planting) to minimise fragmentation of vegetation corridors and to avoid interrupting the movement of fauna.
			○ Selecting appropriate species for the exclusion zone above the buried pipe.
			○ 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.
			  ○ 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.

Pipeline cleaning, testing and commissioning: pipeline cleaning	1. Soil (erosion) 2. Waste (hazardous; non-hazardous) 3. Chemical and contamination.	• Soil erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Ensure initial wash water (slug) is captured separately to mainline hydro test water and disposed of at a licensed waste-water facility or carrier. • Additional risk assessment may be required for any water storage structures.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Potential for contamination of land or water.	• Testing to required guideline standards and approvals for use and discharge to land
Pipeline cleaning, testing and commissioning: hydrostatic testing planning and design	1. Native vegetation 2. Fauna 3. Soil (erosion) 4. Water (hydrology, watercourses) 5. Third parties (nuisance) 6. Chemical and contamination.	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Soil erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (water logging). • Potential impacts to visual and aesthetic amenity.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Hydrotesting operations shall conform to the requirements of relevant legislation and AS/NZS 2885.5. • Prior to the commencement of hydrotesting activities, a hydrostatic testing plan shall be prepared, describing at least the following aspects: o The procedure to be used. o Personnel roles and responsibilities. o Permits and approvals required. o Environmental and social objectives and their fulfilment. o Hydrotest medium, its source and quantities required. o Any hydrotest medium additives and their management, with applicable SDS. o Hydrotest timing and scheduling. o Hydrotest medium disposal. o Reporting. • Consultation with landowners and/or relevant regulatory authorities shall be conducted to determine an acceptable water sourcing and disposal methodology.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Pipeline cleaning, testing and commissioning: hydrostatic testing	1. Native vegetation 2. Fauna 3. Soil (erosion; acid sulphate) 4. Water (hydrology, watercourses) 5. Third parties (nuisance) 6. Chemicals and contamination.	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Soil erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Potential for contamination of land / water. • Generation of hazardous (liquid / water) waste. • Temporary disruption to landowners (water logging). • Potential impacts to visual and aesthetic amenity.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Measures which prevent hydrotest water discharge resulting in soil erosion or sedimentation of land and water shall be adopted. • 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. • Water quality testing prior to release as required. • Hydrotest water discharge or recycling for secondary uses, such as dust control, pasture irrigation or livestock watering, shall only be undertaken in accordance with applicable water quality guidelines, release permits and procedures. • Where practicable, the same test water shall be reused for multiple test sections.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Pipeline cleaning, testing and commissioning: planning purging and gas venting	1. Fauna 2. Emissions (noise and vibration; gas) 3. Third parties (nuisance).	• Disturbance to, or loss of, fauna individuals. • Temporary disruption to landowners (noise). • Greenhouse gas emissions. • Odour from odorant release.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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). • Records of gas released should be maintained for emissions reporting (NPI, NGERS etc.). • Purging or venting gas from the pipeline should be conducted under meteorological conditions that facilitate rapid atmospheric dispersal of the gas. • Adjacent residents should be advised of the venting operation prior to undertaking the activity.
Pipeline cleaning, testing and commissioning: purging and gas venting planning: water / slurry	1. Fauna 2. Emissions (noise and vibration; gas) 3. Third parties (nuisance).	• Disturbance to, or loss of, fauna individuals. • Temporary disruption to landowners (noise). • Greenhouse gas emissions. • Odour from odorant release.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Where possible, air valves and scour valves shall be 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Reinstatement and rehabilitation: planning	1. Fauna 2. Biosecurity (pests, weeds, disease) 3. Soil (erosion; acid sulphate) 4. Water (hydrology, watercourses) 5. Emissions (dust; noise and vibration; gas) 6. Third parties (nuisance) 7. Chemical and contamination.	• Soil erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Potential for contamination of land / water. • Generation of hazardous (liquid / water) waste. • Temporary disruption to landowners (water logging). • Potential impacts to visual and aesthetic amenity.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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. • Site-specific rehabilitation plans should be prepared, in consultation with the landowner, referring to pre-existing conditions and outlining proposed rehabilitation methodology and monitoring regimes. • Rehabilitation planning to include provisions for ecological assessment over the following years to ensure success. • Adequate plant and equipment should be maintained to ensure rehabilitation is completed adequately.
Reinstatement and rehabilitation: earthworks	1. Biosecurity (pests, weeds, disease) 2. Soil (erosion; acid sulphate) 3. Water (hydrology, watercourses) 4. Waste (hazardous; non-hazardous) 5. Emissions (dust; noise and vibration; gas) 6. Third parties (nuisance)	• Loss of fauna individuals. • Soil erosion and sediment release to land and water.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	7. Chemical and contamination.	• Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Potential for contamination of land / water. • Generation of hazardous (liquid / water) waste. • Temporary disruption to landowners (water logging). • Potential impacts to visual and aesthetic amenity.	• Compaction relief shall be undertaken, as required, by ripping or scarifying soils along the contours. • The pipeline corridor should be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features. • Where topsoil has been removed, it should be respread, or clean topsoil imported where there are insufficient stockpiles. Biosecurity measures shall be applied to imported topsoil. • Topsoil should be re-spread in the same location from where it was stripped. Avoid overhandling and transporting of the topsoil. • Reintroduction of biosecurity measures as required during clear and grade activities. • Erosion and sediment control measures shall be installed as required for ground stabilisation while revegetation occurs • Hazardous soils and watercourses shall be reinstated as soon as practicable in line with specialist requirements and plans. • Areas exposed to hazardous substances (e.g. WWTP) will be graded with material maintained for disposal.
Reinstatement and rehabilitation: reinstatement	1. Fauna 2. Biosecurity (pests, weeds, disease) 3. Soil (erosion; acid sulphate) 4. Water (hydrology, watercourses) 5. Waste (hazardous; non-hazardous) 6. Emissions (dust; noise and vibration; gas) 7. Third parties (nuisance).	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Soil erosion and sediment release to land and water.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Potential for contamination of land / water. • Generation of hazardous (liquid / water) waste. • Temporary disruption to landowners (water-logging). • Potential impacts to visual and aesthetic amenity.	• 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). • Flagging used to identify sensitive environmental features (e.g. natural and cultural heritage) along with any other construction materials, shall be removed and disposed of at the completion of construction.
Reinstatement and rehabilitation: rehabilitation	1. Fauna 2. Biosecurity (pests, weeds, disease) 3. Water (hydrology, watercourses) 4. Waste (hazardous; non-hazardous) 5. Emissions (dust; noise and vibration; gas) 6. Third parties (nuisance).	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Soil erosion and sediment release to land and water.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Any required ameliorants (ie gypsum, fertiliser or aglime) to be applied to promote revegetation and ground cover. • Rehabilitated areas should be fenced where possible, to prevent access until site stability is established.

Activity	Environmental Risk Area / Aspects Potentially Affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Potential for contamination of land / water. • Generation of hazardous (liquid / water) waste. • Temporary disruption to landowners (water-logging).	• Vegetation stockpiles will be assessed for fauna prior to respreading. • Seed stock should be respread or sown in accordance with the rehabilitation plan to assist natural regeneration. Surface roughness is encouraged when spreading topsoil to trap water and seeds. • Soil ameliorants may be added to the subsoil/topsoil as required. • Pipeline construction rehabilitation shall use native species that are typical of the surrounding vegetative community for revegetation where appropriate. • Tube stock of additional planting may be employed around watercourses for additional stability.

8 Pipeline Lifecycle Phase - Operation

The operation of onshore pipelines involves the use (or state of being ready for use) of a pipeline as intended by its design. This pipeline lifecycle phase can also include care and maintenance where a pipeline is considered operational but is temporarily underused.

This section of the Code outlines:

- The typical activities which occur during the operation lifecycle phase;
- A list of key environmental risk areas / aspects applicable to those activities; and
- Suggested environmental management methods to minimise or avoid the associated risk(s)

Reference should be made to AS 2885.3, for specific guidance on operation of pipelines.

Figure 28: An operational pipeline corridor

8.1 Activity description: initial operations defects period

The first few years post-construction will often include addition tasks, to allow for full close-out of the construction phase. These will include, but are not limited to additional defects liability surveys, such as:

- DCVG survey to ensure coating;
- Additional easement inspection to note settling;
- Revegetation assessments; and
- Landholder survey leading to property releases.

It is fundamental that the pipeline operator carryout these assessments in line with the contractor in a timely manner to ensure close-out within the designated timeframes.

8.2 Activity description: access

Access to operational pipeline areas is required on a regular basis. Access may also be required across operational pipeline areas, to facilitate the continuation of land use practices, such as farming.

Access is generally demarcated to the pipeline corridor right-of-way but can also include the installation or upgrade of temporary or permanent access tracks.

The nature and frequency of access will vary according to site environmental conditions. By extension, the required preventive maintenance program requirements and corresponding corrective maintenance will also vary. A higher frequency of access to an operational pipeline may be required immediately following ground disturbance activities. This is necessary to ensure that all environmental protection measures are functioning as intended. Access may be undertaken by vehicle (light or all-terrain) or on foot and can include plant, equipment or machinery for ongoing maintenance or repair is required.

Pipeline easements pass through many types of land tenure. In many cases, this may include freehold or leasehold land that is used for other activities. In such situations, agreements are negotiated with land users that allow for the continued use of land while the pipeline operator retains a right of access to the pipeline easement (if present) to operate and maintain the pipeline with its associated easement (in accordance with the provisions of tenure and the pipeline licence).

8.2.1 Pipeline surveillance

Pipeline surveillance is an essential activity in the operation of every pipeline and is required by AS 2885.3. Any surveillance activity requiring land access should be undertaken in consultation with the landowner, and with due attention to appropriate biosecurity procedures.

Pipeline surveillance and inspections may be undertaken to:
- Identifying evidence of any third-party activity, either on, or immediately adjacent to, the easement;
- Monitoring infrastructure condition and identifying required corrective maintenance requirements (access tracks, pipeline signage, fencing, gates);
- Monitoring for evidence of erosion, washouts or land subsidence;
- Assessment of vegetation cover on the easement (establishing the requirement for line of sight maintenance or checking rehabilitation of sites);
- Identify areas of erosion and subsidence;
- 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.

8.2.2 Cathodic protection

Steel pipelines contain cathodic protection systems as part of their integrity management. These systems include test posts, which require readings to be undertaken intermittently. This also requires access to, and traverse of, the easement. It is important that appropriate hygiene, as well as access and stakeholder consultation, is undertaken on these surveys as with pipeline surveillance.

Ongoing maintenance may also require the installation of additional cathode protection sites as pipelines age. Where these are new anode beds or associated infrastructure outside the existing corridor and disturbance area such works may be (greenfields) construction. In such circumstances, legislation should be consulted with consideration to aspects noted in Section 7.

8.2.3 Land access arrangements

The easement access arrangements negotiated with affected land users should be recorded in an effective land management system that is consulted prior to accessing the easement. Information captured in the system may include:

- Biosecurity hygiene protocols to be applied to various sections of the easement e.g. landholder vehicle / plant clean down requirements
- Conditions on the use of herbicides and other chemicals within the easement e.g. no chemicals to be used in vicinity of organic farms

Records of actions undertaken to fulfil agreed access arrangement should be retained. Refer to Section 5.3 above for further information on biosecurity risks.

8.3 Activity description: vegetation removal

Vegetation removal is required for objectives such as:

- maintenance of line of site between pipeline markers and safe access as per AS 2885.
- to ensure vegetation roots do not establish around the pipeline and cause integrity issues via disruption to coating (or rupture in the event of a tree falling).
- maintenance of firebreaks.

Native vegetation clearing is a highly regulated environment area in all jurisdictions. A native vegetation clearing permit is usually required prior to clearing vegetation. Vegetation removal should be minimised, especially around watercourse areas.

8.3.1 Weed management

Weed management (both corrective and preventive) is integral to maintaining a pipeline easement. Weeds can be managed via physical (mechanical), biological or chemical means. It is important that the weed strategy employed is applicable to the type and nature of weed infestation, as well as surrounding environment. Generally, chemical management should be limited around watercourse areas and, where required, should be undertaken in consultation with landholders.

8.4 Activity description: pigging

Pipeline pigging, or running through of a pipeline integrity gauge, will occur over the life of a pipeline. Pigging occurs in the operational phase to clean and assess the pipeline.

For integrity assessment, an 'intelligent pig' is launched through a given section of the pipeline and will record information concerning coating and wall thickness as it travels. The information gathered will then be used for assessment by pipeline engineers. This information then informs the requirement for dig-up and inspection regimes. Pigs enter the pipeline at a pig launcher (generally located at a scraper station – see Section 8.6 below) and are captured at a corresponding receiver station.

Pigging can generate general and hazardous wastes including naturally occuring radioactive material (NORM). Appropriate planning is required to ensure appropriate equipment and resources are on hand during these works to prevent contamination and to ensure correct handling and disposal of waste materials.

Refer to Section 5.8 above for further information on waste risks.

8.4.1 Naturally occurring radioactive material

Naturally occurring radioactive material (NORM) is a term to describe materials containing radionuclides that exist in the natural environment. NORM creates ionising radiation, and everyone is exposed to naturally occurring ionising radiation coming from space, radioactive particles in the air and from the Earth. The production and transmission of hydrocarbon-based products, such as gas, can concentrate the level of NORM found in process plant and work locations.

Once NORM has been identified, it should be managed appropriately. Solids and liquids containing NORM must be handled, stored, transported, and disposed in accordance with an approved radiation management plan and in compliance with the regulations relevant for the jurisdiction in which the NORM affected activity takes place.

8.5 Activity description: earthworks

Earthworks may be required for activities such as:

- corrective maintenance and inspections
- construction of additional facilities
- to maintain access tracks and drainage controls
- to stabilise areas of erosion.

During the operation phase, earthworks are generally of relatively short duration and to a minimal depth of excavation. Excavations to expose the pipeline for coating, defect and corrosion repairs, or to protect the pipeline from land subsidence or new land uses, will result in a greater level of environmental disturbance.

8.6 Activity description: management of above-ground facilities

Pipelines are operated via above-ground facilities. Above-ground facilities associated with pipeline operations can include compressor stations, pressure reduction stations, mainline valves, delivery facilities, scraper stations and instrumentation such as metering. Permanent buildings may be constructed at major facilities, such as compressor stations.

Figure 29: A mainline valve. (W. Mathieson)

The high-pressure equipment located within above-ground facilities may present environmental risks from noise, gas release, waste generation or fire.

Above-ground facilities associated with water and slurry pipeline operations may 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. Environmental risks can be minimised for pump stations and water treatment equipment by housing them within permanent buildings.

8.6.1 Odourising facilities

Natural gas has little or no odour. An odourising agent (odourant) is added to gas to meet legislative requirements and ensure that gas possesses both a sufficiently strong and distinctive odour.

Odourant may be added at the point where the gas enters a distribution network or, in rare cases, it may be added directly at a customer site. The rate of odorant injected into the system must be controlled to ensure that leaking natural gas can be easily detected and odorant levels are monitored to ensure statutory requirements are met. These requirements are specified in AS4645.1 section 6.4.

Proponents operating odourising facilities should document safe handling and operating procedures in a manual to minimise the risk associated with such facilities.
Refer to Section 5.9 above for further information on emission risks

8.7 Activity description: pipeline failure and response

Pipelines carrying liquids such as oil, condensate or chemicals as well as natural gas, 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 AS 2885 to minimise the chance of such failures.

Notwithstanding this engineering design, operational activities on any pipeline (gas or liquid) can result in chemical spills such as: fuels and oils from plant and equipment or contaminated water (such as from water bath heaters).

Chemical spill prevention and response should be risk assessed and response mechanisms planned.

8.8 Operation lifecycle phase: activity environmental risk profiles

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Access: operational pipeline access track general provisions	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise and vibration; gas) 10. Third Parties (nuisance) 11. Chemicals and contamination.	• Disturbance of significant flora or wildlife habitat. • Introduction of pests, disease, weeds. • Soil compaction, erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses. • Degradation of existing road infrastructure. • Unauthorised access track proliferation.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Development of a construction environmental management plan. • 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 occur only with individual landowner and/or occupier approval and in a manner consistent with pre-established access arrangements. • Pre-established access arrangements should be recorded in an effective land management system and required actions implemented (e.g. vehicle clean down, restricted use of herbicides near organic farms). • Public access along the easement shall not be permitted unless that right already exists. Public access 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 must be by pre-established agreement with the landowner. Typically, the 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. 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.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			• Access shall adequately consider potential noise or dust impacts. 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. • Vehicle access should be restricted to stable ground where practicable. Additional care should be taken near watercourses and drainage lines. • Vehicle parking shall be restricted to designated areas.

Access: pipeline surveillance	1. Native vegetation
	2. Fauna
	3. Biosecurity (pests, weeds, disease)
	4. Emissions (dust; noise and vibration; gas)
	5. Third Parties (nuisance)
	6. Chemical and contamination.
		• Disturbance of significant flora or wildlife habitat.
		• Introduction of pests, disease, weeds.
		• Soil compaction, erosion and sediment release to land and water.
		• Temporary disruption to landowners (access, dust).
		• Damage to agricultural production or other land uses.
		• Degradation of existing road infrastructure.
		• Unauthorised access track proliferation.
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• Ensure environmental values along easement are maintained via regular inspection as determined by risk assessment for the asset.
			• Inspection to address vegetation:
			  ○ Regrowth for ground cover and stability.
			  ○ Line of site between pipeline markers and safe access.
			  ○ Establishment to ensure root systems do not pose an integrity risk (to pipeline coating or in a situation where they fall).
			• Inspection to address erosion:
			  ○ To occur as scheduled and in high-risk areas following significant rainfall.
			  ○ If significant erosion is encountered, erosion and sediment control structures should be installed and monitored.
			  ○ Sediment is not being transported offsite.
			  ○ Soil structure is being maintained.
			  ○ Depth of cover is maintained for pipeline protection.
			  ○ Subsidence along the trench line.
			  ○ Inspection to assess land use.
			  ○ No third-party encroachment.
			  ○ No high activities being undertaken without appropriate assessment.
			• Inspection to identify weeds:

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			○ 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. • Heritage sites should be identified from construction with information on assessment of significance, location and ongoing operational management measures for each site entered onto a database which shall be available to patrol officers and environmental advisers and auditors during operations.
Vegetation removal: operational pipeline activity; maintenance of access and line of site	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Soil (erosion) 5. Emissions (dust; noise and vibration; gas) 6. Third Parties (nuisance).	• Disturbance of significant flora or wildlife habitat. • Introduction of pests, disease, weeds. • Soil compaction, erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, dust). • Damage to agricultural production or other land uses. • Unauthorised access track proliferation.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Development of a construction environmental management plan. • Plant and equipment should be certified clean prior to commencement of easement works, with regular wash-down as required. • Awareness of the types of fauna found on or adjacent to the pipeline easement and the possibility that other fauna, especially listed fauna, should be available. ○ Fauna management developed in line with requirement. • Fauna habitat should be considered when planning for easement management, especially for general mowing, slashing or line of sight maintenance activities. ○ 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. • Where appropriate, native groundcover and shrubs shall be encouraged to regenerate over the entire pipeline construction area, to minimise negative habitat barrier effects. • If vegetation has remains in a stockpiled for a lengthy duration, suitably qualified fauna spotter/catchers should catch and relocate fauna from it, prior to re-spreading. • Records of any vegetation removed are to be maintained.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			• Where erosion is 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; in consultation with landholders.
Vegetation Removal: Weed Management	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Soil (erosion) 5. Chemical and Contamination 6. Emissions (dust; noise and vibration; gas) 7. Third Parties (nuisance).	• Soil compaction, erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Temporary disruption to landowners (access, dust). • Damage to agricultural production or other land uses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • The pipeline corridor should be inspected for weeds. • Should a significant weed infestation be found, aspects to be recorded should include: o Weed species that are present. o Estimated coverage area. o Possible reasons for infestation. o Suggested management measure. • An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Maintenance inspections should include notes on weeds encountered and actions taken / recommended. • A weed management strategy should be developed with the pipeline operator, subject matter expert and landholder. • All known weeds areas should continue to be monitored once treated.
Pigging: integrity assessment and clearing	1. Waste (hazardous; non-hazardous) 2. Emissions (dust; noise and vibration; gas) 3. Third Parties (nuisance) 4. Chemical and contamination.	• Temporary disruption to landowners (access, noise and dust). • Generation of various waste streams. • Release of hazardous materials.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Commensurate resources shall be available onsite for the activity pending this assessment; potential items include portable bunds, lined receptacles and / or sucker truck for immediate removal offsite. • Any waste generated it to be disposed of at the appropriately licensed waste facility.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			• Licensing may be required in some States and Territories for transport of liquid waste. • NORM affected waste must be handled, stored, transported, and disposed in accordance with jurisdictional regulations.
Earthworks: operational pipeline integrity assessment	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise and vibration; gas) 10. Third Parties (nuisance) 11. Chemical and contamination.	• Disturbance of significant flora or wildlife habitat. • Introduction of pests, disease, weeds. • Loss of heritage values. • Soil compaction, erosion and sediment release to land and water. • Potential modification to surface water flows (drainage lines and streams). • Potential for site run-off into drainage lines and watercourses. • Disturbance of ASS or contaminated soils. • Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Prior to commencing earthworks, adequate notification shall be given to the regulator (as required), adjacent landowners and nearby sensitive receptors. • Where required, vegetation is to be assessed for sensitive of threatened species, with permits obtained as required. • Licensed fauna handlers to be onsite for spotting and catching where habitat exists. • Where required (generally where excavation is wider than previously disturbed area) site to be assessed for heritage values prior to commencement. • 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 Erosion and Sediment Control and should be routinely checked to ensure they are in good condition and remain stable and 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. ○ It is recommended that an issue-specific management plan outlining ASS management methodology is developed, approved and implemented prior to undertaking the activity. e.g. a pH neutralising agent (such as agricultural lime) can be used to neutralise soil during stockpiling or backfilling. • Only clean fill shall be used if additional material is required. Fill material should preferably be sourced locally and be compatible with the surrounding area. Fill

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			material from off-site needs to be certified as weed-free by a suitably certified service provider. • Plant and machinery should be clean upon arrival at dig sites; cleaning is likely to be required in-between each site (dependent on conditions) • During pipeline operations, the disturbance of ASS 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. • 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.
Management of above-ground facilities: land use	1. Soil (erosion) 2. Waste (hazardous; non-hazardous) 3. Emissions (dust; noise and vibration; gas) 4. Third Parties (nuisance) 5. Chemical and contamination.	• Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Consultation with relevant landowners and regulatory authorities should be undertaken. See APGA Stakeholder Engagement Guidelines. • 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.
Management of above-ground facilities: planning	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Waste (hazardous; non-hazardous) 5. Emissions (dust; noise and vibration; gas)	• Disturbance of significant flora or wildlife habitat. • Introduction of pests, disease, weeds. • Soil compaction, erosion and sediment release to land and water.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Where practicable, pipeline facility sites shall be located remote from populated areas and sensitive receptors. • Relevant landowners are to be consulted regarding the location of above-ground facilities. • Visual impact from pipeline facilities should be minimised.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	6. Third Parties (nuisance) 7. Chemical and contamination.	• Potential for site run-off into drainage lines and watercourses. • Disturbance of contaminated soils.	• Facility design should ensure adequate installation of adequate bunding (oily water separators etc.) commensurate with amounts to be stored during operations. • Facilities should be in lower fire risk areas with fire breaks maintained. • Any waste generated is to be: ○ Maintained within the appropriately labelled, lidded bins. ○ Collected regularly. ○ Disposed of at the appropriately licensed waste facility with records maintained.
Management of above-ground facilities: management	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Waste (hazardous; non-hazardous) 5. Emissions (dust; noise and vibration; gas) 6. Third Parties (nuisance) 7. Chemical and contamination.	• Temporary disruption to landowners (access, noise and dust). • Generation of various waste streams. • Release of hazardous materials. • Proponent's response to their complaint.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Potential odour issues should be minimised. • Vegetation removal should be compliant with applicable legislation; with permits obtained as required and compliance with relevant fire restrictions. • Any non-essential maintenance works should be avoided on days of extreme fire rating or Total Fire Ban. • 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. • 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. • Pipeline facilities will be maintained in a clean and tidy condition. This includes maintenance of any screening around pipeline facilities. ○ All waste generated should be removed some site regularly. ○ Waste should be contained within lidded and labelled receptacles. • Noise emissions from pipeline facilities should be compliant with applicable legislation, conditions and standards. ○ Notification (of 24 hours or more) to be provided to close, and sensitive receptors prior to loud activities (blow-downs, venting etc.).

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			○ A landholder management system / complaints register should be maintained to allow for appropriate rectification of disputes. • Pipeline licensees should maintain an accurate record of operational emissions. • The storage and handling of fuels and chemicals shall comply with all relevant legislation and Australian Standard AS 1940 – 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. • Fuels and chemicals shall not be stored or handled in the vicinity of natural or built waterways or water storage areas (>100m). • Areas for storage of liquids such as oil or pipeline liquids should be bunded and drains from bunds kept clear of foreign material.
Pipeline failure and response: planning	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Waste (hazardous; non-hazardous) 5. Emissions (dust; noise and vibration; gas) 6. Third Parties (nuisance) 7. Chemical and contamination.	• Disturbance of significant flora or wildlife habitat. • Potential for contaminated soils via release of hazardous substances. • Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses.	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Pipelines shall be designed to limit the volume of material released in the case of a spill. • Detailed spill prevention and response plans shall be developed as part of the emergency response planning for all operational pipelines, and shall address: ○ Monitoring and detection systems; plan review / revision, testing and training. ○ Personnel responsibilities, communications and logistics. ○ Response actions required to halt the spill. ○ Spill containment and materials recovery procedures. ○ Equipment requirements, location, storage, maintenance and transport. ○ Call-out procedures; contact lists and incident reporting and investigation procedures. ○ Notification and reporting procedures (both internal and external). ○ Reinstatement and rehabilitation procedures. ○ Requirements for safe and legal disposal of contaminated materials.

9 Pipeline Lifecycle Phase – Decommissioning

Pipeline decommissioning, or abandonment involves the ceasing of operation. Usually, this phase involves the dismantling and removal of above-ground, and dependent on circumstances below-ground, pipeline infrastructure and rehabilitation.

Pipeline decommissioning shall be in accordance with the respective pipeline licensing conditions. Where the decommissioning methodology is not detailed in the pipeline license, a risk assessment process should be undertaken to determine the appropriate method of decommissioning, be that abandonment or removal.

Pipeline decommissioning has two aims:

- To leave the easement in a condition that is as near as practicable to pre-existing environmental conditions.
- To decommission the pipeline in a manner that minimises potential impacts to the environment, land use and third parties.

This section of the Code outlines:

- The typical activities that occur during the decommissioning lifecycle phase;
- Lists the environmental risk areas / aspects applicable to those activities; and
- Suggests environmental risk management methods to minimise or avoid the associated risk.

Reference should be made to AS 2885.3 for specific guidance on abandonment of pipelines.

9.1 Activity description: decommissioning preparation

A renewed environmental risk assessment process that identifies any potential effect on the environment and other uses / users of the easement should support decommissioning preparation. The methodology applied to executing a pipeline decommissioning should be considered on a case-by-case basis in line with the legislation of the time.

The following aspects should be considered during decommissioning preparation 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, particularly the
  - level of revegetation (and potential habitat) over the easement;
  - stability of the easement and soil profiles;
  - presence of heritage features including repatriated materials;
  - current land use; and
- Any other issues relevant to the particular pipeline.

Early environmental involvement in decommissioning preparation is essential in order to determine regulatory requirements and timeframes. This is increasing in many areas in line with end-of-life mining rehabilitation requirements and should be appropriately considered, especially around ongoing survey and resourcing. Decommissioning preparation may also involve setting out the strategy, philosophy, goals and objectives for the decommissioning process. It is recognised that commercial considerations, such as potential future use for the pipeline and / or the cost of removal versus the cost of abandonment, can be key determining factors in planning a decommissioning strategy.

Decommissioning preparation involves consideration of five assessment criteria:

- Regulatory requirements;
- Technical feasibility;
- Environmental and social factors;
- Safety; and
- Cost (including time).

Where complete asset removal is determined to be the preferred method, the decommissioning activities required will heavily reflect corresponding activities required for the stages of construction.

9.2 Activity description: pipe cleaning

Onsite decommissioning commences with pipe cleaning. Decommissioning water pipelines requires the pipe or section of pipe to be hydrostatically tested in accordance with the test requirements detailed in the Water Services Association of Australia (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 such as injecting an inert substance (such as nitrogen), flushing with water, followed using foam or brush PIGs to clean the pipeline.

9.3 Activity description: pipeline suspension

Pipeline suspension is the temporary ceasing of operation, generally in response to a reduction in customer demand. Here, the pipeline is cleaned as above, and then left in a state which allows reactivation of operations when demand is reinstated. Often, once the pipeline is purged of its contents and cleaned, it is filled with an inert gas such as nitrogen. During this time operational licence requirements are reduced, however certain requirements (around things like surveillance) remain.

9.4 Activity description: pipeline abandonment

Abandoning clean, buried pipelines in situ is generally considered environmentally acceptable as it significantly reduces disturbance and environmental impacts associated with digging up decommissioned infrastructure and reducing waste. Where regulatory authorities may prefer pipeline removal, the risk assessment process should demonstrate that the environmental benefits of abandonment outweigh the benefits of removal.

When abandoned in place, the pipeline section shall be abandoned in such a way to ensure that ground subsidence and the risk of contamination of the soil or groundwater is minimised. Where cathodic protection is applied to prevent the eventual collapse of the pipeline, the responsibility for maintenance of the system shall remain with the Licensee and appropriate records shall be kept. NOTE: Consideration should be given to filling the abandoned pipeline with an inert substance.

9.5 Activity description: pipeline removal

Pipeline removal involves removal and disposal of above and below ground pipeline infrastructure. The pipeline material, degradation rates and potential for contamination should be risk assessed. For short sections of pipeline within highly disturbed areas, physical removal may be a more plausible strategy. This can also facilitate potential reuse of materials (see Section 5).

Pipeline removal may involve removal of above-ground facilities (see Section 9.6) as well as capping and plugging the below ground pipeline. This process may involve the filling of the pipeline with an inert slurry and capping to ensure that seepage does not occur. Activity description: removal of above-ground facilities

Removal of above-ground facilities is like, and often a part of, the pipeline removal activity. It involves removal and disposal of all above-ground pipeline infrastructure such as compressors, filtration or pigging skids and fencing, telemetry units and along the pipeline itself.

If only above-ground facilities are being removed (not below ground), the pipelines should be cut-off at a minimum depth of 750mm below the natural surface, or at pipeline depth as determined by AS 2885.3. All above-ground signs and markers above the pipeline should be removed.

If the cathodic protection system is being abandoned, all above-ground elements should be removed. If anode and earthing beds are to remain in situ, they are to be disconnected at 600mm below the natural surface level.

Consideration and assessment of any associated contamination should also occur.

9.6 Activity description: close-out

The close-out activity is an administrative task determined by the relevant regulatory authority and legislation of the time. Once the above and/or below pipeline infrastructure has been removed, abandoned or placed into suspension, the appropriate legislative requirements require completion.

This may include a statement of compliance, close out report or updating or forfeit of environment management plans or approvals, associated licences and easements. A jurisdiction may also require ongoing rehabilitation, as well as environmental monitoring (survey), to ensure that any abandoned pipeline infrastructure meets certain rehabilitation criteria, or species profiles, and does not have an ongoing or negative impact on the surrounding environment or third parties.

Discussions with key regulators should be closed-out formally and recorded, on completion of works to ensure all requirements are met, and impacted parties are satisfied with works undertaken.

9.7 Decommissioning lifecycle phase: activity environmental risk profiles

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods

Decommissioning preparation: strategy option / technical / environment and stakeholders	1. Native vegetation
	2. Fauna
	3. Biosecurity (pests, weeds, disease)
	4. Natural or historic heritage
	5. Indigenous heritage
	6. Soil (erosion; acid sulphate)
	7. Water (hydrology, watercourses)
	8. Waste (hazardous; non-hazardous)
	9. Emissions (dust; noise and vibration; gas)
	10. Third parties (nuisance)
	11. Chemical and contamination.
		• Environmental risks not identified.
		• Environmental risks not assessed.
		• Environmental risk management methods not agreed or implemented.
		• Environmental legal obligations not identified.
		• Regulatory consultation not conducted.
		• Third-party / stakeholder consultation not conducted.
			• The decommissioning strategy must be identified.
			• Decommissioning objectives shall be set and procedures identified.
			• Operational phase environmental and monitoring data and history shall be reviewed.
			• An environmental risk assessment should be conducted to identify and assess risk.
			• Presence of contamination should be assessed and managed.
			• Environmental risk management methods should be determined and agreed upon.
			• Impacts on the environment, stakeholders 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.
			• Planning shall include a description of the pipeline and associated equipment to be decommissioned, including lengths, diameters and type of (construction) methodology.
			• 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.
			    ○ Identification of critical areas where subsidence of an abandoned pipeline cannot be tolerated (e.g. crossings).

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			• 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. • 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, to determine potential environmental impacts associated with decommissioning.
Pipe cleaning and pipeline removal: planning	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses) 8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise, gas) 10. Third Parties (nuisance) 11. Chemical and contamination.	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Soil compaction, erosion and sediment release to land and water. • Potential modification to surface water flows. • Disruption of ASS or contaminated soils. • Potential for site run-off into drainage lines and watercourses. • Generation of general and hazardous wastes. • Temporary disruption to landowners (access, noise and dust).	• An environmental risk assessment should be conducted to identify and assess risk. • Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Site preparation and management requirements shall be implemented in accordance with developed and approved • If the pipeline is to be abandoned, an abandonment plan, developed in accordance with AS 2885 and all applicable regulations shall be developed. • Hydrocarbon gases shall preferentially be disposed to fuel gas or flare systems over cold venting.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Damage to agricultural production or other land uses.	
Pipe cleaning and pipeline removal: depressurising	1. Emissions (dust; noise and vibration; gas) 2. Third Parties (nuisance) 3. Chemical and contamination.	• Disturbance of significant flora or wildlife habitat. • Temporary disruption to landowners (access, noise and dust).	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • As systems become depressurised, the pipeline may then be isolated by valving and subsequent blanking. • Third parties and stakeholders should be notified of works generating noise or odour.
Pipe cleaning and pipeline removal: venting	1. Emissions (dust; noise and gas) 2. Third Parties (nuisance) 3. Chemical and contamination.	• Disturbance of significant fauna or wildlife habitat. • Temporary disruption to landowners (noise, odour and dust).	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Third parties and stakeholders should be notified of works generating noise or odour. • Where flammable or other harmful materials are to be vented, the point(s) for release should be located so that they 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 stakeholders and regulatory agencies. • Records of vented amounts are to be maintained for reporting purposes.
Pipe cleaning and pipeline removal: flaring	1. Emissions (dust; noise and gas) 2. Third Parties (nuisance) 3. Chemical and contamination.	• Disturbance of significant fauna or wildlife habitat. • Temporary disruption to landowners (noise, light odour and dust).	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Third parties and stakeholders should be notified of works generating light, noise or odour. • Where flaring is occuring, the point(s) for release should be located so that they preclude any likelihood of ignition, under suitable meteorological conditions and away from residential and environmentally sensitive areas. • Prolonged or significant flaring activities should be undertaken in consultation with the appropriate stakeholders and regulatory agencies. • Records of flared amounts are to be maintained for reporting purposes.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Pipe cleaning and pipeline removal: draining	1. Waste (hazardous; non-hazardous) 2. Emissions (dust; noise and vibration; gas) 3. Chemical and contamination.	• Potential for site run-off into drainage lines and watercourses. • Generation of general and hazardous wastes. • Temporary disruption to landowners (noise, odour and dust).	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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.
Pipe cleaning and pipeline removal: purging and flushing	1. Emissions (dust; noise and gas) 2. Waste (hazardous; non-hazardous) 3. Third Parties (nuisance) 4. Chemical and contamination.	• Potential for site run-off into drainage lines and watercourses. • Soil compaction, erosion and sediment release to land and water. • Generation of general and hazardous wastes. • Temporary disruption to landowners (noise, odour and dust).	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Third parties may be notified of works if noisy or odorous. • Pipe-work can be flushed or purged using steam, water and / 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 (foam, brush etc.) are pushed through the pipeline often 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. • Wastewater should be managed as a waste or regulated waste (as applicable). • 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, flush water shall be disposed of at an approved waste facility or otherwise re- treated to meet acceptable levels.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
			• Discharging water shall be undertaken in a manner that prevents localised effects, including erosion and sediment transport, and in consultation with any affected landowners

Pipe cleaning and pipeline removal: abandonment: rehabilitation and monitoring	1. Emissions (dust; noise and gas)
	2. Soil (erosion)
	3. Waste (hazardous; non-hazardous)
	4. Third Parties (nuisance)
	5. Chemical and contamination.
		• Potential for site run-off into drainage lines and watercourses.
		• Potential for contamination.
		• Generation of general and hazardous wastes.
			• Environmental risk management methods should be implemented from an environmental management plan or equivalent.
			• 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.
			  ○ Maintenance or upgrade of the cathodic protection system in order to prevent pipeline collapse. If CP 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.

Pipeline removal: excavation	1. Native vegetation 2. Fauna 3. Biosecurity (pests, weeds, disease) 4. Natural or historic heritage 5. Indigenous heritage 6. Soil (erosion; acid sulphate) 7. Water (hydrology, watercourses)	• Disturbance of significant flora or wildlife habitat. • Loss of fauna individuals. • Introduction of pests, disease, weeds. • Soil compaction, erosion and sediment release to land and water.	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • The width of vegetation clearance shall be minimised to the safest practical width. • Cleared vegetation shall be stockpiled for re-spreading during rehabilitation. • Topsoil shall be stripped and stockpiled for re-spreading during rehabilitation. • Trench subsoil and pipeline padding material shall be stockpiled separately from vegetation and topsoil.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
	8. Waste (hazardous; non-hazardous) 9. Emissions (dust; noise and vibration; gas) 10. Third Parties (nuisance) 11. Chemical and contamination.	• Potential modification to surface water flows. • Disruption of ASS or contaminated soils. • Generation of general and hazardous wastes. • Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses. • Degradation of existing road infrastructure.	
Pipeline removal: removal of pipe	1. Waste (hazardous; non-hazardous) 2. Emissions (dust; noise and vibration; gas) 3. Third Parties (nuisance) 4. Chemical and contamination.	• Generation of general and hazardous wastes.	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • The recovered pipe will be dismantled and segments either salvaged for reuse or disposed of as scrap, depending on its condition, relative costs, demand, and potential contamination etc. • Waste should be disposed of at the appropriately licensed waste facility, with records maintained.
Pipeline removal: reinstatement	1. Native vegetation 2. Biosecurity (pests, weeds, disease) 3. Soil (erosion) 4. Water (hydrology, watercourses) 5. Waste (hazardous; non-hazardous) 6. Emissions (dust; noise) 7. Third Parties (nuisance) 8. Chemical and contamination.	• Introduction of pests, disease, weeds. • Soil compaction, erosion and sediment release to land and water. • Potential modification to surface water flows. • Site run-off into drainage lines and watercourses.	• Stockpiled trench subsoil and padding material shall be returned to the excavation. • Additional fill will be required, to replace the volume previously occupied by the pipe: any imported fill should be certified as weed-free by a certified service provider prior to importation to the site. • Stockpiled topsoil and cleared vegetation should be re-spread over the excavation and re-profiled to a stable form. • Rehabilitation aids such as berms, gabions, rock dams, etc, should be installed as required to ensure ongoing stability of the reinstated area.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
		• Generation of general and hazardous wastes. • Temporary disruption to landowners (access, noise and dust). • Damage to agricultural production or other land uses.	• Ongoing survey of rehabilitation success will likely be required – ensure your targets for rehabilitation (species profiles and distribution) and survey intensity (frequency) is agreed prior to commencement.
Removal of above-ground facilities: well head pipework	1. Soil (erosion) 2. Waste (hazardous; non-hazardous) 3. Emissions (dust; noise) 4. Third parties (nuisance) 5. Chemical and contamination.	• Generation of general and hazardous wastes.	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • 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.
Removal of above-ground facilities: other infrastructure	1. Soil (erosion) 2. Waste (hazardous; non-hazardous) 3. Emissions (dust; noise) 4. Third parties (nuisance) 5. Chemical and contamination.	• Soil compaction, erosion and sediment release to land and water. • Potential for site run-off into drainage lines and watercourses. • Generation of general and hazardous wastes. • Temporary disruption to landowners (access, noise and dust).	• Environmental risk management methods should be implemented from an environmental management plan or equivalent. • Presence of contamination should be assessed and managed. • 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. • Septic systems associated to be included. • Recovered pipe, the power plants, generators, compressor station equipment, mainline valves and other ancillary infrastructure that is part of the pipeline designed under AS 2885 will be dismantled and either salvaged for reuse or disposed of as scrap, depending on its condition, relative costs, demand, etc. • Waste to be appropriately classified and disposed of.

Activity	Environmental risk area / aspects potentially affected	Mechanism of harm (how the activity could cause harm)	Example / key management methods
Close-out		• Non-compliance.	• Ensure appropriate close out reporting, licence surrender and ongoing monitoring rehabilitation is appropriately resourced and owned to allow it to be conducted as required.

Glossary

Indigenous or First Nations (Aboriginal and Torres Strait Islander) heritage	Indigenous heritage includes both physical and non-physical elements. Physical heritage such as objects created by traditional societies, such as stone tools, grinding grooves, culturally modified trees. Sites such as art sites and ceremonial or burial grounds. Non-physical heritage such as peoples' memories, storylines, ceremonies, language and 'ways of doing things' that continue to enrich local knowledge about the cultural landscape and facilitate local Indigenous people's connection with the land.
Acid Sulfate Soils	Acid sulfate soil (ASS) is the common name for soils that contain metal sulfides. Acid sulfate soils can be classified as inland, coastal or geological. In an undisturbed and water-logged state, these soils may pose no or low risk. However, when disturbed or exposed to oxygen, acid sulfate soils undergo a chemical reaction known as oxidation. Oxidation produces sulfuric acid.
Actual ASS (AASS)	Soils or sediments that once contained sulfides but that have oxidised and become severely acidic.
Biosecurity	Biosecurity is defined as the protection of environment, economy and public health from negative impacts associated with pest, diseases and weeds.
Built heritage	Built heritage refers to places or sites of non-indigenous buildings, infrastructure and commemorative locations.
Cathodic protection system	Application of an electrical current to the pipeline exterior to prevent the electrochemical corrosion.
Chemical or hazardous chemical	Materials which, because of their chemical, physical or biological properties have the potential to cause environmental harm. It is a term that collectively describes substances which are classified according to the hazard they present, including but not limited to dangerous goods or hazardous substances. Refer to State/Territory laws and guidelines.
Chemical spill or spill	An event where a chemical becomes uncontained and/or comes in contact with the environment (soil, flora, water).
Construction	The building of a pipeline or associated pipeline infrastructure. This can include the refurbishment or upgrade of an existing piece of infrastructure.
Contaminated land	Land, water or an area which has an unnatural substance present in it at above background concentrations as the result of human activities. Contaminated land can present a hazard to the environment or people. It is often a legacy from historical land use practices. Registered contaminated land is tracked by State and Territory governments, but not all contaminated land is registered (confirmed).
Contamination	Environmental harm from a chemical/s.
Declared weed / Listed weed	A weed specifically listed under the applicable State/Territory jurisdiction due to its risk of causing environmental or economic damage. For example, in Western Australia 'Declared weed' means a flora species that has been gazetted under the *Agriculture & Related Resources Protection Act 1976* (WA).

Decommissioning	The ceasing of operation. Usually, this phase involves the dismantling and removal of above, and often below ground, pipeline infrastructure and rehabilitation.
Disease	In animals, a disordered or incorrectly functioning organ, part, structure, or system of the body resulting from the effect of genetic or developmental errors, infection, poisons, nutritional deficiency or imbalance, toxicity, or unfavourable environmental factors; illness; sickness; ailment. In plants, any abnormal condition in a plant that interferes with its vital physiological processes, caused by pathogenic microorganisms, parasites, unfavourable environmental, genetic, or nutritional factors, etc.
Easement	A right held by the proponent to make use of, or access the land (in this case, for the installation and operation of a pipeline).
Environmental approval	An environmental approval is a generic term for any consent granted from a relevant authority under, or as an exemption from, an environmental law. An environmental approval – once granted – operates as complementary or exemplary function of the Act under which it was granted.
Environmental integration	Environmental integration is a general term for the mechanism or strategy which ensures that the environmental risk management methods – contained within an EMP or equivalent – are implemented as a part of an activity.
Environmental management plan (EMP)	A centralised, scope-specific document which describes all environmental risks and hazards related to an activity and sets out environmental risk management methods which should be implemented to avoid or minimise the environmental risk of that activity.
Environmental management system (EMS)	An environment management system (EMS) is a business tool for managing the impacts of a business on the environment.
Environmental risk - assessment	Environmental risk assessment – or risk analysis and evaluation – is the process of evaluating the identified risks (in terms of likelihood and consequence of risk coming to fruition) and developing environmental risk management methods (controls) to avoid or minimise the risk.
Environmental risk - audit and assurance	Environmental audit and assurance – or monitoring and review – is a broad term, which describes the process of reviewing the implementation of environmental risk management methods and proposing modifications to ensure that environmental risks continue to be managed appropriately.
Environmental risk - identification	Environmental risk identification is the process of identifying the context, stakeholders, hazards, environmental aspects and environmental impacts of an activity.
Environmental risk - management	Environmental risk management – or risk treatment – is the process of implementing environment risk management methods, which were developed and agreed on during the environmental risk assessment.
Environmental risk management methods	Environmental risk management methods are agreed methods and/or techniques for avoiding or minimising the environmental risk of conducting an activity

Horizontal directional drilling	A 'trenchless technology' 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.
Hydrostatic testing (or hydrotesting)	A pipeline testing process used to test welds and pipeline integrity 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 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).
Legal/regulatory environmental harm	An undesirable outcome relating to an environmental law, legal process or condition. This could include a breach, violation or omission
Native vegetation	Native vegetation comprises plants that are indigenous to the bioregion they inhabit, including trees, shrubs, herbs and grasses.
Natural heritage	Natural heritage refers to any natural features or places which are known, or suspected, to possess significant heritage value such as fossils, unique landforms and significant areas.
Noise	Noise is as an audible vibration of any frequency, whether transmitted through air or any other physical medium.
Operation	The use (or state of being ready for use) of a pipeline as intended by its design (this pipeline lifecycle phase can also include care and maintenance where a pipeline is considered operational, but is temporarily underused)
Pests	Fauna species that have, or could have, serious economic, environmental or social impacts. The applied definition varies across jurisdictions and must be reviewed for relevance and obligations on a case-by-case basis
Planning and asset acquisition	The preparation of pipeline activities, budgets, access, approvals ahead of the construction, operation and/or decommissioning pipeline lifecycle phases. The planning and asset acquisition pipeline lifecycle phase is the only non-linear phase and could occur either prior-to, in between or after any other pipeline lifecycle phase.
Potential ASS (PASS)	Soils or sediments that contain sulfides with the potential to oxidise and become severely acidic.
Regulated waste	Waste subject to specific State/Territory government regulation under environmental law. Depending on the jurisdiction, regulated waste is also referred to as 'controlled waste', 'prescribed waste', 'hazardous waste' or 'trackable waste'.
Rehabilitation	Rehabilitation is the process of restoring a 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, depending 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.
Riparian	Relating to the bank or shore of a natural watercourse, such as a river or stream.
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.
SDS	Safety data sheet, also referred to as material safety data sheet (MSDS), and containing information on the substance's physical, chemical and environmental characteristics.
Stringing	Laying the pipe adjacent to the pipeline trench.
Technical/biological environmental harm	An undesirable outcome to a physical environmental receptor or feature. This includes death, damage, degradation or loss of utility
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 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, rainwater or runoff) in the pipeline trench.
Vibration	Vibration is periodic back-and-forth motion of the particles of an elastic body or medium, commonly resulting when almost any physical system is displaced from its equilibrium condition and allowed to respond to the forces that tend to restore equilibrium.
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.
Weed	A weed is any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Weeds are also known as invasive plants.

Appendix 1 - About APGA

The Australian Pipelines and Gas Association Ltd (APGA) is the peak body representing Australasia's pipeline infrastructure. APGA members have a focus on gas transmission, but also transport other products, such as oil, water and slurry. Our members include constructors, owners, operators, advisers, engineering companies and suppliers of pipeline products and services.

APGA 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 Officer, Corporate Services Manager, National Policy Manager, Communications Manager, Engagement Manager, Membership Officer and Secretariat Coordinator.

The APGA website at www.apga.org.au is a vital tool for members, providing access to specialist industry information. APGA manages and promotes an Annual Convention and

Exhibition as well as a comprehensive program of seminars and networking events. APGA also provides information and promotes the interests of the pipeline industry through public presentations, newspaper feature articles, editorial comment in *The Australian Pipeliner* and other publications and media releases.

An important role for APGA has been its industry research programs and the association has strong working relationships with leading institutions. As part of this research focus, APGA has been a leading proponent in the development of the industry technical standard, AS 2885.

APGA's Vision

Securing Australia's prosperity through a progressive industry investing in pipelines.

APGA's Mission

To foster innovation and collaboration, provide valued services and to represent the collective interests of our members.

APGA's Objectives:

- To encourage the participation, networking and collaboration of our membership.
- To maintain, enhance and promote industry expertise, innovation and safety.
- To be a respected and effective influencer in the Australasian community.
- To lead and support the industry in delivering positive environment, social and governance outcomes.

Appendix 2 - Environmental Risk Assessment Template

*To be used in conjunction with the AS 2885 QUALITATIVE RISK ASSESSMENT Matrix

Item	Activity *(e.g. trenching; access to site)*	Event/cause of harm *(e.g. chemical spill)*	Environment risk area	Environment impact description	Relevant risk? Y/N	Pre-Control (inherent)			Risk management method/s	Post-Control (residual)		
						Consequence	Likelihood/ frequency	Risk level + score		Consequence	Likelihood/ frequency	Risk level + score