

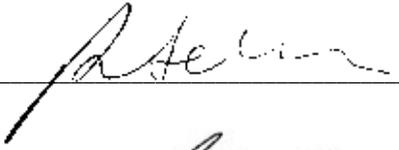
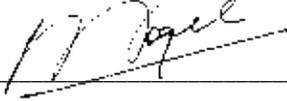
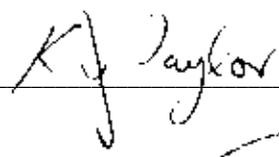
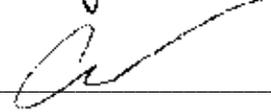
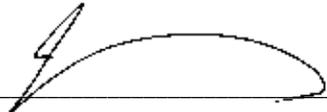
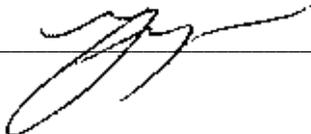


Guide to the Regulatory Framework for
Shale and Tight Gas in Western Australia

A Whole-of-Government Approach

2015 Edition



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Disclaimer

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Foreword

For more than 100 years, the development of Western Australia's natural resources has underpinned the State's economy and the livelihoods of many of its citizens. Careful management of inherent risks is critical to ensure all Western Australians continue to benefit from the opportunities that these industries present.

A whole-of-government approach is a key element in the development of the State's mineral and petroleum resources. This means that public sector agencies work collaboratively across portfolios to achieve an integrated response to the development of these resources.

The Western Australian Government agencies that oversee the development of the State's natural resources are united by a common and overarching responsibility to manage risk, whether to the natural environment, human health, or the amenity of communities. This responsibility applies at every stage of resource development, from the assessment and approval of development proposals, regulation of resource projects and monitoring for compliance, to decommissioning and rehabilitation.

The Western Australian Environmental Protection Authority is an independent body governed by the *Environmental Protection Act 1986*, whose objective is to use its best endeavours to protect the environment and to prevent, control and abate pollution and environmental harm.

The Environmental Protection Authority's assessment process is separate to the other Government agencies approvals for any proposal that is likely to have a significant impact on the environment.

In December 2014, the Environmental Protection Authority released Environmental Protection Bulletin number 22. The purpose of this bulletin is to inform the community of circumstances under which the Authority would assess proposals that include hydraulic fracture stimulation, outline the Authority's expectations for assessment and ensure that the Authority has sufficient information to undertake a thorough assessment of impacts and risks to the environment from proposals involving hydraulic fracture stimulation.

Western Australia's shale and tight gas resources represent a significant economic opportunity for the State and offer benefits to regional communities. The scale of these resources could have a transformative impact on the State's energy strategy and security into the future.

However, there remains significant public concern and debate about shale and tight gas development. The public is more familiar with the risks and benefits of petroleum activities offshore resulting in these oil and gas projects achieving a high level of community acceptance.

Shale and tight gas development is an emerging industry in Western Australia that requires hydraulic fracture stimulation of rock formations deep beneath the Earth's surface. Public concern about hydraulic fracture stimulation has resulted in this activity being banned in some Australian and international jurisdictions, despite extensive experience and continuing technological improvements, particularly in the US.

The Western Australian public expects that the agencies charged with assessing and regulating petroleum resources, including shale and tight gas projects, do so with caution, rigour and transparency.

The Government of Western Australia and its agencies are aware of this expectation as Western Australia seeks to maximise the benefits these developments can provide. To this end, Government works collaboratively and collectively to manage risk inherent to the industry under one regulatory framework outlined in this document.

The Guide to the Regulatory Framework for Shale and Tight Gas in Western Australia:

- provides an account of the State's assessment and regulation processes for shale and tight gas projects and
- provides clarity regarding the State's requirements and the legislation and regulations through which those requirements are enforced.

Government agencies that regulate shale and tight gas activities throughout Western Australia respect the right of all communities and individuals to form their own views about shale and tight gas projects and about the petroleum industry as a whole. This guide provides the regulatory criteria for assessment, approval and compliance to enable the public to reach an informed opinion.

The State Government's message to industry is clear, it must engage in a timely, open and ongoing manner with all stakeholders throughout the life of the project.

Government will continue to keep stakeholders informed of issues that affect them by providing transparent, timely and accessible information, and by engaging in a manner that encourages trust and respect.

1. Shale and tight gas in Western Australia

This section defines shale and tight gas, discusses how these resources are developed and describes key terms used in discussion of this industry.

1.1 What is ‘shale and tight gas’?

Shale and tight gas refers to natural gas trapped in low **permeability** geological rock units called **formations**. More specifically, **shale gas** is natural gas, generally methane, found trapped deep underground within **shale** formations. Shale is a type of sedimentary rock formed of very fine-grained, or small, particles, such as clay, that have been compacted to form a layered rock. **Tight gas** refers to natural gas found in low permeability **reservoir** rocks that are most often **sandstone**, but also include low permeability **carbonate** rocks.

Shale gas, tight gas and **coal seam gas** are also known as ‘**unconventional** gas’ because the gas may not flow freely into a petroleum well. The pore spaces in these rocks are tiny and not connected so that it is difficult for the gas to move through the rock. These types of rock are described as having low permeability, which is the low ability for gas to flow (Figure 1).

Gas that flows freely is called **conventional** gas. It occurs in sandstones and carbonate rocks that have higher permeability, such as those found in the offshore **sedimentary basins** of Western Australia’s North West Shelf and many conventional gasfields in the northern Perth Basin.

Shale formations and tight rocks can also contain oil; these resources are known as **shale oil** and tight oil, respectively. These types of petroleum also fall within the scope of the *Guide to the Regulatory Framework for Shale and Tight Gas in Western Australia*.

1.2 How does shale and tight gas differ to coal seam gas?

Coal seam gas (CSG), which is sometimes known as coal bed methane, is natural gas that is formed by, and found in association with, coal deposits. CSG typically lies at depths of 300 to 1000 metres, and therefore is closer to groundwater resources. While the CSG industry is established in Queensland, it has not been demonstrated to be prospective in Western Australia and is unlikely to be so because of different geology.

In Western Australia, shale and tight gas resources generally lie at depths between 2000 and 4000 metres. These depths generally lie significantly below groundwater resources and under multiple thick layers of low permeability rock that act as barriers between the formation and any water resources, and the land surface.

With CSG, gas is extracted by drilling wells into the coal seam. The goal is to decrease the water pressure by pumping groundwater from the well, a process known as **dewatering**. The decrease in pressure allows gas to be released from the coal and flow up the well to the surface. CSG extraction relies upon dewatering and only sometimes requires water for **hydraulic fracture stimulation** to **fracture** the coal seam.

The production of shale and tight gas does not require the removal of groundwater to release gas.

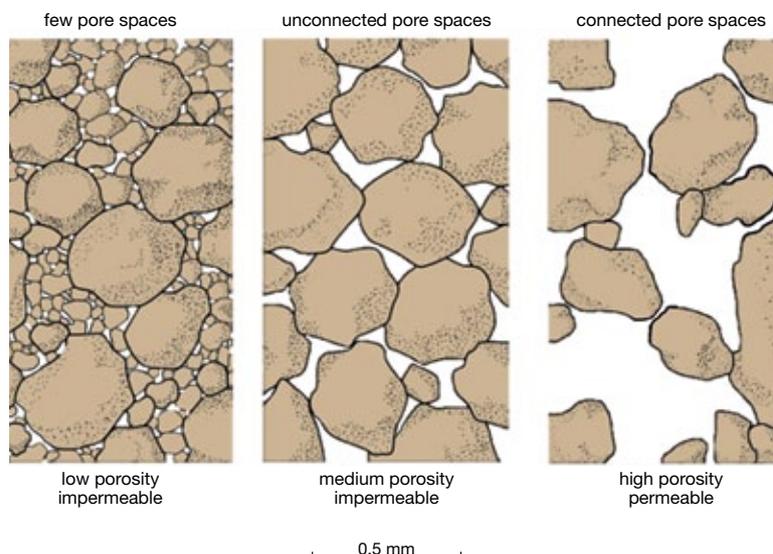


Figure 1: Schematic diagram of microscopic view of sandstones ranging from low porosity–impermeable rock to high porosity–permeable rock

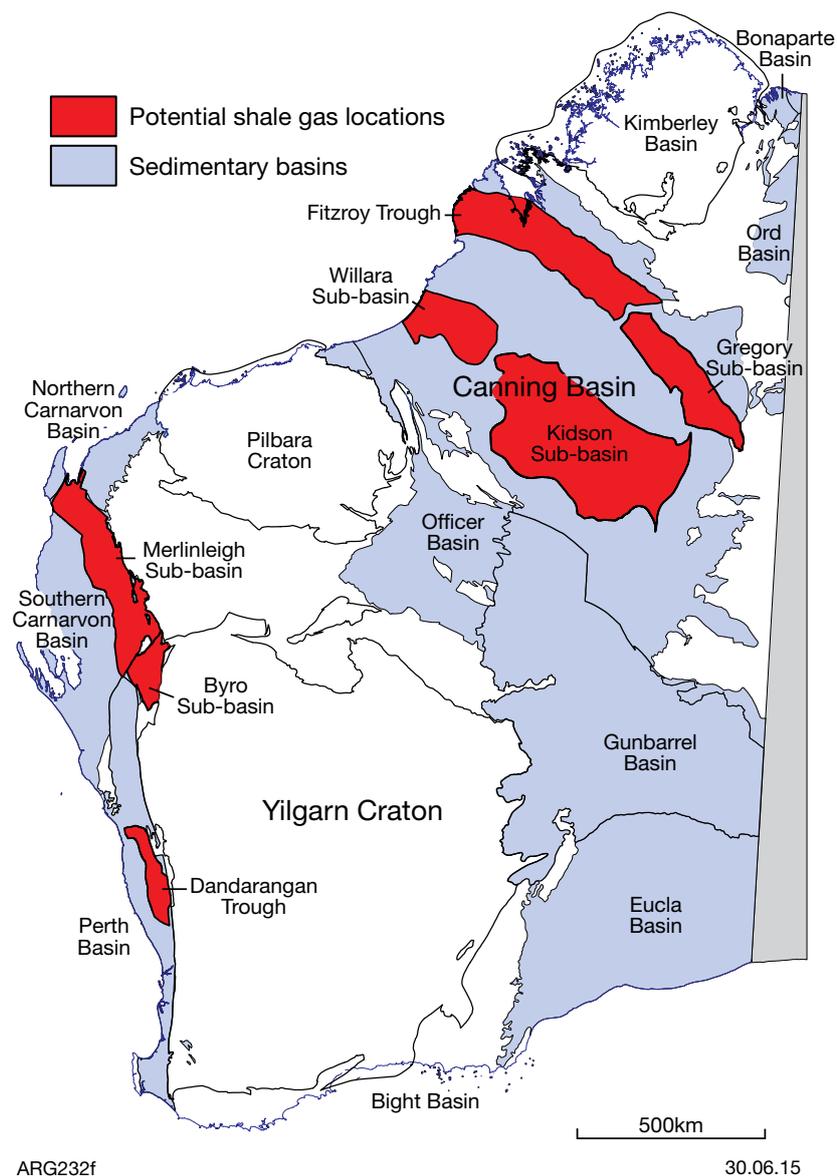


Figure 2: Sedimentary basins and troughs of Western Australia showing potential shale gas resource locations

1.3 Location and amount of shale and tight gas in Western Australia

Sedimentary basins in Western Australia have been identified as potentially prospective for shale and tight gas by DMP and the US Energy Information Agency – the primary two being the Canning Basin and the Perth Basin. Within these basins are deep sub-basins and troughs, which are comprised of rock layers or geological formations of varying ages, from 70 million years old to more than 500 million years old. Some of these formations contain shale or tight gas resources, along with other conventional oil and gas resources. Figure 2 shows the locations of the sedimentary basins, sub-basins and troughs that have potential to host shale or tight gas resources in Western Australia, as well as the location of known shale gas deposits.

DMP has estimated that Western Australia holds shale gas resources of approximately 37 000 billion cubic metres (**Gm³**), or 1300 trillion cubic feet (**Tcf**). Of this resource, DMP currently estimates that around 2600–5350 Gm³ (100–190 Tcf) could be produced, depending on how much of the resource can be recovered given current knowledge of the geology of the area and future technological advances. To put this figure into perspective, 28 Gm³ (which is equivalent to 1 Tcf) is enough energy to supply a city of one million people with electricity for 20 years. Western Australia currently produces around 28 Gm³ of gas per year, mostly from the offshore.

A number of tight gasfields have been discovered in the Canning and Perth Basins. Tight gas resources have not yet been estimated for the State as a whole because tight gas locations cannot be as clearly defined as shale gas prospective formations. Tight gas depends on local permeability values identified only after wells have been drilled.

1.3.1 Perth Basin

The Perth Basin extends from the south western corner of the State to Northampton, west of the Darling Range. It is relatively small in comparison to other basins in the State, with an area of 100 000 km². The basin contains the Dandaragan Trough (Figure 2) — a structural unit, which is up to 12 km deep and contains numerous formations that may produce shale or tight gas. DMP estimates 6300 Gm³ (220 Tcf) of shale gas, of which about 480–960 Gm³ (17–34 Tcf) may be recoverable, and 340 Gm³ (12 Tcf) of tight gas resources, exist in the Perth Basin.

1.3.2 Canning Basin

The onshore Canning Basin extends from the coast between Port Hedland and Derby to the State's eastern border with the Northern Territory and South Australia. The basin covers about 530 000 km² and contains approximately 70 000 km² of prospective shale gas formations.

The Canning Basin contains three deep troughs — the Fitzroy, Kidson and Willara Sub-basins (Figure 2). The Canning Basin contains many recognised source rocks within its sub-basins, which have the potential for shale gas or oil.

DMP estimates that the Canning Basin contains 27 700 Gm³ (1000 Tcf) of shale gas, of which about 2000–4200 Gm³ (73–147 Tcf) may be recoverable. Tight gas resources also exist in the basin, notably in the Laurel Formation, but their sizes remain untested.

1.3.3 Other sedimentary basins with potential

The Southern Carnarvon Basin features the deep Merlinleigh Sub-basin and the Byro Sub-basin (Figure 2). These are as yet untested for shale gas resources. However, DMP has assessed the shale gas potential for three formations in the Merlinleigh Sub-basin to contain 2700 Gm³ (95 Tcf) of shale gas, of which about 110–250 Gm³ (4–9 Tcf) may be recoverable.

The Bonaparte Basin is the most northerly sedimentary basin in the State, straddling the border between the Northern Territory and Western Australia. Only 20 000 km² of the basin is located onshore, the remaining 250 000 km² is located offshore. The onshore Southern Bonaparte Basin remains untested for shale and tight gas.

The Officer Basin in central Western Australia that extends to the South Australian border under the Gunbarrel Basin also remains untested for shale and tight gas, and again, prospectivity may exist. No estimates have been made of the potential resources in this basin.

1.3.4 Viability of development

Developments in the Perth Basin will be able to take some advantage of existing infrastructure and therefore may require a lower initial capital investment. This feature is likely to improve the economic viability of relatively small gas discoveries and reduce the timeframe required for these discoveries to reach **production** and contribute to the domestic gas supply.

In contrast to the Perth Basin, the remoteness and lack of existing infrastructure in the Canning Basin poses increased challenges to **petroleum title holders (registered holders)** seeking to explore for and develop resources in this area. Initial capital expenditure for infrastructure such as roads and pipelines will be significant, so development of small gas discoveries may not be economically viable in the short term. This remoteness would suggest that initial developments in the Canning Basin might need to be on a larger scale than those in the Perth Basin to be economically viable, and therefore the development timeframe is likely to be further away.

1.4 Developing shale and tight gas

Oil and gas occurs conventionally in accumulations in a rock formation such as sandstone, as discrete reservoirs of petroleum that are usually found trapped beneath layers of impermeable rock. Shale gas, however, is a resource that is found trapped within a formation that is spread continuously over a very large area. Therefore, shale gas often requires more wells to produce the same amount of gas compared to a conventional gasfield. In general, shale gas developments proceed in the same manner as conventional petroleum **exploration** and production, but there are a few aspects that differ, including the use of hydraulic fracture stimulation.

Technology is continuing to improve as new knowledge and techniques come together. This is the case with shale and tight gas development where, in a period of approximately ten years, improvements in **directional drilling** and hydraulic fracture stimulation technologies have combined, resulting in a massive expansion of shale gas developments in the US. These same technologies are starting to be used in Western Australia in the exploration for shale and tight gas resources.

1.4.1 What would a shale or tight gas project look like?

Currently, there is no shale or tight gas development in Western Australia so we must look to the US for an idea of what a project will look like.

A petroleum well is usually drilled in the centre of a clearing, known as the well pad. A shale or tight gas well pad typically requires 1.5 to 2 hectares of land to be cleared for the well and site access¹. A **drilling rig** is erected on the well pad to carry out the drilling of the wells. The number of wells required to develop a shale or tight gasfield will depend on the quality and size of the gasfield being targeted. Most wells will be concentrated in areas where there is greater potential for petroleum recovery and will not cover the entire area containing the shale.

If a petroleum company was to drill six shale gas wells from one well pad and used **horizontal drilling**, it is estimated one well pad would be required for every 225 hectares (2.25 km²) of land. Therefore well pads may be spaced 1.5 km apart above the gasfield.

Other equipment such as data monitoring vans, vehicles, sand and chemical storage units, pumping trucks and ponds will also be found on site for one to two weeks during hydraulic fracture stimulation operations (Figures 3 and 4). After the drilling and hydraulic fracture stimulation activities are completed, most of the equipment is removed from the site.

At well completion, all that remains visible on the well pad from this time is a series of sealed valves approximately two metres high. These structures are known in the industry as a '**Christmas tree**' (Figure 5). Equipment may return to the site to complete further hydraulic fracture stimulation or other **workover** activities for short periods of time. If the site has reached the production stage, it will also require a gas pipeline which will feed into a gas processing facility. Pipelines are buried or contained within a secure fenced area.

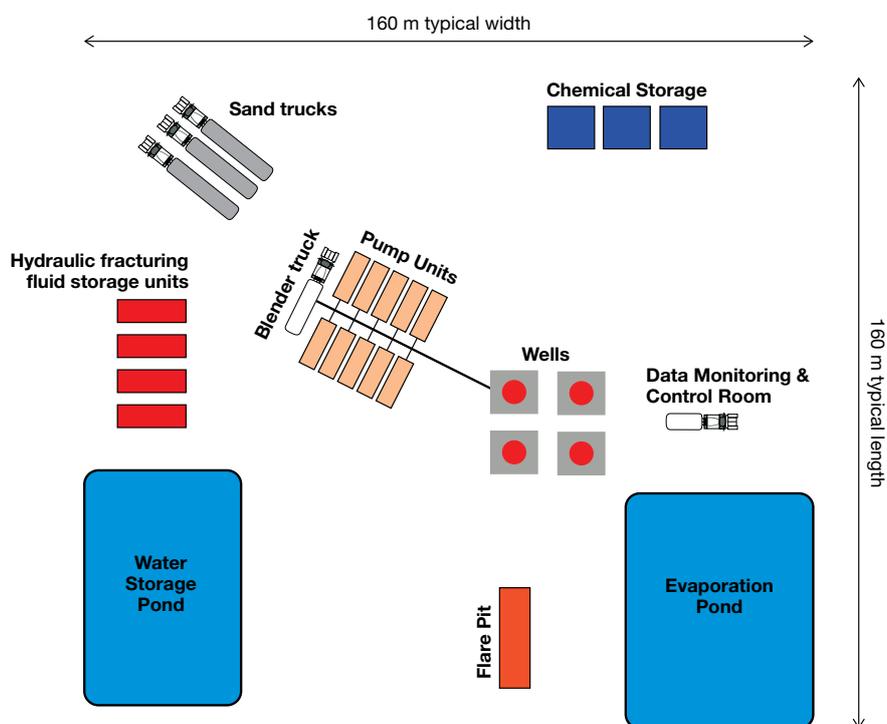


Figure 3: Schematic of the typical layout of a well site during hydraulic fracture stimulation

¹ Cook, P, Beck, V, Brereton, D, Clark, R, Fisher, B, Kentish, S, Toomey, J and Williams, J, 2013, *Engineering energy: unconventional gas production. Report for the Australian Council of Learned Academies.*



Figure 4: Hydraulic fracture stimulation equipment at the Arrowsmith 2 well site in the northern Perth Basin (courtesy of Norwest Energy Ltd)



Figure 5: The principal component of a petroleum production well that is visible on the surface is the Christmas tree, an assembly of valves and pipework fitted to the wellhead to control the flow of oil or gas production from the well to a pipeline or a production facility

Conventional reservoirs have connected pore spaces that will allow gas to flow from a large area into the **wellbore**, but shale and tight gas reservoirs only allow gas to be recovered from the fractured zone. To maintain constant production, the gasfield will require ongoing drilling and completion of new wells, due to the initial rapid decline of gas flow from individual wells.

Once a shale or tight gas well is producing, it can flow gas for several decades. For the duration of the project, **operators** are required to maintain the well and report on production and other activities to government agencies.

At the end of a well's production life, all surface equipment and infrastructure is removed, the well is plugged, sealed and decommissioned and the site is rehabilitated to its initial condition.

1.4.2 Drilling techniques

Historically, petroleum wells were drilled vertically, extending straight down into the targeted rock formation. Technological advances allowed the drilling of horizontal wells at depth to access conventional reservoirs. Horizontal wells are commonly used in conventional offshore petroleum fields, where the wells are drilled from a platform in different directions. A horizontally drilled well can reach more than five kilometres from the platform in the US. This technology is now used in drilling for shale and tight gas, but is extremely rare in onshore wells in Western Australia.

To drill horizontally, a well is initially drilled straight down (vertically) to a point above the target rock formation and then turned to drill in a shallow arc until the wellbore extends horizontally. The well continues horizontally until it reaches the desired length in the targeted reservoir formation (Figure 6). A horizontal wellbore contacts a greater surface area of the reservoir, allowing more petroleum to be produced.

Several horizontal wells can be drilled in multiple directions from a single well pad. Typically four wells are accommodated on a single pad, although some pads have supported up to eight. This configuration results in a smaller surface footprint, as fewer well pads and access roads are needed to produce the same amount of gas as many single well pads (Figure 7).

1.4.3 Hydraulic fracture stimulation

Worldwide, hydraulic fracture stimulation is a reservoir stimulation technique that has been applied in the oil and gas industry for nearly 70 years. It was originally developed to assist in extracting a greater amount of oil and gas from conventional reservoirs. This has included pumping low-volume, low-pressure or high-volume, high-pressure fluid down wellbores.

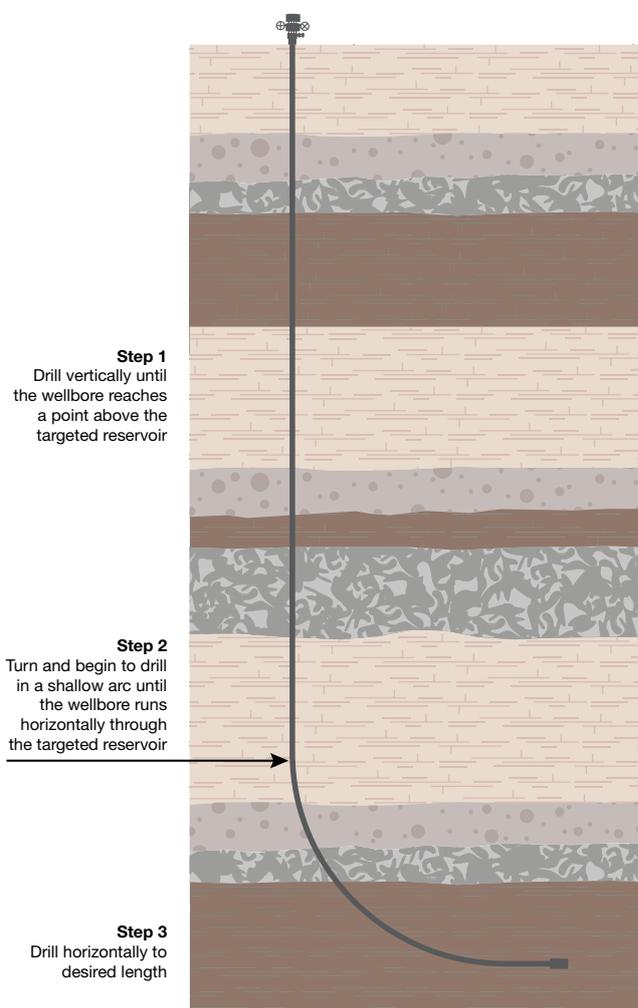


Figure 6: Schematic diagram showing how a horizontal well is drilled

In Western Australia, more than 600 wells have undergone fracture stimulation in conventional reservoirs since 1958. These involved small scale, low-pressure fracturing to improve oil recovery. Modern-day, high-volume high-pressure fracturing is used to recover oil and gas from unconventional reservoirs with low permeability. This technique may be used in tight gas formations, depending on their permeability, and is required in all shale formations in order to extract gas. It is currently rare in Western Australia, with only eight modern fracture stimulations having occurred in the State between 2004 and 2015. These stimulation activities have all been performed in vertical wells.

Hydraulic fracture stimulation involves pumping fluids and ‘**proppants**’ (solid material such as sand or ceramic beads) into a low-permeability rock under high pressure to create fine fractures. Typically the fluid is about 90 per cent water with 9.5 per cent proppant, which is designed to keep the fractures open, the remaining 0.5 per cent is made up of chemical additives. Chemical additives are used to suspend

the proppant in the fluid, stop algae growth, prevent corrosion and make it easier for the fluid to move through the fractures. When the pumps are turned off, the proppant contained in the fluid remains in place, holding the fractures open and allowing the excess hydraulic fluids and then gas to flow out of the shale and up the wellbore (Figure 8). The fluid can be recovered at rates of 40 to 70 per cent and reused in further hydraulic fracture stimulation programs.

Gas will be produced from the shale in the immediate vicinity of the induced fractures. Initially the gas production rates are high as the gas that is made available by the hydraulic fracture stimulation flows to surface and is produced. This initial high production rate will decrease as the amount of gas left adjacent to the fracture diminishes. The effectiveness of hydraulic fracture stimulation is enhanced in combination with horizontal drilling. It is for this reason that drilling of new wells is necessary and is why horizontal drilling has been so successful in shale gas development overseas.

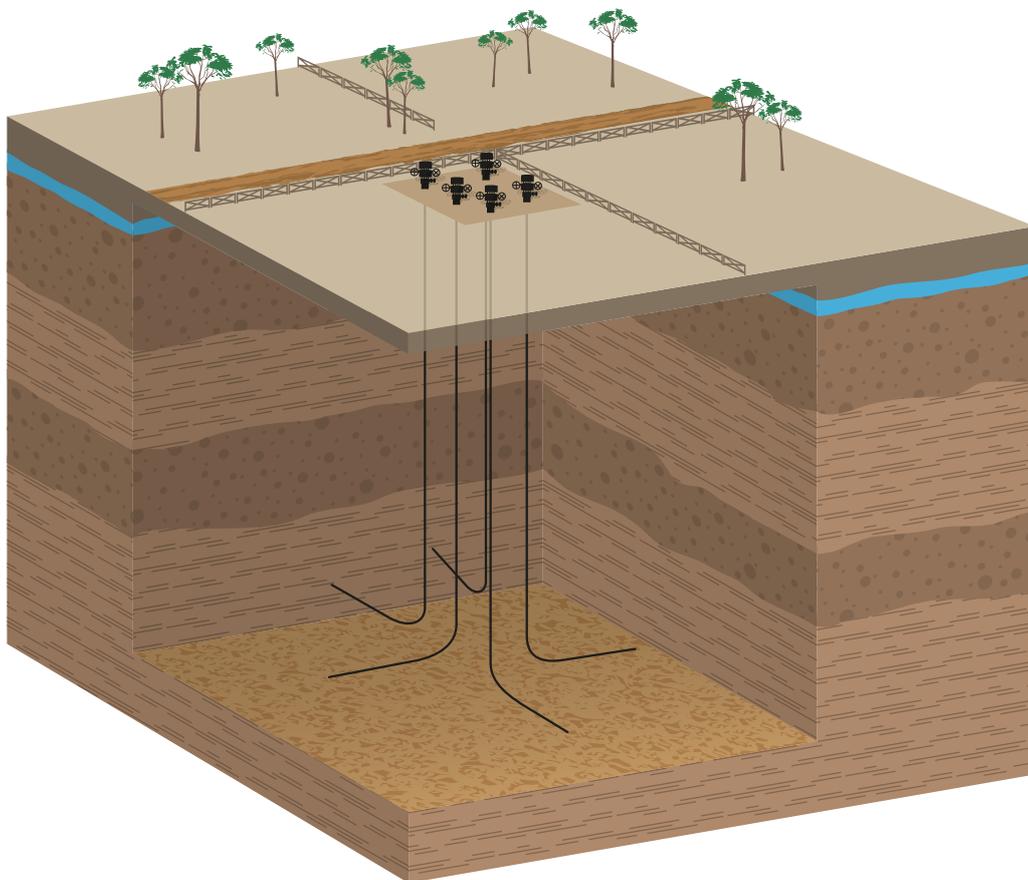


Figure 7: Diagram illustrating how multiple horizontal wells can be drilled in many directions below ground from a single multi-well pad

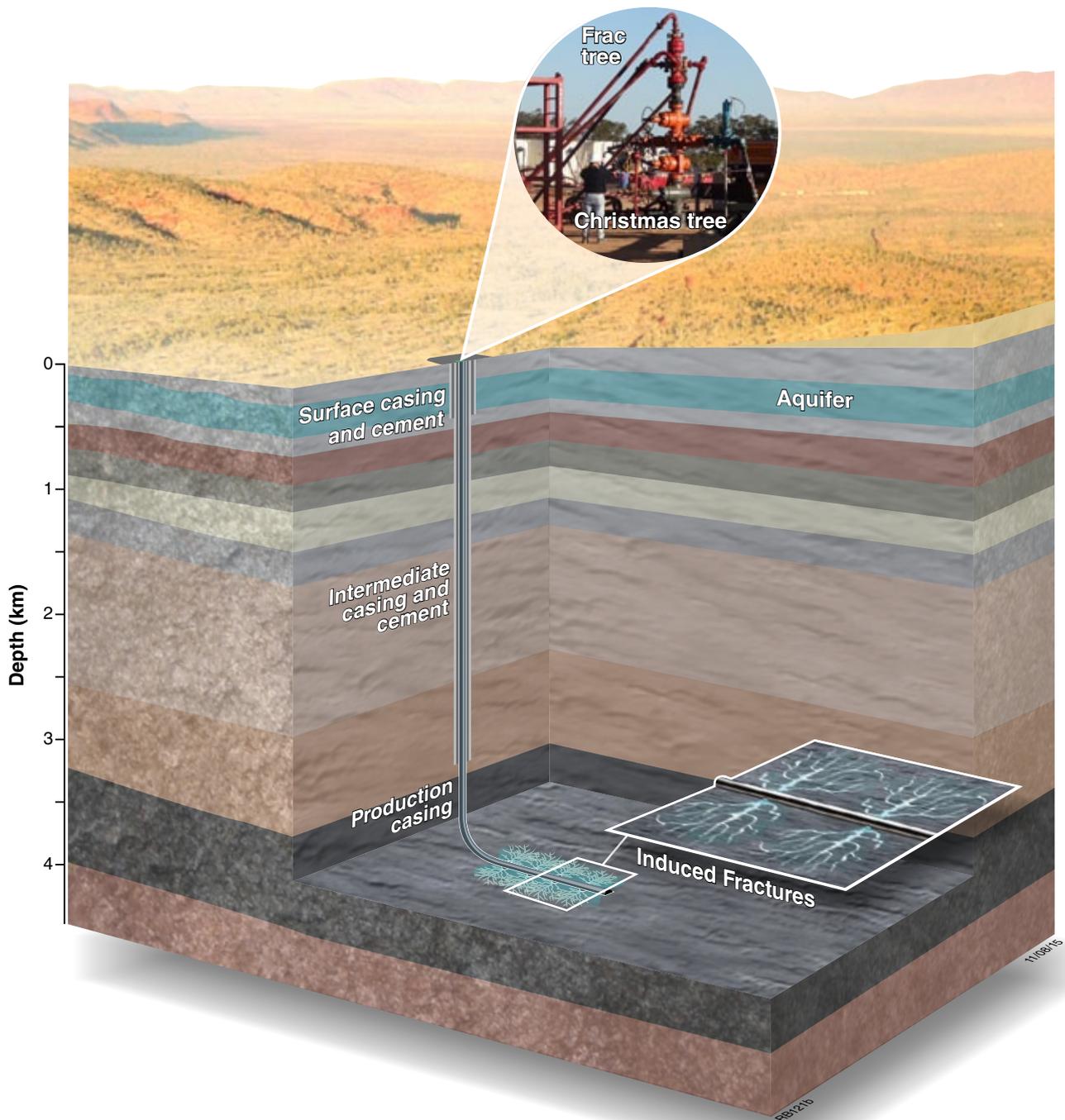


Figure 8: Schematic diagram showing a well, initially drilled vertically through several different rock formations then turned and drilled horizontally through a shale formation, in a typical Western Australian setting. At the surface, hydraulic fracture stimulation equipment (including the frac tree) is attached to the Christmas tree on top of the well (refer to Figure 5). The image is cut away to show what the subsurface and well path would look like. The horizontal section has undergone hydraulic fracture stimulation. Lower inset shows induced fractures in the shale formation

2. Statutory Framework

The Western Australian Government has been regulating the oil and gas industry for nearly a hundred years. The regulation by government covering the development of a petroleum resource — irrespective of whether it is for conventional petroleum, shale gas or tight gas — is exactly the same. All future projects will be assessed on a site-by-site, project-by-project basis with regards to safety and the environment.

This framework rests on five key principles:

1. Transparent, effective and risk-based regulation
2. Whole-of-government approach
3. Consistent State and Commonwealth Government objectives
4. Effective engagement with stakeholders, particularly local communities
5. Compliance and enforcement.

This section provides details of the statutory framework that Western Australian Government agencies use to assess and regulate shale and tight gas projects.

2.1 Relevant Acts and Government agencies

DMP is the lead agency responsible for the regulation of petroleum activities in Western Australia. The key statutes, administered by DMP relating to shale and tight gas, are the *Petroleum and Geothermal Energy Resources Act 1967*, the *Petroleum (Submerged Lands) Act 1982* and the *Petroleum Pipelines Act 1969* and associated regulations.

Administration of these Acts covers petroleum titles and applications, releasing areas for competitive bidding, exploration, administering resource management, environmental and health and safety provisions, as well as other compliance responsibilities. DMP maintains a publically available Register of Titles on DMP's website.

DMP evaluates all technical matters relating to drilling for petroleum, formation evaluation, resource management and production in accordance with industry best practice. A valid title must be granted under the relevant petroleum Acts before an application can be submitted to DMP for any petroleum activity over land or State waters. Before the activity commences, DMP must have approved the operational, safety and environment management plans for the project.

Only registered title holders can explore for and produce petroleum in Western Australia. The registered holder may appoint an operator to undertake activities.

A 'petroleum title' is any of the following: Exploration Permit, Drilling Reservation, Special Prospecting Authority, Retention Lease or Production Licence. Exploration and appraisal can occur under any of these titles, while production can only occur under a Production Licence. The petroleum title system is based on discrete areas or **blocks**. Each block is roughly equivalent to 80 km². The average petroleum permit covers 1700 km² or 21 blocks.

DMP's lead agency role is complemented by key regulatory processes undertaken by the Department of Water, as well as the Environmental Protection Authority (EPA) and Office of the Environmental Protection Authority (OEPA).

Other State Government agencies, including the Departments of Environment Regulation (DER), Parks and Wildlife (DPAW), Aboriginal Affairs (DAA), Health (DoH), Planning (DoP), and the Radiological Council support these major regulatory agencies.

Table 1 provides an overview of Western Australian and Commonwealth legislation relevant to the shale and tight gas industry, as well as the agencies responsible for administering the legislation.

These agencies regulate and approve a variety of elements with respect to shale and tight gas developments (along with all other oil and gas developments in State jurisdiction) under legislative powers relevant to each agency. These agencies' roles include conducting detailed environmental impact assessments where activities may result in significant environmental impacts, providing licences to extract water, the protection of drinking water, and protecting Aboriginal heritage.

Commonwealth legislation also regulates the development of shale and tight gas projects. The *Environment Protection and Biodiversity Conservation Act 1999* applies where a proposed exploration or development action is likely to have a significant impact on a matter of national environmental significance.

Table 1. Overview of Western Australian legislation relevant to the shale and tight gas industry.

Agency	Role	Legislation
WESTERN AUSTRALIA		
<p>Department of Mines and Petroleum (DMP)</p>	<p>DMP is the State’s lead agency in regulating minerals and energy resources in Western Australia and ensuring that safety, health, and environmental standards are of the highest standard and are consistent with relevant State and Commonwealth legislation, regulation and policies.</p> <p>The department has a role in the provision of geoscientific information on minerals and energy resources, administering the collection of royalties and management of an equitable and secure titles system for the mining, petroleum and geothermal industries.</p> <p>The department is committed to educating the community about resource development and regulation in WA and ensuring the responsible development of the resources industry to maximise the economic and social return to all Western Australians.</p> <ul style="list-style-type: none"> • Safety Regulation: regulation of all safety obligations associated with the petroleum operation including the health and safety of workers. Regulated through the operator’s submission of a Safety Management System and Safety Case. • Environment Regulation: regulation of all potential environmental impacts as a result of the petroleum activity i.e. impacts on land, air, water, the subsurface, flora and fauna. Regulated through the operator’s submission of an Environment Plan for each activity at each stage, bringing together and identifying all environmental impacts, risk mitigation measures and implementation strategies. • Native Vegetation Clearing: certain powers under Part V Division 2 of the <i>Environmental Protection Act 1986</i> for regulation of the clearing of native vegetation for petroleum activities as provided for by delegation. • Resource Management and Administration: regulation of the technical aspects/operation of petroleum activities, ensuring they comply with international standards and best practice. Regulated through applications for exploration surveys and wells and various management plans governing these activities. 	<p><i>Petroleum and Geothermal Energy Resources Act 1967</i></p> <p><i>Petroleum Pipelines Act 1969</i></p> <p><i>Environmental Protection Act 1986</i> (Delegated Authority for native vegetation clearing)</p> <p><i>Petroleum (Submerged Lands) Act 1982</i></p> <p><i>Dangerous Goods Safety Act 2004</i></p> <p><i>Occupational Safety and Health Act 1984</i></p>
<p>Department of Environment Regulation (DER)</p>	<p>DER has the primary responsibility for the regulation of pollution, unreasonable emissions, environmental harm and clearing of native vegetation; assessment and classification of contaminated sites based on risks to the community and the environment; and management of waste to promote the efficient use of resources and prevent environmental harm.</p> <p>DER’s roles include:</p> <ul style="list-style-type: none"> • regulating activities with potential impacts on the environment through works approvals and licences for premises prescribed under Schedule 1 of the Environmental Protection Regulations 1987 to prevent unacceptable risks to the environment and public health. • developing and implementing policies and strategies that promote environmental outcomes. • reducing the environmental impact of waste. 	<p><i>Environmental Protection Act 1986</i></p> <p><i>Contaminated Sites Act 2003</i></p> <p><i>Waste Avoidance and Resource Recovery Act 2007</i></p>

Table 1. Overview of Western Australian legislation relevant to the shale and tight gas industry cont...

Agency	Role	Legislation
<p>Department of Parks and Wildlife (DPaW)</p>	<p>DPaW has primary responsibility for managing the State's national parks, marine parks, State forests and other reserves that cover a total area of more than 27 million hectares, for conserving and protecting native animals and plants, and for managing many aspects of the access to and use of the State's wildlife and natural areas.</p> <p>DPaW also provides support to the Marine Parks Reserves Authority and the Conservation Commission (which under proposed amendments to the <i>Conservation and Land Management Act 1984</i>, will be amalgamated to form the Conservation and Parks Commission).</p>	<p><i>Conservation and Land Management Act 1984</i></p> <p><i>Wildlife Conservation Act 1950</i></p>
<p>Department of Water (DoW)</p>	<p>DoW has broad responsibilities on conserving, protecting, managing and assessing water resources, and planning for the use of water resources under the <i>Water Agencies (Powers) Act 1984</i>. Specifically:</p> <ul style="list-style-type: none"> • The <i>Rights in Water Irrigation Act 1914</i> provides for a licensing system to take water and construct water wells in proclaimed areas from artesian sources; and a permit system for activities that may damage, obstruct or interfere with water flow or the beds and banks or watercourses and wetlands in proclaimed rivers, surface water management areas and irrigation districts. • The <i>Country Areas Water Supply Act 1947</i> and <i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i> and associated by-laws protect public drinking water sources. • The <i>Country Areas Water Supply Act 1947</i> and the <i>Country Areas Water Supply (Clearing Licence) Regulations 1981</i> provide for a licensing system for the clearing of vegetation in the Denmark River, Harris River Dam, Mundaring Weir, Wellington Dam and Warren River catchment areas and the Kent River Water Reserve. This licensing system applies when there is an exemption under the <i>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</i>. • The <i>Waterways Conservation Act 1976</i> provides for a licensing system for dredging, reclamation, dewatering, drainage, excavation and construction activities in the Albany waterways, Avon River, Wilson Inlet, Peel-Harvey estuaries and Leschenault Inlet management areas. <p>DoW also provides expertise and advice, and prepares policies, plans and guidelines about protecting and managing water resources.</p>	<p><i>Rights in Water and Irrigation Act 1914</i></p> <p><i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i></p> <p><i>Country Areas Water Supply Act 1947</i></p> <p><i>Water Agencies (Powers) Act 1984</i></p> <p><i>Waterways Conservation Act 1976</i></p>
<p>Environmental Protection Authority (EPA)</p>	<p>EPA is an independent authority established by the <i>Environmental Protection Act 1986</i>, under which the EPA is to: 'use its best endeavours – a) to protect the environment; and b) to prevent, control and abate pollution and environmental harm.'</p> <p>EPA's functions include:</p> <ul style="list-style-type: none"> • conducting environmental impact assessments • preparing statutory policies for environmental protection • preparing and publishing guidelines for managing environmental impacts • providing strategic advice to the Minister for Environment. 	<p><i>Environmental Protection Act 1986</i></p>
<p>Office of the Environmental Protection Authority (OEPA)</p>	<p>OEPA monitors compliance with conditions set by the Minister for Environment under Part IV of the <i>Environmental Protection Act 1986</i>.</p>	<p><i>Environmental Protection Act 1986</i></p>

Table 1. Overview of Western Australian legislation relevant to the shale and tight gas industry cont...

Agency	Role	Legislation
Department of Health (DoH)	DoH provides a number of functions to support the delivery of health services across the State including the area of public health. This activity encompasses the regulation of the quality of drinking water in Western Australia, in addition to providing advice about potential environmental hazards impacting health.	<i>Health Act 1911</i>
Radiological Council	The Radiological Council is an independent statutory authority appointed under the <i>Radiation Safety Act 1975</i> in Western Australia to assist the Minister for Health to protect public health and to maintain safe practices in the use of radiation. The Act regulates the keeping and use of radioactive substances, irradiating apparatus and certain electronic products. Registration and licensing are the principal means by which the use of radiation is regulated. The officers of the Radiological Council also provide radiation health advice.	<i>Radiation Safety Act 1975</i>
Department of Aboriginal Affairs (DAA)	DAA is responsible for developing strategic policy to guide and inform service delivery to Aboriginal people; coordinate service delivery to Aboriginal Western Australians through chairing and supporting the Aboriginal Affairs Coordinating Committee; preserve and protect Aboriginal heritage by supporting the work of the Aboriginal Cultural and Material Committee; and support the Aboriginal Lands Trust in the management of lands held by the Trust in accordance with wishes of people of Aboriginal descent.	<i>Aboriginal Heritage Act 1972</i> <i>Aboriginal Affairs Planning Authority Act 1972</i>
Department of Planning	Department of Planning is Western Australia's lead land use planning agency, and provides professional and technical expertise, and assists the Western Australian Planning Commission (WAPC) and the Minister for Planning in the development and implementation of land use plans and policies across the State. The <i>Planning and Development Act 2005</i> provides statutory powers to the WAPC and Minister, as well as establishes the statutory force of local planning schemes administered by Local Governments.	<i>Planning and Development Act 2005</i>
COMMONWEALTH		
Department of the Environment	Conducts an environmental impact assessment of actions likely to have an impact on matters of national environmental significance as defined in the Act.	<i>Environment Protection and Biodiversity Conservation Act 1999</i>

2.2 DMP's role in the Statutory Framework

There are four broad and often overlapping stages in shale or tight gas developments:

1. Exploration
2. **Proof of concept** (appraisal)
3. Production
4. Decommissioning and rehabilitation

A timeline for shale or tight gas development is shown in Figure 9.

2.2.1 Exploration

In order to explore for any petroleum resource, a company must apply for, and be granted, a petroleum exploration title over the relevant area of land, generally through a competitive bidding process. Typically, every six months, DMP conducts an acreage release, inviting companies to submit competing applications on areas available for exploration. Areas identified in each acreage release are accompanied by a release package containing information available on the geology of the area, environmental maps (including the location of environmentally sensitive areas), water reserves and native title boundaries. Applicants are made aware of challenging issues that will require special attention, such as environmentally sensitive areas that are likely to require additional assessments by State and Commonwealth agencies, and the need to engage early and regularly with local communities.

Companies submit an application during the acreage release phase. This application must include a work program, which is a schedule of proposed activities to be carried out during the six-year term of the permit, the timing of those activities and estimated expenditures. Applications are assessed by DMP against criteria that determine the applicant's capacity to undertake the work, the suitability

of the work program, environmental management and native title management. DMP takes into consideration each applicant's past performance and their technical and financial capabilities to undertake their proposed work program. Through this process the most deserving application is identified.

The successful applicant must commit to fulfilling the first two years of the work program, as submitted in their application. The secondary phase of the program may be negotiated on a year-by-year basis, depending upon the exploration results. Petroleum Exploration Permits are allocated for a period of six years. At least one exploration well would normally be proposed to be drilled within the first four years. Permits can be renewed, provided the initial permit conditions have been met.

A Petroleum Exploration Permit can be granted after successful finalisation of native title access arrangements. This process may take two years or more.

A Drilling Reservation is a smaller sized title that allows drilling and other exploration-type activities to be conducted. Drilling Reservations are granted for a period of up to three years in the same way as an Exploration Permit.

In general, most onshore petroleum exploration is carried out as an outcome of the acreage release process as outlined above. However, in some limited circumstances, it can be carried out under the petroleum legislation by way of a Special Prospecting Authority with an Acreage Option — this title allows a company to conduct surveys on the physical or chemical properties of the rocks in the area for a period of six months. Wells are not allowed to be drilled under Special Prospecting Authorities. The Special Prospecting Authority aims to encourage exploration in areas where little or no exploration has been undertaken previously. Once this preliminary exploration period is complete, the company may apply for a Drilling Reservation or a Petroleum Exploration Permit.

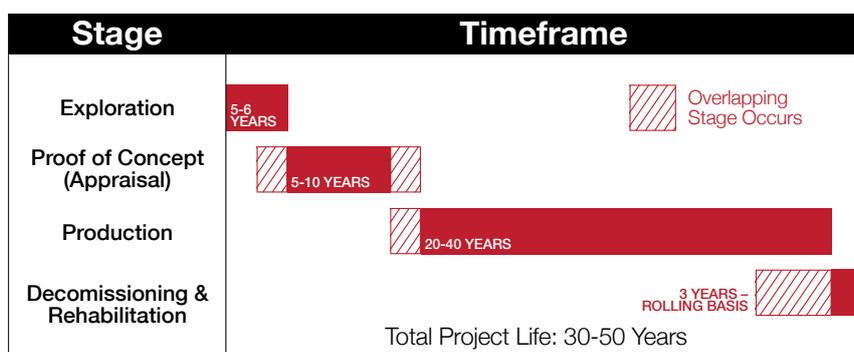


Figure 9 : Timeline for development stages for shale or tight gas

2.2.1.1 Land access

Once DMP grants a petroleum title, the registered holder(s) must meet certain conditions in order to gain access to land.

Registered holders must obtain consent from the landowner to access private land and provide compensation for the right to occupy the land. As compensation for land access is a confidential matter between landowners and registered holders, DMP does not require the details of compensation. Conducting operations on private land without having reached agreement with the landowner/occupier would be a serious breach and one which could put the registered holder at personal risk of imprisonment as well as jeopardise the title. The registered holder must pay compensation to the landholder or neighbouring land users for loss or damage incurred.

2.2.1.2 Initial exploration approvals and commitments

After negotiating access to the land, the registered holder is required to apply for approval from DMP to conduct a survey or drill a well.

To identify potential risks, registered holders are required to submit a Well Management Plan, a Safety Management System/Safety Case and an Environment Plan (including baseline monitoring) to DMP for assessment and approval before well activities can start. While DMP is responsible for approving Environment Plans in accordance with the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012, Petroleum (Submerged Lands) Regulations 2012 and Petroleum Pipeline (Environment) Regulations 2012, other environmental agencies may become involved where environmental impacts and risks are deemed to be significant.

The identification of potential environmental risks and their proposed environmental management is a crucial factor. In line with regulatory requirements by DMP, and in addition to identifying risks and providing details of mitigation strategies, the applicant must be able to demonstrate that the well construction is to international standards.

A water well construction licence and a licence to take water must be obtained from DoW if groundwater or surface water is required for use in drilling or hydraulic fracture stimulation.

Once petroleum activities commence, regular reports such as daily drilling reports, well completion reports and annual reports, must be submitted to DMP. Under an approved Environment Plan, the operator must submit an annual report outlining its progress against its environmental commitments and also notify DMP of any incidents that may have potential to cause adverse environmental impact. DMP will undertake site audits and inspections during the activity to determine the level of compliance in relation to the approved Well Management Plan, Safety Management System/Safety Case and Environment Plan. It also undertakes audits and inspections if warranted in relation to complaints. Enforcement action is taken where non-compliance is identified.

The exploration stage to delineate a field could take up to five years (Figure 9).

2.2.2 Proof of concept

The proof of concept stage involves drilling multiple wells to determine the physical extent, reserves and likely production rate of a field, and provides the information to design a fracture stimulation program if required. As in the exploration stage, before drilling can commence, a DMP approved Well Management Plan, Safety Management System/Safety Case and Environment Plan must be in place. Similar to the exploration stage, DMP will continue to monitor progress through submitted reports, and undertake inspections to determine compliance with the approval. Enforcement action is undertaken when non-compliance is identified.

If potentially recoverable quantities of petroleum products are discovered, the registered holder must apply to DMP for a Declaration of Location. Hydrocarbons have to be brought to surface and recovered before a location can be declared. The registered holder must identify the blocks which cover the area of the discovery. If the registered holder requires further appraisal within the location to more accurately determine the extent of the discovery, each activity must be proposed, assessed and approved. The proof of concept stage may take five years or more (Figure 9).

If the discovery is not currently deemed commercially viable, the registered holder may apply for a Retention Lease so that in future, if the discovery becomes commercial, the registered holder may convert the Lease to a Production Licence.

2.2.3 Production

If the discovery is commercially viable and a location has been declared, the operator may apply for a Production Licence. A commercial shale gas project could be in production for as long as 40 years (Figure 9).

Prior to the grant of the Production Licence the applicant will need to comply with the requirements of the Commonwealth *Native Title Act 1993*. While native title processes are underway, the applicant can commence discussions with private landholders for the purpose of accessing land. Once native title agreement is reached, the grant of a Production Licence can proceed. Prior to project development, access arrangements with landholders must be settled. This stage of approvals may take one to two years.

The operator must submit a Field Management Plan to DMP for assessment, prior to receiving approval to commence production. This plan provides an overview of the entire petroleum field covered by the Production Licence and covers all stages of the production phase from pre-commissioning, commissioning, start-up and operations to decommissioning. It further covers all the anticipated facilities located on the surface (such as production and storage facilities). The Field Management Plan addresses key issues in reservoir development, such as estimated gas production rates over the life of the field and the number and placement/spacing of wells and well pads. It also explains how **produced formation water** will be monitored, managed and disposed. The Field Management Plan must be varied and approved as a result of any major changes to the project.

Oil or gas production from wells either on land or offshore, with a design or production capacity of 5000 tonnes or more of petroleum per year is a prescribed premises under the Environmental Protection Regulations 1987. A works approval from DER is required to carry out any works which would cause a premises to become a prescribed premises under the *Environment Protection Act 1986*. This would include activities such as construction of a well. The occupier of a prescribed premises, which may cause or alter an emission, commits an offense unless done under the authority of a licence granted under the *Environment Protection Act 1986*. As a result, a licence is generally required to operate a prescribed premises. Conditions may be imposed as necessary or by convention for the purposes of prevention, control, abatement or mitigation of pollution or environmental harm.

If additional sources of water are required for the production process, a water well construction licence and a licence to take water will be required from DoW in accordance with the *Rights in Water and Irrigation Act 1914*.

Prior to new petroleum wells being drilled, the operator must submit a Well Management Plan, a Safety Management System/Safety Case and an Environment Plan to DMP for approval for each well or group of wells. These plans can be revised, with DMP approval, if there are changes to activities that are not covered under the original approved plans.

Similar to previous stages, DMP will continue to monitor progress of the activity through submitted reports, and undertake inspections to determine compliance of the approval conditions. Enforcement action may be undertaken where non-compliance is identified.

During the production stage the operator must submit to DMP a series of reports including: monthly production reports, annual title assessment reports and well monitoring audit reports. Licence conditions may impose a requirement for reporting of emissions and discharges during production, which must be reported to DER.

Operators are required to obtain certification and approval for the operation of critical pieces of equipment related to well and petroleum production operations through the implementation of an Asset Integrity Management System (AIMS). The AIMS addresses the following main elements as a minimum:

- corrosion management inspection and repair (e.g. tanks, pipelines, instrumentation)
- safety critical elements (e.g. emergency shut down and isolation equipment, fire protection and detection for plant and equipment)
- instrumented protective functions (failsafes)
- planned maintenance inspection and repair, and fitness-for-purpose (e.g. mobile plant)
- **wellhead** and subsurface well **integrity**.

2.2.4 Decommissioning and rehabilitation

The final stage in the lifecycle of a petroleum field is decommissioning, where the wellhead, pipelines and other surface facilities are removed and the land is rehabilitated to its pre-existing state, in consultation with the landholder (Figure 9). Decommissioning may also occur where exploration or proof of concept activities have been unsuccessful. Buried pipelines will normally remain in place, where it is safe to do so. To decommission a well, the production zone is isolated with cement and barriers placed within the casing so that no fluids can flow into or out of the well once the wellhead is removed.

This process requires the registered holder to carry out the decommissioning procedures in accordance with the DMP agreed Field Management Plan, Well Management Plan, Environment Plan, and Safety Management System/Safety Case. It is a requirement that the registered holder monitors the rehabilitation of the site for an appropriate period before the licence can be surrendered. DMP will undertake inspections of the site rehabilitation to determine compliance against the Environment Plan.

2.3 Environmental assessment by other agencies

Beyond the environmental approvals and reporting requirements required under the petroleum Acts and regulations (administered by DMP), additional environmental assessments may be required in some cases before approval is granted. Depending on the nature of the potential environmental impact, this can result in additional environmental assessments and approvals being required from the State Government's Environmental Protection Authority or the Commonwealth Government's Department of the Environment (DoE).

2.3.1 Referral to the Environmental Protection Authority

EPA is an independent statutory authority established under the provisions of the *Environmental Protection Act 1986*. One of EPA's primary roles is to assess the environmental impacts of proposals that may have a significant impact on the environment. EPA then makes recommendations to the Minister for Environment, who decides whether to approve the proposal. Approval may be subject to conditions. Compliance with conditions of approval is monitored by the Office of the Environmental Protection Authority (OEPA).

The role and processes of EPA aim to protect the Western Australian environment, incorporating the following key elements:

- Independence – EPA is an independent board comprising members selected from a wide range of fields, professions and sectors of the community. It has responsibility for making recommendations to the Minister for Environment on environmental matters, supported by assessment work undertaken by OEPA.
- Transparency – All recommendations made by EPA to the Minister for Environment are made public.
- Public involvement – Opportunities are available for members of the public to make submissions to EPA regarding individual proposals.

While DMP is responsible for approving Environment Plans in accordance with the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012, it is required to refer proposals that may result in significant environmental impacts to EPA for assessment². Third parties and **proponents** may also refer proposals that may have a potential significant environmental impact to EPA.

Under Part IV of the *Environmental Protection Act 1986*, decision-making authorities must refer proposals to EPA which may, if implemented, cause a significant effect on the environment. EPA's administrative procedures³ describe the matters which EPA may take into account in determining whether a proposal is likely to be significant, and include:

- The values, sensitivity and quality of the environment that is likely to be impacted.
- The intensity, duration, magnitude and geographic footprint of the likely impacts.
- The consequence of the likely impacts.
- The resilience of the environment to cope with the impacts or change.
- The level of confidence in the prediction of impacts and the success of proposed mitigation.
- The presence of other statutory decision-making processes that regulate the mitigation of the potential effects on the environment to meet EPA's objectives and principles.
- The level of public concern about the likely effect of the proposal on the environment.

DMP considers these matters in deciding which proposals should be referred to EPA.

² EPA document "Environmental Assessment Guideline for Referral of a proposal under s38 of the Environmental Protection Act 1986" – <http://www.epa.wa.gov.au/EPADocLib/EAG16%20s38%20Referral%20January2015.pdf>

³ Environmental Impact Assessment (Part V Divisions 1 and 2) Administrative Procedures 2012 – <http://www.epa.wa.gov.au/EIA/assessdev/Pages/EIAAdministrativeProcedures.aspx> EIA Administrative Procedures 2012

DMP and EPA have also established a Memorandum of Understanding (MOU), available on the DMP and EPA websites⁴. The purpose of the MOU is to establish an efficient and transparent administrative process for DMP to refer environmentally significant mineral, petroleum and geothermal proposals to EPA. The MOU sets out additional criteria to the significance test described to guide DMP in determining whether proposals are likely to have significant effect on the environment and should be referred. DMP also consults OEPA regularly on the need to refer individual proposals.

Across government, decision-making authorities must refer to EPA any proposals received that may have a significant environmental impact. EPA assesses each proposal on a case-by-case basis and determines if the proposal requires a formal environmental impact assessment.

2.3.2 Environmental Impact Assessment

After receiving a referral, EPA decides if the proposal should be formally assessed and, if so, the level of assessment. If a proposal is not formally assessed, EPA may publish advice to the proponent and other decision-making authorities, but that advice is not binding. EPA has two main levels of formal assessment:

- Assessment on proponent information — Category A (API-A)
- Public Environmental Review (PER).

EPA sets the level of assessment based on a number of factors, including the level of public interest, the scope and complexity of the environmental issues, and the values of the environment that might be impacted. EPA also considers the degree to which the environmental objective for each of its environmental factors can be met by the proposal. For example, the EPA objective for the factor ‘Inland Waters Environmental Quality’ is to maintain the quality of groundwater and surface water, sediment and biota so that the ecological and social values of the environment are protected.

Where a proposal is of regional or State-wide significance or has complex environmental issues, EPA will normally assess the proposal at the PER level of assessment. Figure 10 outlines the PER assessment process.

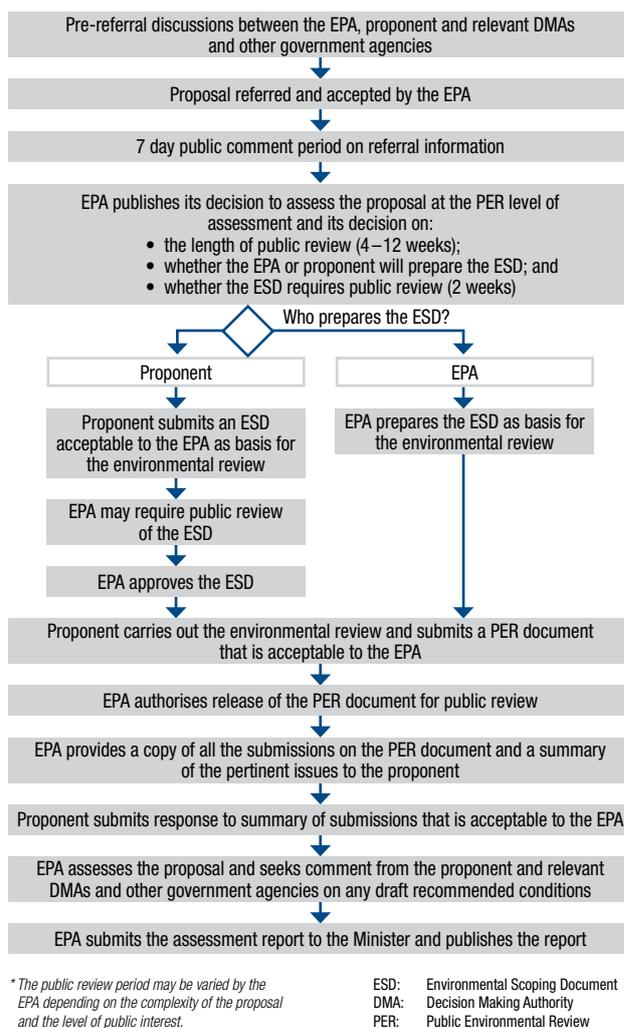
While the process and opportunities for public comments vary between the two levels of assessment, common features are that:

- The process is fully transparent.
- The public has an opportunity to comment on which level of assessment should be set by EPA.

- The public can appeal against the content or recommendations of EPA’s assessment report.

After EPA has reported, and after any appeals have been determined, the Minister for Environment decides whether the proposal may be implemented. When the Minister gives environmental approval to a proposal, a Ministerial Approval Statement is issued which sets out the conditions and procedures that the proponent must adhere to during the project implementation. While a proposal is being assessed by EPA — and until the Minister for Environment has made a final decision — other decision-making authorities cannot make a decision on any approvals that the proposal may require.

2.3.3 Referral to the Australian Department of the Environment



* The public review period may be varied by the EPA depending on the complexity of the proposal and the level of public interest.

ESD: Environmental Scoping Document
DMA: Decision Making Authority
PER: Public Environmental Review

Figure 10: Procedure for Public Environmental Review level of assessment

⁴ See http://www.dmp.wa.gov.au/documents/environmental_protection_authority.pdf

The Australian government, through DoE, is required to assess any action that has the potential to have a significant impact on a matter of national environmental significance. Matters of national environmental significance are defined under the *Environment Protection and Biodiversity Conservation Act 1999* including:

- World Heritage properties
- National Heritage places
- wetlands of international importance (Ramsar wetlands)
- listed threatened species or ecological communities
- migratory species protected under international agreements
- the environment where nuclear actions are involved (including uranium mines)
- a water resource.

For example, Western Australia has more than ten wetlands protected under the Ramsar Convention, which aims to halt the worldwide loss of wetlands and to ensure wise use and management conserves those wetlands that remain. If an onshore petroleum activity is proposed that could impact one of these wetlands, the operator needs to refer the action to DoE and obtain approval prior to commencing any activities, in addition to any approvals from State agencies.

Similarly, if an operator proposes onshore petroleum activities in a National Heritage place, such as the Dampier Archipelago/Burrup Peninsula or the West Kimberley National Heritage Area, the action needs to be referred to DoE and appropriate Commonwealth approvals need to be obtained before activities could start.

It is up to the operator to decide whether an action needs to be referred to DoE for assessment under the *Environment Protection and Biodiversity Conservation Act 1999*. Operators referring their activity to DoE may do this at the same time as the State Government process progresses.

In order to reduce duplication between the Australian and State Government approval processes, an assessment bilateral agreement has been established. This agreement accredits the State's environmental impact assessment and clearing permit processes under the *Environmental Protection Act 1986*, for assessing the impacts of the action on matters of national environmental significance. Details are available on the EPA and DER websites.

2.3.4 Administrative arrangements with other State agencies

While DMP is the primary regulator for petroleum activities, it works in conjunction with other agencies in accordance with formal arrangements.

2.3.4.1 Administrative agreement between the former Department of Environment and Conservation and DMP

There is an administrative agreement between the former Department of Environment and Conservation (now DER) and DMP⁵. This agreement relates to the delegation of provisions for clearing of native vegetation under the *Environmental Protection Act 1986*. The administration agreement outlines administrative arrangements between the two agencies to support the delegation under section 20 of the *Environmental Protection Act 1986* of certain provisions for clearing of native vegetation under Part V Division 2 of that Act.

The administration procedures establish processes for the management of clearing permit applications and for appropriate standards and record keeping to apply to exempt clearing activities as agreed to by both agencies.

2.3.4.2 Consultation with the Department of Parks and Wildlife

For all reserved land managed under the *Conservation and Land Management Act 1984*, the Minister for Mines and Petroleum or his delegate must consult, under section 15A of the *Petroleum and Geothermal Energy Resources Act 1967*, with the Minister vested with management responsibilities to determine if there are any special conditions that should be placed on the approval to undertake a petroleum activity on reserved land. The process normally involves consultation with DPaW in regard to planned activities and the associated Environment Plan by the registered holder. The Minister is then formally consulted and may recommend conditions to be placed on approval for entry to the reserved land.

2.3.4.3 Agreement with the Department of Health

DMP will refer Environment Plans (including chemical risk assessments) to the Department of Health (DoH) for comment and advice where there is a potential health risk to the public or there is significant public interest related to health concerns, prior to approval. Furthermore, the DMP will notify the DoH immediately if a public drinking water supply is polluted, as required under the *Health Act 1911*.

⁵ See <http://www.dmp.wa.gov.au/documents/ENV-NVAB-021.pdf>

2.3.4.4 Memorandum of Understanding with the Radiological Council

An MOU⁶ between DMP and the Radiological Council (an authority comprising health officials), which ensures a common approach to the regulation of naturally occurring radioactive materials (**NORMs**) associated with the petroleum industry, is currently being reviewed to reflect recent changes to legislation at the Commonwealth and State level. The MOU is administered by a Radiation Liaison Committee which consists of identified representatives from DMP and the Radiological Council.

The purpose of the MOU is to clarify the administrative arrangements and roles and responsibilities of these agencies in relation to NORMs. It also clarifies the relationship between the various Acts and aims to assist with the effective coordination of the regulation of NORMs associated with petroleum activities.

2.3.4.5 Agreement with the Department of Water

DMP refers petroleum proposals to DoW for comment where they may pose a significant risk to water resources. DMP may also formally refer Environment Plans to DoW under section 15A of the *Petroleum and Geothermal Energy Resources Act 1967* where a petroleum operation is proposed on reserved lands vested in the Minister for Water.

The MOU between DMP and EPA also provides for referrals for water reserves and other environmentally sensitive areas as a further safeguard.

The quality of the State's water sources is protected through a collaborative approach across Government in regulating petroleum activities. The Western Australian Planning Commission's 2003 Statement of Planning Policy No.2.7 – Public Drinking Water Source Policy is relevant to approximately 155 existing public drinking water source areas (PDWSA).

2.3.4.6 Memorandum of Understanding with the Department of Aboriginal Affairs

All operators must conduct due diligence to determine if any Aboriginal heritage sites exist in areas of proposed exploration or development. Where activities may impact on such sites, the consent of the Minister for Aboriginal Affairs under section 18 of the *Aboriginal Heritage Act 1972* must be obtained. The petroleum Acts impose an endorsement on all petroleum titles at grant, drawing the registered holders' attention to the requirements of the *Aboriginal Heritage Act 1972*.

Aboriginal heritage sites must be identified, and sites must be avoided or measures must be taken to protect the site(s) as addressed in an Environment Plan. Conversely, if an Aboriginal heritage site is likely to be concealed, altered, damaged or destroyed as a consequence of an activity, then the Environment Plan needs to demonstrate that the consent of the Minister for Aboriginal Affairs for the activity has been obtained in accordance with the *Aboriginal Heritage Act 1972*. Where relevant, Aboriginal heritage site field surveys should be conducted in consultation with Aboriginal traditional owners and affected native title claimants and/or determined holders.

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* also applies. Under this Act, emergency declarations can be sought to preserve and protect from injury or desecration, places and objects of particular cultural significance to Aboriginal and Torres Strait Islander people.

2.3.4.7 Memorandum of Understanding with the Western Australian Planning Commission and the Department of Planning

An MOU between DMP, the Western Australian Planning Commission (WAPC) and the Department of Planning (DoP) requires that planning proposals, including planning schemes, subdivisions and relevant policies, are referred to DMP for assessment.

If access to mineral or petroleum resources or highly prospective areas is affected by a proposed change in land use, it may be necessary for the government agencies to negotiate.

The Geological Survey of Western Australia (GSWA), a division of DMP, determines any implications of a proposal on access to mineral and petroleum resources. If the proposal's implementation creates access or operational problems, GSWA may consult with the referring agency and the registered title holder to negotiate a mutually acceptable outcome.

⁶ See http://www.dmp.wa.gov.au/documents/RadiologicalCouncil_MOU.pdf

3 Operational requirements

The operational standards that apply to shale and tight gas projects are subject to the provisions of all State and Commonwealth legislation relevant to the activity. There are many Australian and international standards that are applied throughout the approvals process for conventional, shale gas and tight gas projects, which build upon the requirements provided in the regulations and legislation. For example, the Australian standards AS/NZS ISO 31000:2009; AS/NZ ISO 14001:2004 and HB 203:2006 assist operators in carrying out risk assessments reported in the Environment Plans, Safety Management Systems/Safety Cases, Well Management Plans and Field Management Plans required by DMP.

3.1 Standards for hydraulic fracture stimulation

Of particular relevance to shale and tight gas is the American Petroleum Institute (API) standards program accredited by the American National Standards Institute. API publishes standards for the petroleum industry and has specifically published five guidance documents for hydraulic fracture stimulation issues:

- HF1: Well Construction and Integrity
- HF2: Water Management
- HF3: Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing
- RP51R: Environmental Protection for Onshore Oil and Gas Production Operations and Leases
- Standard 65-2: Isolating Potential Flow Zones During Well Construction.

These standards take into consideration the experience and new technology from the large number of wells that have been constructed and operate in the US. They provide a comprehensive framework that Australian and Western Australian operators can use as guidance in developing activities and projects. DMP refers to such standards when assessing operational plans.

3.2 Well construction

Oil and gas producing wells are constructed with multiple barriers to isolate produced well fluids from subsurface rock formations and the external environment. Barriers in well design comprise cemented steel casing, tubing, seals and valves, all of which are pressure rated and tested. These components are specifically designed for the subsurface conditions of each well.

The main aboveground barrier of petroleum well is an assembly of valves and fittings that control the flow of oil or gas and is known as a 'Christmas tree' (Figure 11). The Christmas tree sits on top of the wellhead and it is the interface between the well and a production facility. It allows for surface monitoring and control of production of petroleum from a well.

Multiple barriers are an important element in modern well design to ensure well integrity, where individual barriers are designed to be independent and are constructed to international engineering standards (Figure 11). The number of independent barriers is proportional to the potential risk of a specific well.

3.3 Well integrity

Established standards for well integrity include the principle of having at least two barriers between the subsurface environment and the interior of the well (Figure 11). Effective well design prevents petroleum loss into the subsurface or aboveground environment, while also preventing water and other material entering the well. This objective is achieved by cementing protective, pressure-rated, steel casings between the well bore and the surrounding rock formation. This well design also protects groundwater from contamination.

Petroleum wells are drilled in sections with each consecutive section deepening the well and having a smaller diameter than the previous section (Figure 12). The largest diameter section is drilled first; the smallest diameter section is the production hole, drilled last. When a particular section is drilled to its appropriate depth, steel casing made up of steel pipes joined together (**casing string**) is placed into the hole and cemented to isolate the rock formations that have just been drilled from the next hole section that is about to be drilled deeper. The next section uses a smaller diameter drill bit in order to fit through the casing that has been cemented in the previous section.

Pressure testing is performed to ensure the cement and casing can withstand the pressures involved in subsequent down-hole activities (such as hydraulic fracture stimulation). The production casing and cement layer are perforated to access the gas-bearing rock formation. These perforations are generally less than a few centimetres in diameter. The perforations enable gas to flow from the target rock formation into the wellbore and up the well to the surface, safely isolating the producing zone from groundwater **aquifers**. In the hydraulic fracture stimulation process, the wellbore is used to contain and transport injected hydraulic fracture stimulation fluids to the petroleum-bearing rock formation. It also contains and transports **flowback fluids** and produced water and gas to the surface.

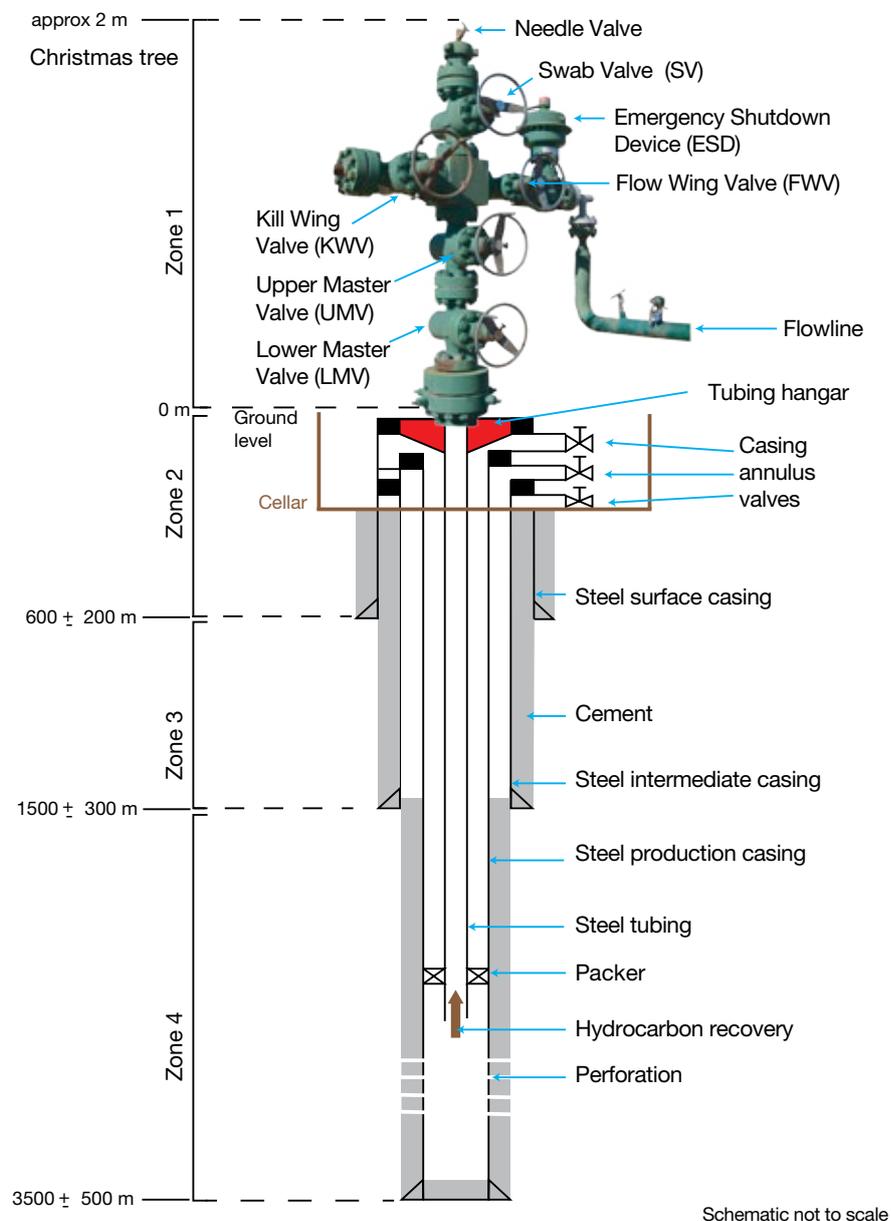


Figure 11: Photograph of a 'Christmas tree', which is the part of an oil or gas production well above ground, sitting on an illustration showing the well barriers (casing and cement) below ground in cross section (not to scale)

DMP regulates the construction and integrity of petroleum wells. Figure 13 illustrates the recommended onshore petroleum well casing design. This design includes:

- Conductor casing – This steel pipe prevents loose surface sediment from collapsing into the well and also protects shallow surface aquifers. It is set approximately 50 m deep and is cemented up to the surface.
- Surface casing – Its key purpose is to protect groundwater. It is set a safe distance below the potable aquifers and is cemented up to the surface. Once the casing is cemented, the **blowout preventer** is installed on the well to prevent uncontrolled influx of formation fluids or release from the wellbore during the drilling phase. The Christmas tree provides the same protection after the well is completed.

- Intermediate casing – This casing is used for deeper wells to reduce the amount of formation that may be exposed in any one hole section.
- Production casing or liner – This casing isolates the wellbore from the petroleum-bearing rock formation. If a full string of **production casing** is used, it will extend from the bottom of the well to the surface. A **liner** is a string of casing that extends from the bottom of the producing zone to a sufficient overlap height inside the previous casing string.

The above petroleum well design exceeds the construction requirements for water well bores owing to the different risk profile. Each casing string is designed with safety factors that exceed the formation pressures at depth. The cementing procedures must meet international standards.

A number of international studies have been completed examining well failure and well failure rates. Well barrier failure and well failure to the environment are not the same. A properly constructed and designed oil and gas well will

have multiple independent barriers providing well integrity. A well may have an internal barrier failure without resulting in hydrocarbons escaping to the environment. Continuous monitoring of well activity will indicate when a well barrier is about to fail or fails so that action can be taken immediately to correct the problem. All failures, including very minor leaks, must be fixed and reported to DMP.



Figure 12: Nested steel casings

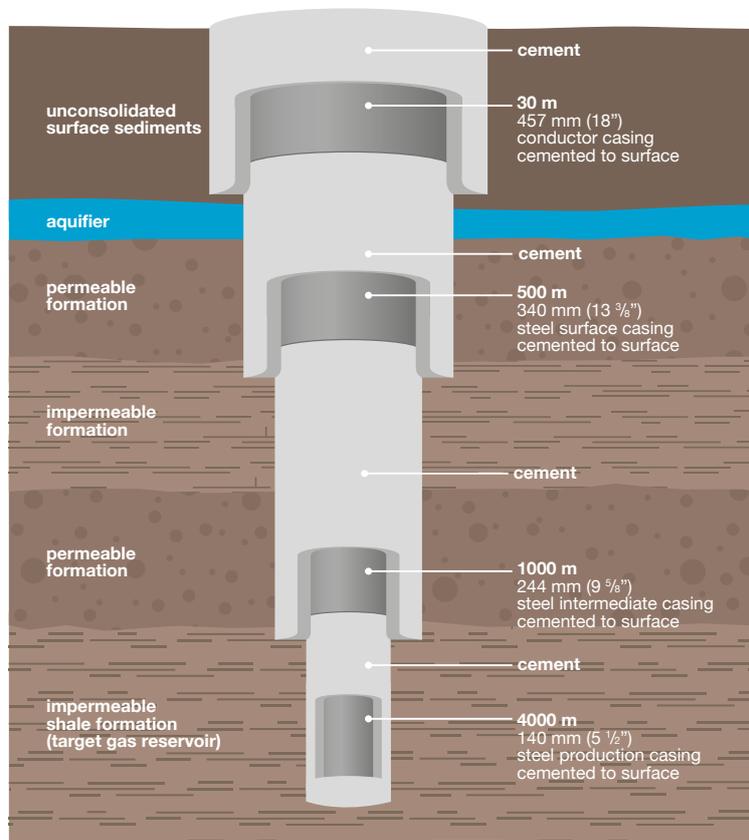


Figure 13: Recommended onshore well casing design for a shale or tight gas well

3.4 Volumes of water used in the hydraulic fracture stimulation fluid

Water is typically required to drill a petroleum well, but the amount of water used for a shale or tight gas project is greater than in a conventional well, due to the hydraulic fracture stimulation process. The volume of water it takes to hydraulically fracture a well depends on how the well is constructed and the qualities of the rock formation. Factors that can influence the amount of water required to extract shale or tight gas include:

- Type of well – Horizontal and vertical wells can both undergo hydraulic fracture stimulation at depth. Vertical wells intersect a much shorter section of a reservoir formation than horizontal wells. Therefore more water is required in a horizontal than a vertical well because it will involve more fracture stages.
- Number of wells – Fewer production wells are required if horizontal wells are used instead of vertical wells because horizontal wells reach more of the reservoir formation. To date, only vertical wells have been drilled for shale or tight gas exploration in Western Australia, however it is expected that future production will include horizontal drilling with hydraulic fracture stimulation to provide better gas flow.
- Number of fracture stages – Vertical and horizontal wells are hydraulically fractured in stages, one stage at a time. The more stages of hydraulic fracture stimulation, the greater the volume of water needed. Horizontal wells would commonly involve between 10 and 20 stages due to the length of the well in the target rock formation. Vertical wells require far fewer stages because they intersect a vertical portion of a targeted rock formation rather than extending through the layer. In Western Australia the number of fracture stages in vertical wells has ranged from 2 to 10.
- Design of the fractures – Longer and more complex fracture patterns require more water.
- Extent of naturally occurring fractures in rock – The greater the number of naturally occurring fractures in the rock formation, the less hydraulic fracture stimulation is required.

- Re-fracturing of the formation – The operator may decide to re-fracture an existing well during its production life, which will require water for hydraulic fracture stimulation activities. While this procedure is commonly used in vertical wells, it is unusual in horizontal wells. For example, less than 10 per cent of horizontal shale gas wells in the US are re-fractured.

3.4.1 Estimated water volumes

Based on overseas and domestic stimulation activities, DMP estimates that the following volumes of water would be required to drill and hydraulically fracture a rock formation:

- a vertical well with three fracture stages averages 7 million litres of water per well, equivalent to 2.8 Olympic size swimming pools
 - 1 million litres for drilling
 - 6 million litres for hydraulic fracture stimulation.
- a horizontal well (with a horizontal length of 1 km) with ten fracture stages averages 21 million litres of water per well, equivalent to 8.4 Olympic size swimming pools
 - 1 million litres for drilling
 - 20 million litres for hydraulic fracture stimulation.

Comparisons with agriculture and household water use can put these amounts of water in perspective. For example, DoW estimates that each year in Western Australia:

- 750 000 million litres of water are used for agriculture;
- the average horticultural farm (about 1200 hectares in size) uses 20 000 million litres for irrigation;
- the average sized household uses about 530 000 litres of water.

The amount of water used to drill and hydraulically fracture a horizontal well is approximately equivalent to that used to irrigate one hectare of farmland for a year, or to supply water to 40 households over a year.

Some additional water will also be required for accommodation, dust suppression, construction and related activities.

3.4.2 Access to water for hydraulic fracture stimulation and drilling

In Western Australia, most water for petroleum activities is sourced from underground aquifers relatively close to the surface. Non-potable water can be used for hydraulic fracture stimulation, including water with salinity equivalent to seawater.

Access to water is regulated by DoW and the specific regulatory requirements are in the *Rights in Water and Irrigation Act 1914*.

To construct a water bore, a construction licence is required. To take water from a proclaimed groundwater or surface water area, a licence to take water must be issued by DoW. This licence allows a licence holder to take water from a watercourse, wetland or underground source in accordance with a set of terms and conditions issued by DoW. However, new licences will only be issued where the water allocation limit has not been reached, thereby protecting existing users and the environment. This process addresses the issue of cumulative impacts of water use in a particular area. In fully allocated areas, water could possibly be obtained by the discovery of new groundwater resources, and also trucking or trading with existing water licence holders, as specified in DoW's Trading Policy⁷.

3.4.3 Assessment of water licence applications

Licences to take water specify the maximum allowable volume of water to be taken over a 12-month period. They are generally issued for 10 years, though this period can vary depending on circumstances. Conditions can be imposed on the licence to manage water quality and quantity and require licensee monitoring, reporting and metering. During the assessment of a licence application DoW must give regard to all matters that it considers relevant, including but not limited to the following:

- Is it in the public interest?
- Is it ecologically sustainable?
- Is it environmentally acceptable?
- Would it prejudice other current and future needs for the water?
- Would it have a detrimental effect on another person?
- Could the water be provided by another source?

Additional information may need to be supplied to support licence applications. For example, a hydrogeological assessment may be required in accordance with DoW's Operational Policy 5.12, Hydrogeological reporting associated with a groundwater well licence⁸.

An application may be refused if it does not meet the assessment criteria or if potential impacts are considered unacceptable. To be eligible to hold a water licence, registered holders must have legal access to the land the water is intended to be taken from.

DoW also has a range of policies that guide the licensing regime and provide information to help prospective licensees. Water allocation plans set out how much water is available from a particular source or area, how much water needs to be left in the system and the conditions that will be applied to licences in the local area. DoW follows a consistent and transparent process for developing allocation plans across the State. The plans are non-statutory, however they reflect the intent of the *Rights in Water and Irrigation Act 1914*.

The water allocation plans are regularly evaluated and the outcomes are published online. Plan evaluations are also used to improve how DoW allocates licences and monitors water resources across the State. Information on individual plans and DoW's guide to the allocation process can be obtained from the DoW website⁹.

3.5 Hydraulic fracture stimulation — use of chemicals

Hydraulic fracture stimulation fluid is generally composed of around 90 per cent water. The next largest constituent is the proppant, which is usually sand or ceramic beads (used to keep the fractures in the rock open), which represent around 9.5 per cent of the fluid. Chemical additives represent approximately 0.5 per cent of the fluid (Figure 14). While a variety of chemicals may be used in hydraulic fracture stimulation fluid, each chemical is only added where necessary. Typically, chemicals are added to improve the transportation of proppant, prevent the growth of bacteria, reduce mineral clogging and prevent well corrosion over time.

DMP will not approve a chemical's use where it presents an unacceptable risk to the environment, water resources and/or public health.

⁷ Water Trading Policy – <http://water.wa.gov.au/licensing/water-trading>

⁸ Operation policy 5.12 – Hydrogeological reporting associated with a groundwater well licence – <http://water.wa.gov.au/PublicationStore/89953.pdf>

⁹ See <http://water.wa.gov.au/planning-for-the-future/allocation-plans>

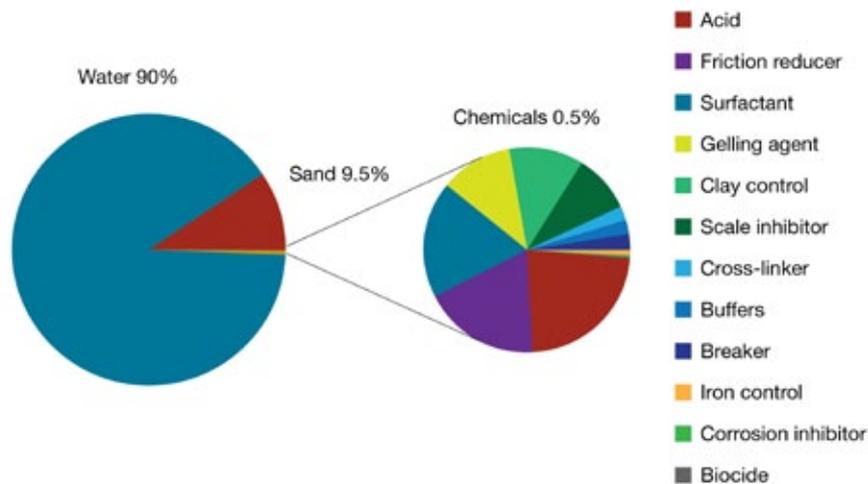


Figure 14: The make-up of typical hydraulic fracture stimulation fluid

The Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 require the disclosure of chemicals and substances used for ‘down-hole’ petroleum activities. This means the Environment Plan must detail all chemicals and other substances in, or added to, drilling or treatment fluids or introduced into a well, reservoir or subsurface rock formation during an activity. This includes drilling, cementing or hydraulic fracture stimulation during exploration, proof of concept, production and well decommissioning. This information is made publically available in the Environment Plan Summary on DMP’s website.

Chemical disclosure information provided to DMP includes information about all the chemicals being used, including relative toxicity to humans and the environment, biodegradation and bioaccumulation information and the volume and concentration of chemicals in the fluid. As a matter of best practice, DMP advocates the use of less hazardous chemicals where available.

DMP allows a systems-based chemical disclosure format to allow protection of ‘trade secret’ products (those that are special recipes, formulas or blends marketed as a unique product).

DMP also has a Chemical Risk Assessment Guideline to assist operators in determining the hazards associated with the use of chemicals¹⁰. This includes information on how toxicity (human), biodegradation and ecotoxicity (algae, fish, crustacean) data can be interpreted to evaluate the relative risk to the environment and human health.

3.6 Spill mitigation and planning

An Environment Plan must provide details about measures undertaken by operators to reduce the risk of a spill occurring during their activities.

The Petroleum Environment Regulations 2012 require an Oil Spill Contingency Plan to be included in an Environment Plan for all activities. This may be submitted either within the Environment Plan or as a standalone document and requires DMP approval prior to an activity commencing. The Oil Spill Contingency Plan should cover all potential spill sources and risks, including chemicals, drilling fluids, fuels and other substances. The plan should consider all potential spill scenarios including the type, volume, location and an assessment of impacts for each potential spill scenario. The plan must also detail how the operator will control, contain and clean up any spill, and provide for ongoing monitoring. DMP is currently drafting Oil Spill Contingency Guidelines to provide guidance to operators on this matter.

3.7 Waste disposal

The disposal of waste must be detailed in an operator’s Environment Plan, which is subject to DMP’s approval. DER also regulates the transportation of controlled waste on roads under the Environmental Protection (Controlled Waste) Regulations 2004.

There are four main sources of waste produced during the drilling, hydraulic fracture stimulation and gas production process for shale or tight gas developments. These include:

- Drilling fluid – Added to the well to cool and clean the drill bit, stabilise the well bore and help carry out drill cuttings.

¹⁰ Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guidelines – <http://www.dmp.wa.gov.au/documents/ENV-PEB-165.pdf>

- Drilled rock cuttings – These are the small broken pieces of rock cut and removed from the well during drilling.
- Flowback fluid – When the hydraulic fracture stimulation fluid is injected into the well under pressure, anywhere from 40 to 70 per cent of the fluid will flow back to the surface.
- Produced formation water – This is naturally occurring water in oil and gas reservoirs that may be recovered during production.

Wastewater from the process of hydraulic fracture stimulation is regulated primarily through DMP and by DER where it is associated with a prescribed premises licensed under the *Environmental Protection Act 1986*. It may be disposed of through:

- Evaporation ponds – These are open ponds lined with strong plastic used to hold flowback fluids or produced formation water. As the water evaporates, fine solids and chemicals remain in the pond. At the end of the evaporation process, the dried contents of the ponds are tested for contaminants. If any chemicals are present, the waste material, including the plastic liners, is excavated and taken to a licensed waste facility for disposal. The excavation is backfilled, re-contoured and rehabilitated.
- Injection/re-injection – This process involves disposing the wastewater underground by injecting into deep porous rock formations.

The method of disposal of wastewater must be detailed in an operator's Environment Plan and submitted to DMP before commencement of any petroleum activities. This plan ensures that the operator outlines the risks and provides an implementation plan to reduce these risks to as low as reasonably practicable (ALARP). If the Environment Plan does not adequately address the risks, it will not be accepted by DMP and the approval to commence the activity will not be provided.

In addition, DER ensures wastes are safely disposed of through licensing carriers, drivers and vehicles involved in the transportation of certain wastes, known as controlled waste, on public roads that may cause environmental or health risks under the Environmental Protection (Controlled Waste) Regulations 2004. This licensing ensures controlled waste is safely transported to an approved licensed waste facility for disposal.

DMP regulates the injection or re-injection of produced formation water through the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012. Operators are required to disclose in their Environment Plan the maximum concentration of petroleum in the produced formation water for injection/re-injection, which is subject to DMP's approval. Most injection/re-injection of produced formation water is into depleted hydrocarbon rock formations.

3.8 Processes associated with decommissioning

Once the gas has been economically recovered, the production wells, facilities and other infrastructure need to be shut down and decommissioned, and the site must be rehabilitated.

Under the approvals required by DMP, a Well Management Plan will need to address the decommissioning of a well. In this plan, the operator must demonstrate in relation to decommissioning that any risks to well integrity are identified and that they will be managed in accordance with sound engineering principles, codes, standards and specifications.

Decommissioning of a well will involve the production zone being isolated with a cement plug. Further cement plugs are set higher inside the casing string as additional barriers so that no fluids can flow to the surface or between rock formations once the wellhead is removed. As part of the implementation of the Petroleum Resource Management and Administration Regulations 2015, DMP is developing well decommissioning guidelines to assist and support industry in achieving best practice and international standards.

A Field Management Plan is required by DMP to describe the decommissioning and rehabilitation processes for the entire field and how the removal of the surface facilities will be addressed.

The activities of decommissioning wells also need to be covered under an approved Environment Plan, which also includes rehabilitating the disturbed sites, and a Safety Management System/Safety Case.

4 Community engagement

Community engagement refers to the interactions between government, industry, the public and communities to enable more informed and better planned policies, programs, projects and services. These interactions cover a wide variety of government–industry–community engagements ranging from information sharing to community consultation, which can be formal or informal. Effective engagement builds confidence with stakeholders and the community.

4.1 Industry engagement

The laws and regulations governing petroleum projects in Western Australia impose a number of consultation requirements on the operator/registered holder, in addition to providing formal consultation opportunities for the public. Table 2 summarises requirements relating to consultation. These are built on the principles that:

- The public has a right to be informed about resource development projects, their potential impacts and how those impacts are managed.
- The public has a right to raise concerns and objections about the assessment and regulation of resource development projects, and about the actions of project proponents.
- Proponents must be frank, honest and thorough in their disclosures to the public about their projects.
- Proponents must demonstrate that matters raised by the public through consultation are adequately considered.

4.2 DMP's stakeholder engagement strategy

DMP has developed an engagement strategy to guide communications and community engagement.

The strategy aims to streamline DMP's resources to ensure the public has access to the most accurate, up to date and unbiased information, to improve public confidence in the industry and the State's ability to facilitate safe and responsible exploration and production of oil and gas.

DMP's community engagement and communication activities for the shale and tight gas industry aim to achieve the following:

- Increased public and media understanding of the processes, opportunities and risks associated with shale and tight gas, and in particular hydraulic fracture stimulation, by providing timely information in a clear and open manner.

- Build and foster positive relationships by ensuring the community is kept informed of industry activities in Western Australia and that their issues and concerns are being noted, understood, and, if appropriate, acted upon.
- Enable the community to contribute and participate in the development of a safe and responsible shale and tight gas industry by providing a variety of accessible and convenient community engagement methods.
- Demonstrate DMP's robust cross-government approach for the management of the shale and tight gas industry in Western Australia by ensuring that stakeholders know what DMP's role as the State's lead regulator entails, and how it ensures approvals and conditions are complied with.
- Maintain confidence in DMP's ability and willingness to ensure safe and responsible management of the oil and gas industry by undertaking regular consultations with key stakeholders.

Stakeholder meetings and presentations have been conducted by DoW and DMP since 2014 to provide the community and stakeholders with a deeper understanding of water resource protection and management in the State. DoW's ongoing participation in communication and engagement activities is a key element in DMP's engagement strategy.

In meeting the aims of DMP's strategy, DMP officials meet regularly with a wide range of stakeholders including:

- Indigenous groups and corporations
- local government
- business associations
- regional development organisations
- agricultural representative bodies
- public interest groups
- State government agencies, including regionally based officers
- media representatives.

To facilitate the dissemination of information, DMP has created a suite of fact sheets and other sources of information available to the public on its website. A number of online systems such as the Petroleum and Geothermal Register (PGR), GeoView and the Western Australian Petroleum and Geothermal Information Management System (WAPIMS) are available.

Table 2. Consultation requirements.

Acts and Regulations	Agency responsible	Scope and extent of consultations
<p>Petroleum and Geothermal Energy Resources (Environment) Regulations 2012</p> <p>Petroleum (Submerged Lands) (Environment) Regulations 2012</p> <p>Petroleum Pipelines (Environment) Regulations 2012</p>	<p>Department of Mines and Petroleum</p>	<p>Operators must provide a report on all consultations undertaken during the course of development of an Environment Plan, and demonstrate how they have provided for ongoing consultation to take place. Additional consultation or consultation planning may be required. Operators are required to consult extensively with Local Government Authorities and comply with Local Government laws, by-laws, planning and works permit requirements.</p> <p>Where risks to private farm bores used for drinking water, stock or agriculture may occur, consultation with landowners is required to ensure the risks to water quality and quantity are considered.</p>
<p><i>Environmental Protection Act 1986, Part IV</i></p>	<p>Environmental Protection Authority</p>	<p>Seven-day comment on new proposals referred to EPA for assessment. EPA can review a project at any time.</p> <p>Public review and written submissions on proponent documentation for proposals subject to the public environmental review level of assessment.</p>
<p><i>Environmental Protection Act 1986, Part V</i></p>	<p>Department of Environment Regulation</p> <p>Department of Mines and Petroleum under delegation</p>	<p>Advertising of applications for works approvals, licences and clearing permits seeking comments within such period as specified in the advertisement (usually 7-21 days).</p>
<p><i>Environmental Protection Act 1986, Part VII</i></p>	<p>Appeals Convenor</p>	<p>Public appeals on EPA assessment reports and recommendations to the Minister for the Environment.</p> <p>Public appeals on decisions of the CEO (including DMP on delegation) on applications for works approvals, licences and clearing permits.</p>
<p><i>Rights in Water and Irrigation Act 1914</i></p>	<p>Department of Water</p>	<p>Depending on the volume of water required, the proponent must advertise their application. Comments received will be considered by DoW as part of their assessment of the application to take water.</p>
<p><i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i></p> <p><i>Country Areas Water Supply Act 1947</i></p>	<p>Department of Water</p>	<p>DoW undertakes a consultation program when determining the boundaries of public drinking water source areas to be proclaimed under these two Acts. DoW is consulted by DMP or EPA when proposed projects have the potential to impact a proclaimed public drinking water source area.</p>
<p><i>Aboriginal Affairs Planning Authority Act 1972</i></p>	<p>Department of Aboriginal Affairs</p>	<p>DAA administers the entry requirements onto Aboriginal Land Trust estate by ensuring that Aboriginal communities have been properly consulted and give their consent for the issue of a Mining Access Permit for entry onto Part III Reserve lands in accordance with the <i>Aboriginal Affairs Planning Authority Act 1972</i>.</p>

5 Addressing potential issues and impacts

Potential adverse impacts from shale or tight gas projects are addressed by the Western Australian statutory framework and the responsible authorities. This framework explains how these potential impacts are addressed by the Western Australian Government.

Relevant issues that have been identified in relation to shale and tight gas include:

- Land access
- Flora and fauna
- Air quality
- Local amenity
- Water quality and quantity
- Protection of drinking water supplies
- Protection of human health
- **Induced seismicity**

5.1 Land access

Registered holders of a Petroleum Exploration Permit or Production Licence are required to obtain consent from the landholder, verbal or otherwise, to access land, as listed in the *Petroleum and Geothermal Energy and Resources Act 1967*. However, registered holders are required to obtain written consent in the following cases:

- Private land not exceeding 2000 m² in area
- Land used as a cemetery or burial place
- or
- Land that is less than 150 m laterally from:
 - any cemetery or burial place
 - any natural storage or accumulation of water, a spring, dam, bore, or artesian well, or
 - any substantial improvement.

In relation to what constitutes substantial improvement, the Minister for Mines and Petroleum is the arbiter.

The Minister may also limit access through conditions placed on the petroleum title that prohibit the registered holder from entering specific areas within the title area, such as those with heritage and tourism value.

The Petroleum Pipelines Act 1969 regulates the construction and operation of petroleum pipelines in onshore Western Australia. The pipelines licensed under this Act are generally the trunk or main lines and are generally buried below ground as required by Australian Standards. Licences to construct and operate a petroleum pipeline are issued upon a valid application, where the Minister is satisfied that it is in the public interest to do so. Pipelines can be licensed to cross any type of land, including private land. It is a mandatory condition that before pipeline construction commences that the licensee has valid access agreements to the land in the licence area.

In the case of major pipelines, land could be compulsorily acquired by the State. The State may then allocate land to the pipeline operator for the purposes of constructing and operating a pipeline. The Minister first needs to be satisfied that the licensee has been unable to acquire the land or the easement by agreement with the landowner.

Once a decision to take the land has been registered under the *Transfer of Land Act 1893*, every person who has an interest in the land being taken is entitled to compensation pursuant to Part 10 of the *Land Administration Act 1997*. All costs incurred, and compensation awarded, are the responsibility of the pipeline registered holder.

5.1.1 Comparison of access rights between mining and petroleum projects

Mining projects generally have a much larger development footprint (e.g. for heavy mineral sand mining or bauxite mining) when compared to petroleum projects. Private landholders on *Mining Act 1978* tenure have the right to deny an operator access for exploration and extraction purposes if certain agricultural activities are being undertaken. Under the *Petroleum and Geothermal Energy Resources Act 1967*, private landholders do not have the right to deny access, but do have the right to full compensation.

5.1.2 Access to petroleum resources in public reserves

Where a petroleum title covers an area that is a public reserve managed by the State Government, the operator/registered holder is not permitted to enter onto the land without the consent of the Minister for Mines and Petroleum. The Minister must consult with the Minister responsible for the land before granting consent. This may be the Minister for Lands, or in the case of land managed under legislation such as the *Conservation and Land Management Act 1984*, the Minister responsible for administration of the land. Discussions are held with the relevant Minister(s) or their departments to determine to whom the land is vested and to identify any conditions to be placed on the exploration or production activities that occur on those lands.

5.1.3 Compensation for access to land

In Australia, petroleum and mineral resources are the property of the Crown.

In circumstances where private landowners agree to registered holders accessing their land, or where they are required to provide access to their land, formal notice to the private landowner and occupier (if they differ) must be given regarding the intention to explore or produce. The registered holder must be able to demonstrate that such a notice has been served in writing.

A compensation agreement must be finalised before operations can commence. This includes a compensation agreement with the landowner, as well as the occupier if the land is being leased. In accordance with the *Petroleum and Geothermal Energy Resources Act 1967*, compensation for petroleum activities is for:

- damage to the land including damage to improvements or rights of way, and all consequential damage
- the landholder being deprived of possession or use of the land
- severance (separation) of adjacent land owned by the landholder.

The procedure for adjudicating any disputed compensation claim (for those directly and indirectly affected) is through the Magistrates Court. An application must be made to the Magistrates Court at the place nearest to where the land in question is situated. The timeframe for submitting disputes to the Magistrates Court is three months after the day the landowner/occupier was given notice of the intention to commence operations on the private land.

Private landowners or occupiers in the vicinity of the operations may be entitled to compensation if they suffer damage by those operations.

Compensation in this instance is for damage or depreciated value of the land or any improvements. Compensation can also be sought for further damage to private land (damage not previously contemplated or addressed in the agreement for or determination of compensation) in the same manner as the directly affected landowners and occupiers. Compensation for land access cannot be in consideration of the value of resource that is supposed to be on or under the land.

Private land does not include pastoral or grazing leases, timber leases or leases for the use and benefit of Indigenous land users. The registered holder must provide notification of a proposed activity and access requirements to these leaseholders. The leaseholders are required to provide access to the land. Unlike private land, compensation is not paid to the lease holder for being deprived of the land, any damage to the land or rights-of-way easements. However, there is still an entitlement to compensation for damage to any improvements on the lease lands. Again, no compensation is payable for the value of the petroleum resources.

5.2 Flora and fauna

Any impacts to the natural environment, including the biological environment such as flora and fauna species or communities, must be addressed in the Environment Plan. The description of fauna must include invertebrates, birds, fish, reptiles and mammals, and identify species listed under relevant legislation (for example, the *Environment Protection and Biodiversity Conservation Act 1999* and *Wildlife Conservation Act 1950*). The Environment Plan should also address, where relevant, migration seasons and paths, and breeding and nesting seasons and locations.

Under the Environment Plan, the description of the biological environment needs to be supported by on-ground flora and fauna surveys undertaken by suitably qualified personnel and in accordance with the relevant EPA guidance statements and related technical guides¹¹.

Operators may require a permit to clear native vegetation under the *Environmental Protection Act 1986* and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. DMP has a delegation to administer the certain native vegetation clearing provisions for clearing regulated under various petroleum Acts.

¹¹ *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (No. 51)* and *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (No.56)* –http://www.epa.wa.gov.au/Policies_guidelines/EAGs/guidance/Pages/ReportPages.aspx

If any disturbance (“taking”) is proposed to threatened flora or fauna, a licence must be obtained under the *Wildlife Conservation Act 1950*. Operators are required to minimise disturbance to flora and fauna and approved disturbance is closely monitored by regulators.

An action that may significantly impact on threatened flora and fauna which are matters of national environmental significance requires referral under the *Environment Protection and Biodiversity Conservation Act 1999* to determine whether it is a controlled action.

5.3 Air quality

There are several possible sources of air emissions from a shale or tight gas operation, and these change over time as the operation progresses from exploration to decommissioning.

Potential sources at the exploration stage, which are temporary in nature, include:

- diesel/natural gas emissions from drilling operations
- diesel emissions from the fracturing fluid pumps that provide the pressure needed to pump the fluid into the well and propagate fractures
- flaring during exploration/proof of concept stage during the testing and completion of the well while no production facilities are available to capture the gas.

During production, emissions may occur from pumps used to bring the gas to the surface or releases known as ‘*fugitive emissions*’ from pipe connections. DMP requires operators to ensure good oilfield practice and to minimise emissions to levels to as low as reasonably practicable, below limits prescribed by law. These emissions can be minimised with good design and maintenance by the operator.

Venting gaseous hydrocarbons, including volatile organic compounds, poses a fire and explosion risk to a gas plant and is not permitted under any circumstance at the production stage. Worker and community health and safety requirements aim to preclude any significant risks of this nature.

The Environment Plan submitted to DMP must also detail the anticipated air emissions and how the risk of these emissions will be managed to as low as reasonably practicable and within acceptable standards and monitoring of bulk emissions, such as venting or flaring.

5.4 Local amenity

The establishment of a new project has the potential to create impacts beyond the boundaries of the title or development area. These impacts may be positive or negative, will change in scale over time and will have consequential socio-economic effects on the community. Projects that require full EPA assessment may also require a social impact assessment.

Local governments play a key role in addressing these impacts, expressly dealing with issues such as noise management and traffic management.

5.4.1 Noise impact

As with all other environmental impacts relating to an activity, potential noise impacts must be identified in an operator’s Environment Plan, ensuring that risks are reduced to as low as reasonably practicable. The plan must include an implementation strategy for addressing the noise impacts.

Noise emitted from any premises/facility must comply with all assigned noise levels under the Environmental Protection (Noise) Regulations 1997, established under the *Environmental Protection Act 1986*.

5.4.2 Landscape and visual amenity

The effect of shale or tight gas projects on the landscape and overall visual amenity fall within the ‘social surrounds’ assessment provisions of the *Environmental Protection Act 1986*, Part IV, which are administered by the OEPA. However, once the production stage is established visual impacts at the well site generally only include tracks for monitoring, servicing and maintenance. The production pad is small and connecting pipes are generally buried.

There will be a production facility close to the wells, which will be made up of production vessels, pumps, piping and storage tanks.

5.4.3 Traffic management

The hydraulic fracture stimulation process requires the movement of relatively large volumes of proppant material and potentially water to the well site from external sources over a short period of time. The movement of these materials is generally by road transport. Detailed traffic management plans are required by DMP for transport to the well site. The operator is required to work cooperatively with local government, the Department of Transport and the police department.

5.5 Water quality and quantity

The quality of the State's water sources is protected through a collaborative approach across Government. Agencies involved include DoW, DER, DoH, DMP and EPA where appropriate.

The quality of the State's water resources are protected by addressing the following key issues:

- Petroleum well integrity – regulated by DMP through the Well Management Plan. This plan details how the well integrity, through the design of the well, will address and prevent any potential risks of damage or leaks. It is the primary tool used by DMP to regulate the activities below the surface to provide protection to groundwater aquifers.
- Prevention of chemical spills and leaks at the surface – regulated by DMP through an Environment Plan and an associated spill contingency plan. The Environment Plan explains how environmental impacts and risks associated with drilling and hydraulic fracture stimulation will be addressed and managed. DER regulates prescribed premises through works approvals and licences.
- DMP/EPA Memorandum of Understanding – details when DMP should liaise with EPA on the approval of a project with respect to potential impacts on water resources.
- DoW Water Quality Protection Notes – outline best management practices for a variety of activities to limit the risk of water contamination to acceptable levels.

As with any industrial or mining activity, there are potential risks to groundwater, wetlands and waterways, which can be posed by well integrity failure, surface contamination from spills, the release of hydrocarbons, or gas leaks. These risks can be mitigated and managed through best practice and stringent regulation.

As part of the approvals process, DMP, EPA and DER may require that the operating company (licensee or occupier) conduct onsite environmental monitoring. This monitoring includes the testing of groundwater by a certified laboratory in the vicinity of the operations before and after an activity. Proponents are required to undertake baseline monitoring before starting any activity that is a potential risk to groundwater or surface water.

5.6 Protection of drinking water supplies

In Western Australia, DoH regulates drinking water quality. Licences issued by the Economic Regulation Authority (ERA) to public water service providers require the provider to monitor its systems and report the results to DoH. Private small-system operators supplying drinking water to the public are also monitored by DoH through a network of local government health authorities. All drinking water service providers in Western Australia must comply with the Australian Drinking Water Guidelines¹².

The water quality guidelines are monitored by the Advisory Committee for the Purity of Water¹³, a non-statutory interdepartmental committee that is chaired by DoH. Amongst other functions, the Advisory Committee provides advice to the Ministers for Health and Water on protecting, monitoring and managing drinking water quality and fosters the inter-agency cooperation on related matters.

The committee reviews all drinking water monitoring and catchment management activities undertaken throughout the State. Combining this information with scientific and industry knowledge, the Advisory Committee is able to identify and respond to longer-term trends that may affect public health in Western Australia.

5.6.1 Public Drinking Water Source Areas

A 'public drinking water source area' (PDWSA) is a term defined in DoW policy for water sources proclaimed under specific legislation as either water reserves, catchment areas or underground water pollution control areas.

PDWSAs can be established under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*. Metropolitan areas are proclaimed by the Governor and country areas are constituted by Orders in Council made by the Governor. Water reserves established under other legislation are not PDWSAs.

PDWSAs are subject to their own government agency assessment and approvals processes that reflect the Australian Drinking Water Guidelines. The PDWSA protection framework employed in Western Australia is consistent with world's best practice and is managed by DoW and DoH. Drinking water source protection reports drafted for each PDWSA are available from DoW's website¹⁴.

There are more than 120 such reports available for PDWSAs across Western Australia.

¹² Australian Drinking Water Guidelines (2004) – <http://www.nhmrc.gov.au/guidelines-publications/eh34>

¹³ The Advisory Committee for the Purity of Water Factsheet – http://www.public.health.wa.gov.au/cproot/2411/2/ACPOW_background_2015.pdf

¹⁴ Drinking water source protection reports – <http://water.wa.gov.au/urban-water/drinking-water/drinking-water-source-protection-reports>

PDWSA risk assessments have been undertaken for more than 20 years and most of the potential risks to PDWSAs often linked with shale and tight gas projects are similar to the risks posed by most other industries or intensive land users. This means that risk mitigation measures are well established and can be directly applied to petroleum projects. For example, the risks of surface and near surface contamination of groundwater from the storage and use of chemicals is the same for petroleum projects as it is for agriculture and mining industries that use chemicals.

One water resource risk specific to shale and tight gas projects relates to the potential for contamination to occur within and between aquifers at depth. This risk is due to the need to drill deep wells (2000 to 5000 m below ground) to access the shale or tight gas resource. Risks from well integrity failure and contamination between aquifers at depth are not commonly considered in PDWSA risk assessments. However, as a consequence of the onshore petroleum industry, risk mitigation measures have been developed by DoW and DMP. For example, separation distances and potential contamination travel times between petroleum wells and PDWSA bores can be considered in PDWSA risk assessment processes by DoW. Well integrity matters are also considered by DMP in well design and construction standards.

DoW consults with DMP or EPA when proposed projects have the potential to impact a proclaimed public drinking water source area.

5.6.2 Public water service providers

The Western Australian water services industry serves around 1.7 million customers in more than 300 towns and communities throughout the State. Water services include potable and non-potable water supply, sewerage, irrigation and drainage. The Water Corporation is the State's largest water service provider. Other industry participants include the Bunbury and Busselton water boards, local governments and irrigation scheme cooperatives.

The Economic Regulation Authority (ERA) administers the water licensing regime in Western Australia through the *Water Services Act 2012*. This involves issuing licences, monitoring a licensee's compliance with licence conditions – including ensuring they meet standards of water quality – and ensuring appropriate customer service mechanisms are in place.

5.6.3 Private drinking water supplies

When preparing an Environment Plan, petroleum operators are required to consult landholders and relevant stakeholders in relation to any proposed petroleum activity. This consultation would include identification of any nearby water bores (either registered or unregistered) that are used for private drinking water supplies. If any potential risks are identified in relation to the private water supply a water monitoring program may be recommended.

5.7 Protection of human health

Protection of human health includes ensuring that any emissions from a petroleum activity meet air and water quality standards relevant to nearby populated areas.

The Health Act 1911 provides protection for public drinking water supplies. It also provides protection from pollution for any water supply or catchment area, including any river, stream, watercourse, creek, swamp, water hole, well, tank, lake, or reservoir containing water intended or available for human consumption. The local government or the Executive Director Public Health can direct the closure of a water supply that is considered to be polluted. As with any industry, shale and tight gas operators must comply with all relevant legislation.

5.8 Induced seismicity

The process of hydraulic fracture stimulation may result in minor induced, or man-made, seismicity at depth, although the tremors would normally be much too small to be felt by people at the Earth's surface. Studies into minor earthquakes (magnitude 2.3 and 1.5 on the Richter Scale) that were felt by the public and that coincided with hydraulic fracture stimulation operations in Blackpool, United Kingdom, found they were likely caused by the injection of hydraulic fracture stimulation fluid into a nearby geological fault¹⁵. It is for this reason that geological faults must be avoided during hydraulic fracture stimulation activities.

Larger earthquakes measuring up to magnitude 4 or 5 on the Richter Scale have been associated with large scale disposal of waste water into subsurface rock formations¹⁶.

DMP requires the submission of the results of any microseismic monitoring of fracturing activities for evaluation and assessment.

As part of the assessment process for shale and tight gas projects in Western Australia, explorers may undertake geophysical surveys to determine the location of geological faults. Modelling of expected fracture trajectories typically predicts that the fracture zone can extend 50 m vertically and 300 m to 500 m horizontally from the well bore.

¹⁵ Department of Energy and Climate Change UK – https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283837/Seismic_v3.pdf

¹⁶ <http://www.ideo.columbia.edu/news-events/seismologists-link-ohio-earthquakes-waste-disposal-wells>

6 Compliance and enforcement

Regulations provide the detailed requirements to achieve the overarching objectives of legislation for the development of shale and tight gas projects and they carry the force of law. Western Australian Government agencies administer these regulations, the mechanisms used to enforce them, and the consequences of failing to comply.

6.1 Department of Mines and Petroleum administered regulations

DMP enforces regulations specific to petroleum activities and projects throughout Western Australia, including shale and tight gas resources. As part of the regulatory process, DMP undertakes audits and inspections of petroleum activities and facilities.

6.1.1 Regulations

There are a number of regulations that provide the rules and directions supporting the *Petroleum and Geothermal Energy Resources Act 1967*, the *Petroleum Pipelines Act 1969* and the *Petroleum (Submerged Lands) Act 1982*. The relevant regulations include:

- Petroleum and Geothermal Energy Resources (Management of Safety) Regulations 2010.
- Petroleum and Geothermal Energy Resources (Occupational Health and Safety) Regulations 2010.
- Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015.
- Petroleum and Geothermal Energy Resources (Environment) Regulations 2012.
- Petroleum (Submerged Lands) (Environment) 2012.
- Petroleum Pipelines (Environment) Regulations 2012.
- Petroleum Pipelines (Management of Safety of Pipeline Operations) Regulations 2010.

These regulations aim to ensure that any petroleum or geothermal activity in the State is carried out in a manner consistent with the principles of sustainable development and in accordance with good oilfield practice. They require petroleum, including shale and tight gas-related activities and projects to:

- Demonstrate the environmental impacts and risks of the activity will be reduced to 'as low as reasonably practicable' (ALARP).

- Adopt appropriate environmental, resource management and safety objectives and performance standards.
- Establish appropriate compliance criteria for determining whether those objectives and standards have been met.

6.1.2 Tenure and Approvals

The Department of Mines and Petroleum administers petroleum tenure, Exploration Permits, Drilling Reservations, Production Licences, Retention Leases and Pipeline Licences, in accordance with the above legislation, which impose obligations upon operators.

6.1.2.1 Exploration Title

Exploration Permits, Drilling Reservations and Retention Leases provide the underlying title for exploration activities. Exploration may also be undertaken on Production Licences. Exploration Permits are granted for a period of six years, with two potential renewal periods of five years each. Permits are granted subject to specific minimum work commitments that must be met each year.

6.1.2.2 Production Licence

Once a discovery of petroleum is made, a Production Licence provides the registered holder(s) with an exclusive right to carry out operations for the recovery of petroleum within the licence area in accordance with an approved Field Management Plan and individual activity work approvals. The licence covers the declared locations over the period of production and the decommissioning phase. A Production Licence is granted for an indefinite term (subject to termination provisions if no operations for the recovery of petroleum under the licence have been undertaken during a continuous period of five years).

6.1.3 Plans and commitments

The following plans and permits are required to be in place prior to any activities being undertaken on the land. In instances where operators fail to meet the requirements prescribed in the regulations, DMP administers a range of enforcement actions and penalties.

6.1.3.1 Environment Plan

The objective of an Environment Plan is to ensure the environment, water resources and/or public health are not adversely impacted by a petroleum activity. Operators must understand their local environment, identify potential impacts and risks from their operations, and identify

commitments to ensure that impacts and risks will be managed to be as low as reasonably practicable. Operators must demonstrate adherence to recognised industry best practice, and conformance to Australian and international standards. Non-compliance with these commitments can result in corrective action requests, directions, cease activity notices, fines and forfeiture of title.

Environment Plans also include commitments for the operators to engage in ongoing consultation with stakeholders, as well as obligations to report performance against these requirements.

6.1.3.2 Clearing of Native Vegetation

Under the *Environmental Protection Act 1986*, clearing of native vegetation is an offence unless done under the authority of a clearing permit, or an exemption contained in Schedule 6, or of a prescribed kind outlined in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and not done in an environmentally sensitive area. DMP has a delegation to administer certain clearing provisions, including decisions on clearing permit applications for clearing under petroleum legislation.

6.1.3.3 Well Management Plan

The objective of a Well Management Plan is to ensure the well is designed and managed in accordance with sound engineering principles and industry best practice, including identification of risks. A range of reporting on well operations is required, including daily activity reports, monthly production reports and well completion reports. Non-compliance can result in directions, cease activity notices and prosecution, which may lead to fines and forfeiture of title.

Well Management Plans are assessed by DMP for well integrity. Once approved, Well Management Plans are binding and valid for a maximum of five years.

Any variation to the well design or major change to operations must be approved by DMP.

6.1.3.4 Field Management Plan

Once approved, a Field Management Plan (FMP) provides a description of the life cycle of the petroleum project covered by the Production Licence and how the project will be managed by the operator. Information contained within the FMP typically includes:

- number and type of wells to be drilled and their locations

- description of the subsurface regime, including rock properties and fluid pressures
- estimated production over time, including the rate of recovery from the petroleum field
- how produced fluids and wastes will be monitored and managed
- decommissioning and rehabilitation processes, including surface facilities, following completion of resource extraction.

Non-compliance can result in directions, fines and forfeiture of title.

6.1.3.5 Safety Management System/Safety Case

An approved Safety Management System or Safety Case describes the systems and processes used to minimise risks to processes and employee health and safety. They form the basis for the ongoing safety audit and inspection and cover all activities over the whole life of the operation.

Safety Cases are generated for activities where the risks are well understood and can be controlled. Safety Management Systems are appropriate for many activities including drilling, vessel operations and/or diving operations where the management of risk occurs in real-time. These activities should also comply with the relevant Australian and international standards and demonstrate industry “best practice”. Operators should also be able to demonstrate that their systems manage risks to levels to ALARP.

Safety Management Systems require the ongoing monitoring and assessment of risks and also ongoing assessment as part of a continuous improvement process that the operator uses to manage process, health and safety risks on their facility. The Safety Case should also document the process of assessment of hazards and development of management measures as required in the hierarchy of controls (elimination, substitution, management of change, etc).

Non-compliance can result in directions, improvement notices, prohibition notices, cease activity instructions, fines and/or forfeiture of title.

6.1.4 Enforcement

Table 3 summarises some of the actions available to DMP to address non-compliance with the regulations, approved plans and permits. Due to the extensive nature of penalties available under the legislation and regulations, not all penalties are listed.

Table 3. Enforcement actions and penalties administered by DMP.

Legislation/Regulation	Action	Maximum Penalty*
<i>Petroleum and Geothermal Energy Resources Act 1967</i>		
Section 29 – Exploration for petroleum and geothermal energy resources restricted	A penalty applies for exploration activities conducted without a petroleum or geothermal exploration permit or drilling reservation.	A fine of \$50,000 or imprisonment for five years, or both
Section 49 – Recovery of petroleum or geothermal energy resources in State	A penalty applies for the recovery of petroleum or geothermal energy conducted without a petroleum or geothermal production licence.	A fine of \$50,000 or imprisonment for five years, or both
Section 92 – Maintenance etc. of property	A penalty applies for failing to maintain in good condition and repair an operations area or for failing to remove unnecessary structures, equipment or property.	A fine of \$10,000
Section 95 – Directions by Minister	The Minister may give a registered holder a direction as to any matter with respect to which regulations may be made.	A fine not exceeding \$10,000 for non-compliance with a direction
Section 113 – Discovery of water to be notified	A penalty applies for failing to report a discovery of water in a permit area, drilling reservation, lease area or licence area to the Minister.	A fine of \$10,000
Schedule 1 (occupational safety and health), Clause 7 – Duties of operator, Clause 8 – Duties of persons in control of parts of petroleum operation or geothermal energy operation, Clause 9 – Duties of employers	Operators, controllers and employers must take all reasonably practicable steps to ensure that a petroleum or geothermal operation is carried out in a safe manner.	A fine of \$110,000
Schedule 1 (occupational safety and health), Clause 58 – Power to issue prohibition notices, Clause 59 – Compliance with prohibition notice, Clause 60 – Power to issue improvement notices, Clause 61 – Compliance with improvement notice	Inspectors have the power to issue prohibition and improvements notices in order to remove an immediate safety or health threat or where contravention of a listed OSH law has occurred.	A fine of \$27,500 (prohibition notice) or \$11,000 (improvement notice) for non-compliance with a notice
<i>Petroleum Pipelines Act 1969</i>		
Section 6 – Construction etc. of pipelines	A penalty applies for constructing, altering or operating a pipeline without a licence.	A fine of \$50,000 or imprisonment for five years, or both
Section 24 – Cancellation of licences for breach of conditions, the Act or regulations or non-payment of amounts due	The Minister has the power to cancel the licences as to the whole or a part of a pipeline.	Licence cancellation
Section 25 – Change in position or route of pipeline	A penalty applies for failing to make changes to the route or position of a pipeline, as directed by the Minister.	A fine of \$50,000 or imprisonment for five years, or both
Section 37 – Waste or escape of substances from pipeline	A penalty applies for allowing waste or the escape of any substance from a pipeline.	A fine of \$10,000
Section 38 – Marking route of pipeline and maintenance etc. of property	A penalty applies for failing to adequately mark the route of a pipeline, for failing to maintain the pipeline in good condition and repair, or failing to remove unnecessary structures, equipment or property.	A fine of \$10,000

Table 3. Enforcement actions and penalties administered by DMP cont...

Legislation/Regulation	Action	Maximum Penalty*
Section 40 – Pipelines crossing any water	A penalty applies for pipelines that affect or impede the use of waters, or for not taking all reasonable steps to avoid pollution of waters.	A fine of \$10,000
Schedule 1 (occupational safety and health), Clause 7 – Duties of licensee, Clause 8 – Duties of persons in control of parts of pipeline operation, Clause 9 – Duties of employers	Licensees, operators and employers must take all reasonably practicable steps to ensure that the pipeline operation is carried out in a safe manner.	A fine of \$110,000
Schedule 1 (occupational safety and health), Clause 58 – Power to issue prohibition notices, Clause 59 – Compliance with prohibition notice, Clause 60 – Power to issue improvement notices, Clause 61 – Compliance with improvement notice	Inspectors have the power to issue prohibition and improvement notices in order to remove an immediate safety or health threat or where contravention of a listed OSH law has occurred.	A fine of \$27,500 (prohibition notice) or \$11,000 (improvement notice) for non-compliance with a notice
Petroleum and Geothermal Energy Resources (Environment) Regulations 2012		
Environment plans		
Regulation 6 – Approved environment plan required for activity	The operator of an activity commits an offence if the operator carries out the activity and there is no environment plan for the activity.	A fine of \$10,000
Regulation 7 – Activity must comply with approved environment plan	The operator of an activity commits an offence if the operator carries out the activity in a way that is contrary to the environment plan for the activity.	A fine of \$10,000
Regulation 8 – Activity must not continue if new or increased environmental impact or environmental risk identified	The operator of an activity commits an offence if it carries out the activity after the occurrence of any significant new or increased environmental impact or environmental risk arising from the activity and it is not provided for in the environment plan.	A fine of \$10,000
Regulation 11(7) – Summary of the environment plan	Within 10 days after receiving a notification that the Minister has approved an environment plan, an operator must submit to the Minister a summary of the environment plan for public disclosure.	A fine of \$5,500
Regulation 18(1) – Revision because of a change, or proposed change, of circumstances or activity	An operator of an activity must submit to the Minister a proposed revision of the environment plan for the activity before the commencement of any new activity or any significant modification of, significant change in, or significant new stage of, an existing activity, that is not provided for in the environment plan.	A fine of \$10,000
Regulation 18(2) – Revision as soon as practicable after of a change in circumstances or activity	The operator of an activity must submit to the Minister a proposed revision of the environment plan for the activity before, or as soon as practicable, after – (a) a change in the instrument holder for, or operator of, the activity; or (b) the occurrence of any significant new/increased environmental impact or environmental risk that is not provided for in the environment plan for the activity; or, (c) the occurrence of a series of new environmental impacts or environmental risks, or a series of increases in existing environmental impacts or environmental risks, which, taken together, amount to the occurrence of a significant new environmental increase or risk or a significant increase that is not provided for in the environment plan.	A fine of \$10,000

Table 3. Enforcement actions and penalties administered by DMP cont...

Legislation/Regulation	Action	Maximum Penalty*
Regulation 20 – Revision every five years	The operator of an activity must submit to the Minister a revised environment plan every five years.	A fine of \$10,000
Regulation 25 – Withdrawal of approval of environment plan	In certain circumstances the Minister may withdraw the approval of an environment plan.	Withdrawal of environment plan
Incidents, reports and records		
Regulation 28 – Notifying reportable incidents	The operator of an activity must notify the Minister of a reportable incident orally or in writing.	A fine of \$5,500
Regulation 29 – Written report of reportable incidents	The operator of an activity must submit a written report of a reportable incident.	A fine of \$5,500
Regulation 30 – Written report of recordable incidents	The operator of an activity must, for each month, submit a written report of recordable incidents.	A fine of \$5,500
Requirements relating to emissions and discharges		
Regulation 33 – Discharge, injection or re-injection of produced formation water resulting from petroleum activities	The operator of a petroleum activity must ensure that petroleum in any produced formation water does not exceed the following concentrations (the specified concentration) – (a) for produced formation water discharged into the sea as a result of the petroleum activity – an average of 30 mg/L over any period of 24 hours. (b) for produced formation water injected or re-injected into wells as a result of the petroleum activity – the maximum permissible concentration specified in the environment plan for the petroleum activity.	A fine of \$5,500
Regulation 34(2) – Monitoring and reporting on emissions and discharges	The operator of an activity must monitor all emissions and discharges to any land, air, marine, seabed, sub-seabed, groundwater, sub-surface or inland waters environment that occur in the course of the activity (whether during normal operations or otherwise) and are specified in the environment plan for the activity.	A fine of \$5,500
Regulation 34(4) – Emissions and discharges equipment testing	The operator of an activity must conduct tests to assess the performance of the monitoring equipment used to monitor emissions and discharges.	A fine of \$5,500
Regulation 34(6) – Recording emissions and discharges: results	The operator of an activity must record the results of the monitoring and the results of the testing of the monitoring equipment.	A fine of \$5,500
Regulation 34(7) – Submission of a report on emissions and discharges	The operator of an activity must, for each reporting period, submit a written report to the Minister of emissions and discharges.	A fine of \$5,500
Regulation 35 – Application of chemical dispersant to oil spills	A person must not apply chemical dispersant to an oil spill that has arisen as a result of an activity unless the Minister, or the appropriate hazard management agency prescribed under the <i>Emergency Management Act 2005</i> , has given written consent to the application of chemical dispersant and it is done in compliance with any specified conditions.	A fine of \$10,000
Petroleum and Geothermal Energy Resources (Management of Safety) Regulations 2010		
Safety management systems		
Regulation 5 – Safety management system required for petroleum or geothermal energy operation	A person must not engage in an operation unless there is a safety management system in force for the operation.	A fine of \$8,800

Table 3. Enforcement actions and penalties administered by DMP cont...

Legislation/Regulation	Action	Maximum Penalty*
Regulation 6 – New or increased risks	A person must not engage in an operation if – (a) a significant new risk to safety or health, or a significant increase in an existing risk to safety or health, arises or is likely to arise from the operation, and (b) the new risk or increased risk is not provided for in the safety management system.	A fine of \$8,800
Regulation 7(1) – Compliance with safety management system	A person who engages in an operation must do so in accordance with the safety management system in force for the operation.	A fine of \$8,800
Regulation 9 – Maintaining records for safety management systems	The operator of an operation must ensure that all documents required to be kept, are done so in the manner set out in the safety management system.	A fine of \$3,300
Contents of safety management system		
Regulation 21(2) – Safety management system for drilling operations	The safety management system for a drilling operation must describe the means by which the operator will ensure (among other things) that – (a) drilling and associated equipment that was last used outside this State is not used to drill a well in this State unless it has been inspected by a suitably qualified and competent independent person. (b) drilling and associated equipment is inspected by a suitably qualified and competent independent person every two years. (c) drilling and associated equipment is not used to drill a well unless it has been inspected by or on behalf of the operator or the drilling contractor who proposes to drill the well. (d) a well is not drilled within a drilling operation is not carried out unless the drilling rig is equipped with a penetration rate recorder that – (i) is able to give a clear indication of a change in formation (ii) is able to detect when the drill is approaching an area of abnormal pressure (iii) operates continuously during the drilling process; and is maintained in good working order.	A fine of \$8,800
Petroleum Pipelines (Management of Safety Pipeline Operations) Regulations 2010		
Safety cases		
Regulation 5 – Safety case required for pipeline operation	A person must not engage in a pipeline operation unless there is a safety case in force for the operation.	A fine of \$8,800
Regulation 6 – New or increased risks	A person must not engage in a pipeline operation if a significant new risk to safety or health, or a significant increase in an existing risk to safety or health, arises or is likely to arise from the operation and the new risk or increased risk is not provided for in the safety case in force for the operation.	A fine of \$8,800

Table 3. Enforcement actions and penalties administered by DMP cont...

Legislation/Regulation	Action	Maximum Penalty*
Regulation 7 – Compliance with safety case	A person who engages in a pipeline operation must do so in accordance with the safety case in force for the operation.	A fine of \$8,800
Regulation 9 – Maintaining records for safety cases	A licensee for a pipeline operation must ensure that all documents for the operation required to be kept, are done so in the manner set out in the safety case.	A fine of \$3,300
Regulation 12 – Standards to be applied	The safety case for a pipeline operation must specify the Australian and international standards that apply in relation to the operation and plant used in connection with the operation.	A fine of \$8,800
Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015		
Approval to undertake activities		
Regulation 5 – Requirement for approval of survey	An instrument holder commits an offence if they undertake a survey in an instrument area and they do not have the approval of the Minister to undertake the survey.	A fine of \$10,000
Regulation 10 – Requirement to have approved well management plan	A title holder commits an offence if they undertake a well activity in a title area and they do not have an approved well management plan in force.	A fine of \$10,000
Regulation 11 – Requirement to undertake well activity in accordance with approved well management plan	A title holder commits an offence if the title holder undertakes a well activity in a title area and the well activity is regulated by one or more requirements of an approved well management plan and it is not undertaken in accordance with a requirement of the plan for the activity.	A fine of \$10,000
Regulation 20 – Application for approval of revision required in certain circumstances	A title holder must make an application for approval of a revision if any of the following circumstances exists – (a) a change in the understanding of the geology or underground formation that may have a significant impact on the integrity of a well or a well activity to which the approved well management plan relates; (b) the occurrence or potential occurrence of a significant new detrimental risk to or effect on the integrity of a well or a well activity to which the approved well management plan relates; (c) a significant increase in a detrimental risk to or effect on the integrity of a well or a well activity to which the approved well management plan relates.	A fine of \$10,000
Regulation 27 – Title holder required to comply with notice	The title holder must comply with the requirements of the Minister's notice to revise the plan.	A fine of \$10,000
Regulation 29 – Reasons for withdrawal or approval	The Minister may withdraw approval of a title holder's well management plan if – (a) the title holder has not complied with the Act, this Part or a direction given under section 95 of the Act, (b) the title holder has not complied with the plan, (c) the Minister is satisfied for any other reason that approval of the plan should be withdrawn.	Withdrawal of the well management plan

Table 3. Enforcement actions and penalties administered by DMP cont...

Legislation/Regulation	Action	Maximum Penalty*
Control of hazards and risks		
Regulation 33 – Requirement to control well integrity hazard or risk	<p>A title holder commits an offence if –</p> <ul style="list-style-type: none"> (a) the title holder is operating a well in a title area, and; (b) either – <ul style="list-style-type: none"> (i) a well integrity hazard has been identified for the well, or (ii) there has been a significant increase in an existing risk for the well, and; (c) the title holder does not control the well integrity hazard or risk. 	A fine of \$10,000
Regulation 37 – Requirement to provide annual assessment report	<p>A title holder must give the Minister a report (an annual assessment report) providing the required information for each year of a term of the title within –</p> <ul style="list-style-type: none"> (a) 30 days after the day on which the year of the term ends, or; (a) if the Minister authorises the title holder to give the annual assessment report within another period – the other period. 	A fine of \$10,000
Regulation 41 – Requirement to have an approved field management plan	<p>A petroleum licensee must not undertake the recovery of petroleum from a petroleum pool in the licence area unless –</p> <ul style="list-style-type: none"> (a) the recovery is on an appraisal basis, (b) at the time of the recovery of the petroleum, the licensee has – <ul style="list-style-type: none"> (i) an approved field management plan in force for a field that includes the petroleum pool; or (ii) an approval, under regulation 59(1), to undertake the recovery of petroleum without an approved field management plan. 	A fine of \$10,000
Regulation 42 – Requirement to undertake well activity in accordance with approved field management plan	<p>If an approved field management plan is in force for a field in a licence area, the petroleum licensee must undertake each well activity in the licence area in a way that is consistent with the field management plan.</p>	A fine of \$10,000
Regulation 62 – Requirement to notify Minister of significant event	<p>The licensee must give the Minister oral notice of a significant event as soon as practicable, but in any case within two hours, after becoming aware of it.</p> <p>A significant event is –</p> <ul style="list-style-type: none"> (a) a change in the understanding of the characteristics of the geology or underground formation that may have a significant impact on the optimum long-term recovery of petroleum or geothermal energy. (b) a new or increased risk to the recovery of petroleum or geothermal energy within the licence area. (c) a new or increased risk to the recovery of petroleum or geothermal energy outside the licence area caused by the development of petroleum pools or geothermal resources areas in the licence area. (d) a new or increased risk of activities in the licence area causing effects outside the licence area (for example, aquifer depletion caused by hydrocarbon extraction). (e) a change to the proposed option for development of petroleum pools or geothermal resources areas in the licence area, including any tie-in opportunity with nearby licence areas. 	A fine of \$10,000

Table 3. Enforcement actions and penalties administered by DMP cont...

Legislation/Regulation	Action	Maximum Penalty*
Regulation 62(4) – Requirement to notify Minister of a significant event in writing	The licensee must give the Minister written notice of the significant event, in accordance with sub-regulation (5), as soon as practicable, but in any case within three days, after becoming aware of it.	A fine of \$10,000
Regulation 72 – Daily well activity report	An instrument holder commits an offence if the instrument holder – (a) undertakes a well activity in an instrument area on a particular day (the activity day) and; (b) does not give the Minister a daily activity report in respect of the activity day before midday on the day after the activity day.	A fine of \$7,000
Regulation 73 – Final well activity report and data	An instrument holder commits an offence if the instrument holder – (a) undertakes a well activity (other than a drilling operation) in an instrument area (b) does not give the Minister a final activity report and all final activity data within – (i) 6 months after the completion date for the well activity as approved by the Minister; or (ii) if the Minister authorises the instrument holder to give the report and data within another period – the other period.	A fine of \$7,000
Regulation 74 – Well completion report and data	An instrument holder commits an offence if the instrument holder – (a) undertakes a well activity in an instrument area (b) does not give the Minister a well completion report and all well completion data within – (i) 12 months after the rig release date; or (ii) if the Minister authorises the instrument holder to give the report and data within another period – the other period.	A fine of \$7,000
Regulation 75 – Weekly survey report	An instrument holder commits an offence if the instrument holder – (a) undertakes a survey in an instrument area; and (b) does not give the Minister a weekly survey report within 24 hours the end of each week of survey.	A fine of \$7,000
Regulation 76 – Survey acquisition report and data	An instrument holder commits an offence if the instrument holder – (a) undertakes a survey in an instrument area; and (b) does not give the Minister a survey acquisition report and all survey acquisition data within – (i) 18 months after the day on which the acquisition of the data is completed; or (ii) if the Minister authorises the instrument holder to give the report and data within another period – the other period.	A fine of \$7,000
Regulation 79 – Monthly production report from licensee	A licensee commits an offence if the licensee does not give the Minister a monthly production report for a licence area within the period – (a) starting on the last day of the month to which the report relates; and (b) ending 15 days after that day.	A fine of \$7,000

* NOTE: Section 40 of the *Sentencing Act 1995* has the effect that, on conviction of an offence, a body corporate is liable to a fine that is five times the maximum fine that could be imposed on a natural person convicted of the same offence, unless the offence expressly provides for a statutory penalty for a body corporate

6.2 Other health administered regulations

When requested, DoH provides advice to other agencies, principally DMP, DER and EPA, in relation to potential health impacts from major projects throughout Western Australia and makes recommendations to identify, monitor and address potential health risks.

The Radiological Council of Western Australia has powers in relation to the activities involving radioactive materials. In some cases, the processing of materials in the oil and gas industry may be associated with a build-up of naturally occurring radioactive material. Oil and gas projects that involve the processing of materials may require approval from the Radiological Council.

6.2.1 Regulations

The Radiological Council administers the Radiation Safety (General) Regulations 1983 and Radioactive Safety (Transport of Radioactive Substances) Regulations 2002, established under the *Radiation Safety Act 1975*.

This is additional to radiation safety regulation under the *Mines Safety and Inspection Act 1994* and the Resource Management and Administration Regulations 2015, administered by DMP.

6.2.2 Approvals

In cases where the Radiation Safety (General) Regulations 1983 apply, the Radiological Council will require operators to adhere to approved Radiation Management Plans.

6.2.3 Enforcement

In instances where operators fail to meet the requirements prescribed in the Radiation Safety (General) Regulations, the approved Radiation Management Plan and the Radiation Safety (Transport of Radioactive Substances) Regulations 2002, the Radiological Council administers a range of enforcement actions and penalties. Table 4 summarises the actions available to DoH to address compliance failures and penalties that may apply in cases of serious or ongoing non-compliance; Table 5 summarises the same for the Radiological Council.

Table 4. Enforcement actions and penalties administered by DoH.

Legislation/Regulation	Action	Maximum Penalty*
Health Act 1911		
Section 129 – Pollution of water supply	Any person who defiles or pollutes any water supply or the catchment area thereof or permits or suffers any water supply or the catchment area thereof to become defiled or polluted. (Water supply – contains water intended or available for human consumption).	A fine not more than \$10,000 and not less than: <ul style="list-style-type: none"> \$1,000 (1st offence) \$2,000 (2nd offence) \$5,000 (3rd & subsequent offences) or imprisonment for 12 months. A daily penalty of not more than \$1,000 and not less than \$500 (continuing offences)
Health Act (Underground Water Supply) Regulations 1959		
Section 13 – Deposit of sewage, etc. near wells	A person shall not deposit on, in or under any land any sewage or offensive matter, or any other substance or thing, that may pollute or render unfit for human consumption the water in any well or other underground source of water supply, which water is used or intended or likely to be used for human consumption.	A fine not more than \$1,000 and not less than: <ul style="list-style-type: none"> \$100 (1st offence) \$200 (2nd offence) \$500 (3rd & subsequent offences) A daily penalty of not more than \$100 and not less than \$50 (continuing offences)

* NOTE: Section 40 of the *Sentencing Act 1995* has the effect that, on conviction of an offence, a body corporate is liable to a fine that is five times the maximum fine that could be imposed on a natural person convicted of the same offence, unless the offence expressly provides for a statutory penalty for a body corporate

Table 5. Enforcement actions and penalties administered by Radiological Council.

Legislation/Regulation	Action	Maximum Penalty*
Radiation Safety Act 1975		
Section 48 – Offences as to inspections, etc. Section 52 – Offences	A person who contravenes any provision of the Act or does not do that which, by or under this Act, he is required or directed to do, commits an offence against this Act.	A fine of \$1,000 A daily fine of \$50
Radiation Safety (General) Regulations 1983		
Various Sections	A person who commits an offence against these regulations.	A fine of \$1,000 A daily fine of \$50
Radiation Safety (Transport of Radioactive Substances) Regulations 2002		
Section 5 (3)	A person who does not submit a radiation protection programme to the Council as required by subregulation (1) before 3 months elapses after the person becomes a carrier commits an offence.	A fine of \$1,000 A daily fine of \$50
Section 5 (5)	A carrier must comply with a requirement under subregulation (4) within 3 months after the requirement was given or any further time allowed by the Council.	A fine of \$1,000 A daily fine of \$50
Section 6	A person shall not deal with radioactive materials that are for transport unless the person does so in accordance with the Code.	A fine of \$1,000
Section 6	A person shall not store, pack or stow radioactive materials for transport unless the person does so in accordance with the Code.	A fine of \$1,000
Section 6	A person who is not the consignee of a consignment shall not interfere with the contents of that consignment.	A fine of \$1,000
Section 6	A person shall not interfere with or alter any marking, labelling or placarding that has been applied in accordance with the Code.	A fine of \$1,000
Section 6	A person shall not display, or permit to be displayed, on a package, overpack or freight container that does not contain radioactive material, a label referred to in Section V paragraph 542 of the International Regulations.	A fine of \$1,000

* NOTE: Section 40 of the *Sentencing Act 1995* has the effect that, on conviction of an offence, a body corporate is liable to a fine that is five times the maximum fine that could be imposed on a natural person convicted of the same offence, unless the offence expressly provides for a statutory penalty for a body corporate

6.3 Department of Water administered regulations

DoW enforces regulations specific to the allocation, management and protection of water resources relating to petroleum activities and projects throughout Western Australia, including shale and tight gas resources. In addition to enforcing ALARP, DoW assesses risks to ensure mitigating measures are in place to protect water resources.

6.3.1 Regulations

The following regulations provide the rules and directions supporting the *Country Areas Water Supply Act 1947*, *Rights in Water and Irrigation Act 1914* and the *Waterways Conservation Act 1976*, administered by DoW.

- Country Areas Water Supply By-laws 1957.
- Country Areas Water Supply (Clearing Licence) Regulations 1981.
- Rights in Water and Irrigation Regulations 2000.
- Waterways Conservation Regulations 1981.
- Metropolitan By-laws.

These regulations aim to ensure that Western Australia water needs and economic growth requirements are met. This includes allocation of water to resource projects within ecologically sustainable limits and protecting water resources, including public drinking water, from the potential impacts of human or industrial activities.

6.3.2 Approvals

Where required, the Department of Water may issue licences or permits for the completion of water wells, interference with bed and banks permits and licences to take water. These incorporate binding conditions established in a number of technical plans and policies. DoW also administers mechanisms for the overarching management and protection of water resources.

6.3.2.1 Water Well Construction Licence

Water Well Construction Licences prescribe conditions relating to the construction of water bores or wells within proclaimed groundwater or surface water resources and all artesian resources. The construction details and advice as to where water will be taken must be provided to DoW and will be binding on operators.

6.3.2.2 Water Licence

Water Licences prescribe conditions relating to the taking of water from proclaimed groundwater or surface water

resources and artesian well. As most of the State is proclaimed for either ground and/or surface water, a project involving hydraulic fracture stimulation in such an area requires a licence to abstract a specified volume of water.

6.3.2.3 Permit to Interfere with the Bed and Banks of a Watercourse

These permits follow assessment of any activity or work that may disturb, destroy or interfere with the bed and banks or flow of a watercourse within a proclaimed surface water resource. DoW may refuse to issue a permit if the activity cannot be made acceptable to DoW. Where issued, permits may bind operators to certain conditions and restrictions.

6.3.3 Plans, policies and reports

The regulatory mechanisms above incorporate conditions established in the following plans, policies and reports:

6.3.3.1 Public Drinking Water Source Areas (PDWSAs)

DoW identifies, proclaims and manages PDWSAs to protect the quality of water sourced by drinking service providers.

6.3.3.2 Drinking Water Source Protection Plans

These reports developed by DoW identify the potential risks to water quality and public health in a PDWSA and how these are managed.

6.3.3.3 Water Quality Protection Notes

Developed by DoW, these notes outline best management practices for a variety of activities to limit the risk of water contamination to acceptable levels.

6.3.3.4 Water Allocation Plans

Developed by the DoW, these plans outline the availability of water in a given area of the State and policies related to its access and use.

6.3.3.5 Water Policies

Developed by DoW, these policies describe how the various provisions of the *Rights in Water and Irrigation Act 1914* are to be implemented.

6.3.4 Enforcement

Where operators fail to meet the requirements prescribed in the regulations and mechanisms above or otherwise break a law administered by DoW, a range of enforcement actions and penalties may apply. Table 6 summarises some of the actions available to DoW to address non-compliance with the regulations, approved plans and permits.

Table 6. Enforcement actions and penalties administered by DoW.

Legislation/Regulation	Action	Maximum Penalty*
<i>Rights in Water and Irrigation Act 1914</i>		
Section 5C(1)	Unauthorised taking of water.	A fine of \$10,000 and a daily penalty of \$1,000
Section 17	Obstruction, destruction or interference with a watercourse.	A fine not exceeding \$10,000
Section 22	If a person who has been given a Ministerial Notice diverts, takes or uses water contrary to the direction.	A fine not exceeding \$4,000 and a daily fine of \$400
Section 25	Obstruction, destruction or interference with watercourse on Crown land prohibited.	A fine not exceeding \$10,000
Section 26A	Failure to licence an artesian well.	A fine not exceeding \$10,000 and a daily penalty of \$1,000
Section 26B	Failure to licence non-artesian well in certain area.	A fine not exceeding \$10,000 and a daily penalty of \$1,000
Section 26E	Failure to provide information regarding construction or deepening of a non-artesian well.	A fine of \$1,000
Section 26F	Unauthorised altering of any licensed well or contravention of any well licence.	A fine not exceeding \$10,000 and a daily penalty of \$1,000; Minister may also cancel the licence
Section 26G	Failure to comply with a 26G Ministerial Notice.	A fine of \$5,000 and a daily fine of \$500; Minister may also cancel the licence
Section 26GC	Take, use or cause or permit, take or use after being served with a Ministerial Notice under S26GC that restricts or prohibits the take / use of water.	A fine of \$4,000 and a daily fine of \$400
Section 26O	Breaching by-laws that prohibit in regards to the control of drainage.	A fine not exceeding \$5,000 and a daily fine of \$500
Section 26P	Breaching by-laws that prohibit in regards to flood protection works.	A fine not exceeding \$5,000 and a daily fine of \$500
Section 26P	Breaching any other by-law in regards to flood protection works.	A fine not exceeding \$2,000 and a daily fine of \$200
Section 27A	Engaging in any work or activity that has been prohibited by the regulations, unless the person is authorised to do so.	A fine not exceeding \$10,000 and a daily fine of \$1,000
Section 27A	Breaching any other regulation requiring certain work or activities be licensed.	A fine not exceeding \$2,000 and a daily fine of \$200
Section 70	Obstructing authorised persons in performance of duty.	A fine not exceeding \$5,000
Section 71	Refusing to give up possession of works vested in or under the control of the Crown.	A fine of \$10,000
Section 72	Any offence against the Act if no other penalty is imposed.	A fine not exceeding \$10,000

Table 6. Enforcement actions and penalties administered by DoW cont...

Legislation/Regulation	Action	Maximum Penalty*
Schedule 1, Clause 18	Failure to comply with any term, condition or restriction in a licence.	A fine of \$2,500 and a daily fine of \$250. The Minister may also recover the costs and expenses incurred as a debt due by the licensee
Schedule 1, Clause 46	Failure to maintain meter in good condition.	A fine of \$2,000
Rights in Water and Irrigation Regulations 2000		
Regulation 13(4)	Failure to return a suspended or cancelled permit.	A fine of \$2,000
Regulation 16	Failure to notify the Minister of change of ownership.	A fine of \$250
Regulation 18	Failure to comply with a Ministerial direction regarding a permit condition.	A fine of \$2,000 and a daily fine of \$200
Regulation 25	Failure to inform Minister if licensee no longer eligible to hold a licence.	A fine of \$1,000
Regulation 29	Failure of licensee to return licence within 7 days on suspension or cancellation under clause 25 by the Minister.	A fine of \$2,000
Regulation 41	Failure to return a cancelled licence to the Minister within 7 days.	A fine of \$2,000
Regulation 43	Interfering with a meter.	A fine of \$2,000
Regulation 55	Unauthorised alteration of an infringement notice.	A fine of \$200
Regulation 57	Provision of false or misleading information in respect of applications.	A fine of \$2,000
Country Areas Water Supply Act 1947		
Section 11A	Diverting water within any catchment area or water reserve.	A fine of \$10,000 (for an individual) or \$20,000 (for a body corporate)
Section 12B	Unauthorised clearing of controlled land.	A fine not exceeding \$2,000
Section 112	Obstructing Minister or officers or authorised persons in performance of duty.	A fine of \$5,000
Section 113	Refusing to give up possession of works vested in or under the control of the Crown.	A fine of \$10,000
Waterways Conservation Act 1976		
Section 46	Contravenes or fails to comply with any condition endorsed upon or attached to the licence.	A fine not exceeding \$200 and a daily fine of \$25
Section 50	Fails or neglects to comply with provisions of an order.	A fine not exceeding \$200 and a daily fine of \$25
Section 65	A person who wilfully obstructs any person acting in the execution of this Act commits an offence against this Act.	A fine of \$500
Waterways Conservation Regulations 1981		
Regulation 8(1)(d) and (h)	Certain acts are prohibited in relation to waters. In regards to drains and any structure intended to impede or alter the flow of any waters.	A fine of \$500
Regulation 8(1)	Certain acts are prohibited in relation to waters. All other circumstances.	A fine of \$200

Table 6. Enforcement actions and penalties administered by DoW cont...

Legislation/Regulation	Action	Maximum Penalty*
Regulation 9	A person shall not – construct or permit the construction of, any boat ramp, slip, bridge, jetty, boat house, pier, decking, or any other structure, whether floating or otherwise, in, over or contiguous with any waters; or construct a retaining wall at a bank of any waters, or fill in, wholly or partially, or dredge any portion of the bed of any waters, or cut into, build up or otherwise alter the bank or foreshore of any waters, or dig or excavate on associated land so as to endanger the stability or integrity of the banks or foreshore of any waters, or with the intention of causing any of the waters to be diverted into the place so dug or excavated, except pursuant to and in accordance with a current licence issued under the Act.	A fine of \$500 and a daily fine of \$50
Regulation 10	A person removing a structure referred to in regulation 9 in the case of a retaining wall or other structure the removal of which may impair the stability of, or damage, a part of the bank – must first obtain the written permission of the Minister and then carry out the removal in accordance with any conditions attached thereto.	A fine of \$200
Regulation 10	A person removing a structure referred to in regulation 9 in any other case must notify the Minister within 7 days of such removal.	A fine of \$100
Metropolitan Water Supply, Sewerage and Drainage Act 1909		
Section 16	Unauthorised taking of water within a water reserve or catchment area.	A fine not exceeding \$100 for each day during which that water is so diverted or taken
Section 57B	Any breach of by-laws made for pollution areas.	A fine not exceeding \$200 (first breach) A fine not exceeding \$10 (each day of a continuing breach after Minister serves notice on the offender)
Section 156	Obstructing Minister, officers or authorised person in performance of duty.	A fine of \$5,000
Section 157	Refusing to give up possession of certain property.	A fine of \$10,000
Section 158A	A person who is guilty of an offence against this Act or the by-laws and no penalty is expressly provided.	A fine not exceeding \$10,000
Metropolitan Water Supply, Sewerage and Drainage By-laws 1981		
By-law 31.4.1	A person committing a breach of any of the provisions of the by-laws.	A fine not exceeding \$200
By-law 31.4.2	A continuing breach of any of the provisions of the by-laws.	A fine not exceeding \$50 for each day the breach continues after notice has been given by the Minister or the CEO

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6.4 Department of Parks and Wildlife administered regulations

Parks and Wildlife manages national parks, nature reserves and other natural areas to conserve and protect Western Australia's native flora and fauna. Parks and Wildlife provides advice to regulatory agencies in relation to these natural areas and values.

6.4.1 Regulations

DPaW administers regulations potentially relevant to shale and tight gas projects created under the following legislation:

- *Conservation and Land Management Act 1984*.
- *Wildlife Conservation Act 1950*.

Regulations include:

- Conservation and Land Management Regulations 2002.
- Forest Management Regulations 1993.

6.4.2 Approvals

Operators of shale or tight gas projects are subject to regulations administered by Parks and Wildlife through licences and permits issued in relation to protected plants and animals and activities undertaken on lands and waters managed under the *Conservation and Land Management Act 1984*.

6.4.2.1 Declared Rare Flora

Written consent of the Minister for Environment is required to 'take' (disturb in any way through direct or indirect means) flora that is declared as rare flora, under section 23F of the *Wildlife Conservation Act 1950*. DPaW and/or the Minister will seek to minimise the impact on declared rare flora to provide for its conservation. The habitat of declared rare flora should be avoided.

6.4.2.2 Specially protected fauna

Fauna gazetted by the Minister for Environment as threatened fauna under section 14(4) of the *Wildlife Conservation Act 1950* are specially protected. Licence applications to take (disturb or interact in any way) under the *Wildlife Conservation Act 1950* are assessed by DPaW with the objective of ensuring the conservation of the species. The habitat of threatened fauna should be avoided.

6.4.2.3 Threatened Ecological Communities

Ecological communities defined and declared by the Commonwealth Minister for Environment under the *Environment Protection and Biodiversity Conservation Act 1999* as Threatened Ecological Communities are regarded as being of specific conservation value. The conservation of threatened ecological communities is included in Environmental Impact Assessment under Part IV and V of the *Environmental Protection Act 1986*. Threatened ecological communities should be avoided.

6.4.3 Enforcement

Table 7 summarises the enforcement actions and penalties available to DPaW to address compliance failures, and penalties that may apply in cases of serious or ongoing breaches of DPaW-administered regulations.

Table 7. Enforcement actions and penalties administered by DPaW.

Legislation/Regulation	Action	Maximum Penalty*
Wildlife Conservation Act 1950		
Section 16(1)	Take protected fauna without licence or authority.	A fine not exceeding \$4,000
Section 16(1) & 14(4)	Take of specially protected fauna, including taking incidental to clearing referred to in Section 51C(a), (b) or (c) of the <i>Environmental Protection Act 1986</i> .	A fine not exceeding \$10,000
Section 16A(1)	Possession of protected fauna not lawfully taken.	A fine not exceeding \$4,000
Section 16A(1) & 14(4)	Possession of specially protected fauna not lawfully taken.	A fine not exceeding \$10,000
Section 23B(1)	Taking protected flora.	A fine not exceeding \$4,000
Section 23F(6)	Taking rare flora.	A fine not exceeding \$10,000
Section 25(1)(g)	Fail to comply with conditions of a licence.	A fine not exceeding \$4,000
Conservation and Land Management Act 1984		
Section 106(c)	Without authority of a licence etc clear or break up CALM land for any purpose.	A fine not exceeding \$4,000
Conservation and Land Management Regulations 2002		
Regulation 8(1)	Without lawful authority, take flora or fauna on CALM land.	A fine not exceeding \$2,000
Regulation 30(1)	Without lawful authority, take or interfere with water on CALM land.	A fine not exceeding \$2,000
Regulation 31(1)	Without lawful authority, damage any naturally occurring feature on CALM land.	A fine not exceeding \$2,000
Regulation 35	Without lawful authority, clear any CALM land for a road, track etc.	A fine not exceeding \$2,000
Regulation 35A	Without lawful authority, disturb or remove soil, stone, gravel etc. on CALM land.	A fine not exceeding \$2,000

* NOTE: Section 40 of the *Sentencing Act 1995* has the effect that, on conviction of an offence, a body corporate is liable to a fine that is five times the maximum fine that could be imposed on a natural person convicted of the same offence, unless the offence expressly provides for a statutory penalty for a body corporate

6.5 Other environmental administered regulations

DER regulates emissions and discharges from prescribed premises, which may include shale and tight gas activities, to prevent pollution and environmental harm. Emissions include noise, odour, electromagnetic radiation, or discharge of waste. Waste includes liquid, solid, gaseous or radioactive matter which is discharged to the environment. DER also administers provisions for the clearing of native vegetation.

In addition, OEPA has a regulatory role in monitoring and enforcing compliance with any Ministerial conditions imposed on registered holders as part of their project approvals.

6.5.1 Regulations

DER administers a number of pieces of regulation created under the powers of the *Environmental Protection Act 1986* (Part V) and the *Contaminated Sites Act 2003*. OEPA's powers in relation to Ministerial conditions are established in Part IV of the *Environmental Protection Act 1986*. Regulations potentially relevant to shale and tight gas projects include the following.

- Environmental Protection Regulations 1987.
- Environmental Protection (Controlled Waste) Regulations 2004.
- Environmental Protection (Noise) Regulations 1997.
- Environmental Protection (Unauthorised Discharges) Regulations 2004.

6.5.2 Approvals

DER grants licences and approvals under the *Environmental Protection Act 1986* relating to prescribed premises, which may include certain shale or tight gas facilities. These licences and approvals can apply also to related infrastructure such as gas pipelines.

6.5.2.1 Works approval

A works approval is required to undertake any works that would cause a premises to become or become capable of being a prescribed premises. This is likely to apply to the construction phase of a shale or tight gas production facility which is a prescribed premises.

6.5.2.2 Part V Division 3 licence

A licence under Part V Division 3 prevents, controls, abates and mitigates pollution and environmental harm for a facility that is a prescribed premises.

6.5.2.3 Controlled waste licence

DER regulates the transportation of controlled waste on roads in Western Australia through the Environmental Protection (Controlled Waste) Regulations 2004. The regulations provide for the licensing of carriers, drivers, and vehicles involved in transporting controlled waste.

6.5.3 Enforcement

Table 8 summarises the key offences and penalties that may apply in cases of serious or ongoing non-compliance.

Table 9 summarises the actions available to OEPA to address compliance failures and penalties that may apply in cases of serious or ongoing breaches of Part IV.

Table 8. Enforcement actions and penalties administered by DER.

Legislation/Regulation	Action	Maximum Penalty*
Contaminated Sites Act 2003		
Section 11 – Reporting of known or suspected, contaminated sites	(a) An owner or occupier of a site; (b) a person who knows or suspects that they may have contributed to contamination of a site; or (c) an auditor engaged to provide a report under the Act, all have a duty to report a site that they know or suspect to be contaminated.	A fine of \$250,000 and a daily penalty of \$50,000
Section 11(7)	A person must not report a site maliciously and without reasonable grounds to believe or suspect that the site was contaminated.	A fine of \$250,000
Section 12 – Programme for reporting sites	A person who has had a programme for the reporting of sites that has been approved by the CEO must ensure that the sites are identified and reported in accordance with the programme and within the timeframe specified in the programme.	A fine of \$250,000 and a daily penalty of \$50,000
Remediation of contaminated sites		
Section 30 – Responsibility for remediation may be transferred	When seeking approval from the CEO to approve an agreement that transfers the responsibility for remediation of a site to another person or to the State, a person must not provide information or make a statement that the person knows is false or misleading.	A fine of \$250,000 and a daily penalty of \$50,000
Investigation, clean up and hazard abatement notices		
Section 43 – Notice to be complied with	A person bound by a clean up notice, a hazard abatement notice or an investigation notice, must comply with the notice within such time specified in the notice.	A fine of \$500,000 and a daily penalty of \$100,000
Provisions relating to remediation and notices		
Section 54 – Where entry to a site, or the taking of action, to comply with notice or to remediate refused	An owner or occupier of land commits an offence if without reasonable cause the occupier or owner refuses permission for the person who is responsible for remediation of a site to enter the land to take any action necessary to remediate.	A fine of \$500,000 and a daily penalty of \$100,000
Section 54(5)	If the committee is making a decision whether the occupier or owner of land is to be the person responsible for remediation and the committee requests additional information, a person must comply with this request within the specified time and must not provide information or make a statement that the person knows is false or misleading.	A fine of \$250,000 and a daily penalty of \$50,000
Disclosure regarding contamination and exemption certificates		
Section 68 – Disclosure required to potential owners of certain land before change of ownership occurs	At least 14 days before a completion of a transaction which would result in another person becoming an owner, mortgagee or lessee of land that has been classified as: (i) contaminated – remediation required; (ii) contaminated – restricted use; (iii) remediated for restricted use, each owner of the land must give written disclosure to the CEO and to each person who would become an owner, mortgagee or lessee as a result of the transaction.	A fine of \$125,000 and a daily penalty of \$25,000

Table 8. Enforcement actions and penalties administered by DER cont...

Legislation/Regulation	Action	Maximum Penalty*
Contaminated sites auditors		
Section 70 – Authority of accredited auditor	An auditor must not carry out any duty or imply that they are authorised to carry out any duty that is not authorised by the Act.	A fine of \$125,000 and a daily penalty of \$25,000
Section 71 – Offences relating to accreditation	A person must not obtain or attempt to obtain accreditation as an auditor by providing information that the person knows is false or misleading, by failing to disclose information that the persons knows is relevant or by providing information with a reckless disregard as to whether is it false or misleading.	A fine of \$125,000
Section 71(1)(b)	A person who is not accredited as an auditor must not advertise or otherwise imply that they are accredited as an auditor.	A fine of \$125,000
Section 71(1)(d)	A person accredited as an auditor must not allow that authority to be used by another person.	A fine of \$125,000
Section 74 – Offences relating to mandatory auditor’s reports	A person must not provide information to an auditor in connection with a mandatory auditor’s report that the person knows is false or misleading; or provide information with reckless disregard as to whether the information is false or misleading; or fail to disclose all information that the person knows is relevant.	A fine of \$250,000
Section 74(2)	An auditor must not provide information in a mandatory auditor’s report that the auditor knows is false or misleading; or provide the information with reckless disregard as to whether it is false or misleading; or fail to disclose all information that the auditor knows is relevant.	A fine of \$250,000
General		
Section 93 – CEO may request information on wells	A person who has been requested by the CEO to provide information as to the existence of a well or the taking of underground water, must supply that information to the CEO within the time specified.	A fine of \$50,000 and a daily penalty of \$10,000
Section 94 – False or misleading information	(a) In making a report under section 11 or 12; (b) in making a request for a summary of records under section 21; (ba) in making a written submission to the committee under section 37(e); (c) in making a disclosure under section 64, 68 or 62; or (d) in purporting to comply with a requirement made under this Act to provide information. A person must not provide information which the person knows is false or misleading; or provide information with reckless disregard as to whether the statement is false or misleading; or fail to disclose all information that the person knows is relevant.	A fine of \$125,000 and a daily penalty of \$25,000
Section 95 – Victimisation	A person must not take any sort of detrimental action against another person including: threatening, intimidating harassing, due to the other person furnishing information for a purpose relating to the Act.	A fine of \$125,000 and a daily penalty of \$25,000
Section 96 – Confidentiality	A person subject to a duty of confidentiality must not record, disclose or make use of information obtained under this Act except in limited circumstances.	A fine of \$125 000 and a daily penalty of \$25,000

Table 8. Enforcement actions and penalties administered by DER cont...

Legislation/Regulation	Action	Maximum Penalty*
Environmental Protection Act 1986		
Section 49(2) – Pollution with intent or criminal negligence	A person who intentionally or with criminal negligence (a) causes pollution; or (b) allows pollution to be caused, commits an offence.	A fine of \$500,000 for individual or five years imprisonment or both Daily penalty: \$100,000 A fine of \$1,000,000 for body corporate Daily penalty: \$200,000
Section 49(3) – Pollution	A person who causes or allows pollution to be caused commits an offence.	A fine of \$250,000 for individual or three years imprisonment or both Daily penalty: \$50,000 A fine of \$500,000 for body corporate Daily penalty: \$100,000
Section 49(4) – Unreasonable emission with intent or criminal negligence	A person who intentionally or with criminal negligence (a) emits an unreasonable emission from any premises; or (b) causes an unreasonable emission to be emitted from any premises, commits an offence.	A fine of \$125,000 for individual Daily penalty: \$25,000 A fine of \$250,000 for body corporate Daily penalty: \$50,000
Section 49(5) – Unreasonable emission	A person who emits an unreasonable emission from any premises; or causes an unreasonable emission to be emitted from any premises commits an offence.	A fine of \$62,500 for individual Daily penalty: \$12,500 A fine of \$125,000 for body corporate Daily penalty: \$25,000
Section 49A(2) – Dumping waste in water	A person who discharges or abandons, or causes or allows to be discharged or abandoned, any solid or liquid waste in water to which the public has access commits an offence.	A fine of \$62,500 for individual A fine of \$125,000 for body corporate
Section 49A(3) – Dumping waste other than in water	A person who discharges or abandons, or causes or allows to be discharged or abandoned, any solid or liquid waste on or in any place, other than water to which the public has access, commits an offence.	A fine of \$62,500 for individual A fine of \$125,000 for body corporate
Section 50(1) – Discharging waste likely to cause pollution with intent or criminal negligence	A person who intentionally or with criminal negligence — (a) causes waste to be placed; or (b) allows waste to be placed, in any position from which the waste (c) could reasonably be expected to gain access to any portion of the environment; and (b) would in so gaining access be likely to result in pollution, commits an offence.	A fine of \$500,00 for individual Daily penalty: \$100,000 A fine of \$1,000,000 for body corporate Daily penalty: \$200,000

Table 8. Enforcement actions and penalties administered by DER cont...

Legislation/Regulation	Action	Maximum Penalty*
Section 50(2) – Discharging waste likely to cause pollution	A person who causes or allows waste to be placed in any position from which the waste — (a) could reasonably be expected to gain access to any portion of the environment; and (b) would in so gaining access be likely to result in pollution, commits an offence.	A fine of \$250,00 for individual Daily penalty: \$50,000 A fine of \$500,000 for body corporate Daily penalty: \$100,000
Section 50A(1) – Serious environmental harm with intent or criminal negligence	A person who, intentionally or with criminal negligence— (a) causes serious environmental harm; or (b) allows serious environmental harm to be caused, commits an offence.	A fine of \$500,000 for individual or five years imprisonment or both Daily penalty: \$100,000 A fine of \$1,000,000 for body corporate Daily penalty: \$200,000
Section 50A(2) – Serious environmental harm	A person who causes or allows serious environmental harm to be caused commits an offence.	A fine of \$250,000 for individual or three years imprisonment or both Daily penalty: \$50,000 A fine of \$500,000 for body corporate Daily penalty: \$100,000
Section 50B(1) – Material environmental harm with intent or criminal negligence	A person who, intentionally or with criminal negligence — (a) causes material environmental harm; or (b) allows material environmental harm to be caused, commits an offence.	A fine of \$250,000 for individual or three years imprisonment or both Daily penalty: \$50,000 A fine of \$500,000 for body corporate Daily penalty: \$100,000
Section 50B(2) – Material environmental harm	A person who causes or allows material environmental harm to be caused commits an offence.	A fine of \$125,000 for individual Daily penalty: \$25,000 A fine of \$250,000 for body corporate Daily penalty: \$50,000
Section 50D(2) – Conduct that might cause pollution or environmental harm	If the regulations require an authorisation to be held for conduct affecting the environment, a person who contravenes the regulations by — (a) engaging in that conduct without there being an authorisation in force in relation to it; or (b) engaging in that conduct in contravention of a condition to which an authorisation is subject, commits an offence.	A fine of \$50,000 for individual Daily penalty: \$10,000 A fine of \$100,000 for body corporate Daily penalty: \$20,000

Table 8. Enforcement actions and penalties administered by DER cont...

Legislation/Regulation	Action	Maximum Penalty*
Section 51 – Duties of occupiers as to emissions	The occupier of any premises who does not — (a) comply with any prescribed standard for an emission; and (b) take all reasonable and practicable measures to prevent or minimise emissions, from those premises commits an offence.	A fine of \$25,000 for individual and body corporates Daily penalty: \$5,000
Section 51C – Unauthorised clearing of native vegetation	A person who causes or allows clearing commits an offence unless the clearing — (a) is done in accordance with a clearing permit; or (b) is of a kind set out in Schedule 6; or (c) is of a kind prescribed for the purposes of this section and is not done in an environmentally sensitive area.	A fine of \$250,000 for individual Daily penalty: \$50,000 A fine of \$500,000 for body corporate Daily penalty: \$100,000
Section 51J(1) – Contravening clearing permit conditions	The holder of a clearing permit who contravenes a condition to which the permit is subject commits an offence.	A fine of \$62,500 for individual Daily penalty: \$12,500 A fine of \$125,000 for body corporate Daily penalty: \$25,000
Section 52 – Changing premises to become prescribed premises	The occupier of any premises who carries out any work on or in relation to the premises which causes the premises to become, or to become capable of being, prescribed premises commits an offence unless he does so in accordance with a works approval.	A fine of \$50,000 for individual Daily penalty: \$10,000 A fine of \$100,000 for body corporate Daily penalty: \$20,000
Section 53(1) – Changing premises to become prescribed premises	The occupier of any prescribed premises who, if to do so may cause an emission, or alter the nature or volume of the waste, noise, odour or electromagnetic radiation emitted, from the prescribed premises — (a) alters the method of operation of any trade, or of any process used in any trade, carried on at the prescribed premises; or (b) constructs, installs or alters any equipment on the prescribed premises for — (i) the storage, handling, transport or treatment of waste prior to, and for the purpose of, the discharge of waste; or (ii) the control of noise, odour or electromagnetic radiation prior to, and for the purpose of, the emission or transmission of noise, odour or electromagnetic radiation, into the environment; or (c) alters the type of materials or products used or produced in any trade carried on at the prescribed premises; or (d) alters the type of fuel used in any fuel burning equipment or industrial plant in any trade carried on at the prescribed premises; or (e) installs, alters or replaces any fuel burning equipment or industrial plant on the prescribed premises or carries out any work on the prescribed premises which is the beginning of, or any subsequent step in, that installation, alteration, replacement or carrying out, commits an offence unless he does so —	A fine of \$50,000 for individual A fine of \$100,000 for body corporate

Table 8. Enforcement actions and penalties administered by DER cont...

Legislation/Regulation	Action	Maximum Penalty*
	<ul style="list-style-type: none"> (f) in accordance with — <ul style="list-style-type: none"> (i) a works approval; or (ii) a licence; or (iii) a requirement contained in a closure notice or an environmental protection notice, as the case requires; or (g) only in the course of and for the purpose of general maintenance required to maintain the efficient operation of any pollution control equipment or procedure. 	
<p>Section 53(2) – Changing premises to become prescribed premises</p>	<p>The occupier of any prescribed premises who in or on the prescribed premises —</p> <ul style="list-style-type: none"> (a) carries out any work which is the beginning of, or any subsequent step in, any work referred to in subsection (1)(a) to (e) if the completion of the alteration, construction, installation or replacement concerned might cause an emission, or alter the nature or volume of the waste, noise, odour or electromagnetic radiation emitted, from the prescribed premises; or (b) constructs, relocates or alters any discharge or emission pipe, channel or chimney through which waste is or may be discharged into the environment from the prescribed premises or carries out any work which is the beginning of, or any subsequent step in, any such construction, relocation or alteration, <p>commits an offence unless he does so —</p> <ul style="list-style-type: none"> (c) in accordance with — <ul style="list-style-type: none"> (i) a works approval; or (ii) a licence; or (iii) a requirement contained in a closure notice or an environmental protection notice, as the case requires; or (d) only in the course of and for the purpose of general maintenance required to maintain the efficient operation of any pollution control equipment or procedure. 	<p>A fine of \$50,000 for individual</p> <p>A fine of \$100,000 for body corporate</p>
<p>Section 55(1) – Contravening works approval permit conditions</p>	<p>The occupier of any premises to which a works approval relates (in this section called the relevant premises) who contravenes any condition to which the works approval, or a suspension of the works approval, is subject commits an offence.</p>	<p>A fine of \$62,500 for individual</p> <p>Daily penalty: \$12,500</p> <p>A fine of \$125,000 for body corporate</p> <p>Daily penalty: \$25,000</p>
<p>Section 56 – Occupiers of prescribed premises to be licensed for emissions</p>	<p>The occupier of any prescribed premises who</p> <ul style="list-style-type: none"> (a) causes or increases, or permits to be caused or increased, an emission; or (b) alters or permits to be altered the nature of the waste, noise, odour or electromagnetic radiation emitted, from the prescribed premises commits an offence unless he is the holder of a licence issued in respect of the prescribed premises and so causes, increases, permits or alters in accordance with any conditions to which that licence is subject. 	<p>A fine of \$50,000 for individual</p> <p>A fine of \$100,000 for body corporate</p>

Table 8. Enforcement actions and penalties administered by DER cont...

Legislation/Regulation	Action	Maximum Penalty*
Section 58(1) – Contravening licence conditions	A holder of a licence who contravenes a condition to which the licence is subject commits an offence.	A fine of \$62,500 for individual Daily penalty: \$12,500 A fine of \$125,000 for body corporate Daily penalty: \$25,000
Section 61(4) – Duty of persons becoming occupiers of prescribed premises	When a person becomes the occupier of any prescribed premises, that person commits an offence for non-compliance with the following: (a) conditions to which an existing works approval or licence is subject; and (b) the requirement to apply, within 30 days of the day on which the new occupier becomes occupier of the premises, for the transfer of the existing authorisation to the new occupier or for a works approval or licence.	A fine of \$62,500 for individual Daily penalty: \$12,500 A fine of \$125,000 for body corporate Daily penalty: \$25,000
Section 62A(2) – Some kinds of conditions	An occupier of premises who, being required under a condition attached to a works approval or licence to provide a report on monitoring data, or analysis of it, to the CEO — (a) fails to do so within the specified period or before the specified date; or (b) fails to do so in the specified form or manner, commits an offence.	A fine of \$25,000 for individual and body corporates Daily penalty: \$5,000

* NOTE: Section 40 of the *Sentencing Act 1995* has the effect that, on conviction of an offence, a body corporate is liable to a fine that is five times the maximum fine that could be imposed on a natural person convicted of the same offence, unless the offence expressly provides for a statutory penalty for a body corporate

Table 9. Enforcement actions and penalties administered by OEPA.

Legislation/Regulation	Action	Maximum Penalty*
<i>Environmental Protection Act 1986</i>		
Section 47(1) – Duties of proponents after service of s. 45 statement	The proponent commits an offence if a statement setting out the implementation agreement or decision has been served and the proponent does not ensure that any implementation of the proposal is carried out in accordance with the implementation conditions.	A fine of \$125,000 for individual Daily penalty: \$25,000 A fine of \$250,000 for body corporate Daily penalty: \$50,000
Section 47(4) – Duties of proponents after service of s. 45 statement	If a notification has been given that a proposal may not be implemented and the proponent does anything to implement the proposal to which the notification relates, the proponent commits an offence.	A fine of \$125,000 for individual Daily penalty: \$25,000 A fine of \$250,000 for body corporate Daily penalty: \$50,000
Section 48(6) – Control of implementation of proposals	A proponent who does not comply with an order served on him requiring that proponent forthwith to stop the implementation of that proposal or requiring that proponent to take such steps as are specified in that order commits an offence.	A fine of \$162,500 for individual Daily penalty: \$32,500 A fine of \$325,000 for body corporate Daily penalty: \$65,000

* NOTE: Section 40 of the *Sentencing Act 1995* has the effect that, on conviction of an offence, a body corporate is liable to a fine that is five times the maximum fine that could be imposed on a natural person convicted of the same offence, unless the offence expressly provides for a statutory penalty for a body corporate

6.6 Aboriginal heritage

DAA administers the *Aboriginal Heritage Act 1972*. In accordance with the State's Cultural Heritage Due Diligence Guidelines¹⁷, resource companies in Western Australia are required to make reasonable efforts to determine if any Aboriginal sites exist in areas of exploration or development as part of the assessment process. This may involve detailed consultations with Traditional Owners or native title parties in affected areas and where necessary the completion of site identification or avoidance surveys and heritage surveys conducted.

6.6.1 Consent

Where activities may impact on Aboriginal sites, the registered title holder where the activity is proposed, in accordance with section 18 of the *Aboriginal Heritage Act 1972*, must seek the consent of the Minister for Aboriginal Affairs. If provided, the consent specifies the activity approved and where that activity may be undertaken. Failure to adhere to the detail of that consent may result in an offence in accordance with section 17 of the Act.

Under the South West (Noongar) settlement, the Indigenous Land Use Agreement dictates how certain parties are bound to explicit processes that include engagement via the South West Land and Sea Council in the first instance where activities are planned in the settlement area.

6.6.2 Enforcement

Table 10 shows current and proposed penalties for destroying, damaging, concealing or altering Aboriginal sites or objects as a breach of sections 17 and 57 of the *Aboriginal Heritage Act 1972*. In the event of an allegation of an offence against section 17, DAA will investigate to determine if legal proceedings should be carried against the individual alleged to have committed the offence.

DAA maintains a Register of Places and Objects (ASO Register).

Additional Commonwealth powers exist through the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* to preserve and protect from injury or desecration, places and objects of particular cultural significance to Aboriginal and Torres Strait Islander peoples in all States and Territories.

6.7 Aboriginal Reserve Land

The Aboriginal Lands Trust (ALT) is a statutory body established under the *Aboriginal Affairs Planning Authority Act 1972*. Under the Act, ALT has responsibility for the overall management of Aboriginal reserves, many of which are leased by the Trust to Aboriginal community organisations. ALT administers the issue of permits for entry onto reserves that are subject to Part III of the *Aboriginal Affairs Planning Authority Act 1972*.

Table 10. Enforcement actions and penalties administered under the Aboriginal Heritage Act.

Type of Offender	Action	Maximum Penalty*
Aboriginal Heritage Act 1972 – Section 57		
Individual – First Offence	Destroying, damaging, concealing or altering Aboriginal sites or objects.	A fine of \$20,000 and 9 months imprisonment
Individual – Subsequent Offence	Destroying, damaging, concealing or altering Aboriginal sites or objects.	A fine of \$40,000 and 2 years imprisonment
Body Corporate – First Offence	Destroying, damaging, concealing or altering Aboriginal sites or objects.	A fine of \$50,000
Body Corporate – Second Offence	Destroying, damaging, concealing or altering Aboriginal sites or objects.	A fine of \$100,000

* NOTE: Section 40 of the *Sentencing Act 1995* has the effect that, on conviction of an offence, a body corporate is liable to a fine that is five times the maximum fine that could be imposed on a natural person convicted of the same offence, unless the offence expressly provides for a statutory penalty for a body corporate

¹⁷ *Aboriginal Heritage Due Diligence Guidelines*
<https://www.dpc.wa.gov.au/lantu/MediaPublications/Documents/Aboriginal%20Heritage%20Due%20Diligence-30-April-2013-Updated-Oct.pdf>

Mining Access Permits are required for access to a Part III Aboriginal reserve under the *Aboriginal Affairs Planning Authority Act 1972* to conduct any petroleum operation. The Minister for Aboriginal Affairs issues Mining Access Permits, but is first required to seek the views of ALT, which in turn must consult with the resident Aboriginal Community and relevant native title interests before a Mining Access Permit is issued.

6.8 Planning

The Western Australian Planning Commission (WAPC) is the statutory authority with state-wide responsibility for urban, rural and regional land-use planning and land development matters. WAPC responds to the strategic direction of government and is responsible for the strategic planning of the State.

WAPC operates with the support of the Department of Planning (DoP), which provides professional and technical expertise, administrative services, and resources to advise WAPC and implement its decisions. In this partnership WAPC has responsibility for decision-making and a significant level of funding while DoP provides the administrative and technical advice.

6.8.1 Local government

Local governments are involved in planning for local communities by ensuring appropriate planning controls exist for land use and development. They do this by, among other things, preparing and administering their local planning schemes and strategies.

Local planning schemes contain planning controls such as designation of appropriate land-uses, residential densities and development standards. Local governments must base their planning decisions on the provisions and controls in their local planning scheme.

All local government planning schemes and policies are required to be consistent with State Government planning objectives and requirements. Proponents should consult local governments to determine if exploration and/or operation requires a development application under their relevant local planning scheme.

6.8.2 Development Assessment Panels

Development Assessment Panels (DAPs) were introduced to the Western Australian planning system through the Planning and Development (Development Assessment Panels) Regulations 2011. DAPs are panels of five members, comprising a mix of technical experts and

local government representatives. DAPs have the power to determine applications for development which meet certain monetary value thresholds, in place of the otherwise relevant decision-making authority (with the exception of applications under redevelopment or improvement schemes).

6.8.3 State Planning Policies

State Planning Policies (SPPs), which are specifically provided for in the *Planning and Development Act 2005*, are required to be prepared and kept under review by WAPC.

SPPs can be subject or location specific, and are generally used for two main purposes:

1. To assist WAPC in its decision-making with respect to the subdivision of land and development approval under region schemes.
2. To provide guidance to local government on the matters they need to take into account in preparing local planning schemes.

Local government is required to have due regard to SPPs in preparing or amending a local planning scheme and the Minister for Planning may order a local government to amend its scheme to be consistent with a SPP.

In some instances, legislation overrides planning legislation:

- Under section 120 of the *Mining Act 1978*, while the Minister for Mines and Petroleum, the warden or the mining registrar will take into account any planning instrument made under the *Planning and Development Act 2005* when considering an application for a mining tenement, a planning instrument shall not operate to prohibit or affect the grant of such tenement.
- State Agreement Acts — State Agreements are contracts between the Government of Western Australia and proponents of major resources projects, which are ratified by an Act of State Parliament. They specify the rights, obligations, terms and conditions for development of the project and establish a framework for ongoing relations and cooperation between the State and the project proponent.

For more than 50 years, State Agreements have been used by successive Western Australian governments to foster major developments, including mineral, petroleum, wood processing and related downstream processing projects, together with associated infrastructure investments. Such projects require long-term certainty and extensive or complex land tenure and are often located in relatively remote areas of the State requiring significant infrastructure development.

7 Glossary of Terms and Abbreviations

ALT	Aboriginal Lands Trust
ALARP	As Low As Reasonably Practicable
API	American Petroleum Institute
aquifer	A subsurface water-bearing geological layer of rock that has high porosity and permeability and allows groundwater extraction. Unconfined aquifers, which form the water table, have upper water surfaces that change depth through time. They are usually closer to the earth's surface than confined aquifers. A confined aquifer is an aquifer over- and underlain by layers of low permeable material that stop any movement of water out of the reservoir rock or aquifer
block	Also known as graticular block – The surface of the Earth is divided by predetermined lines of latitude and longitude into regular units of land. A unit of 5 minutes of latitude by 5 minutes of longitude is a block under Western Australian petroleum legislation
blowout preventer (BOP)	A device that can be used to quickly seal the top of a well in the event of a well control event. It usually comprises several sets of valves installed on top of the wellhead which, when closed, will seal around drill pipe, thus preventing uncontrolled flow of formation fluids from a well
carbonate rock	A sedimentary rock composed of carbonate minerals (usually limestone)
casing, production casing	Steel pipe that is cemented into a wellbore to prevent the wall from caving in and stop unwanted fluids from entering the hole from the surrounding rocks. The production casing is the pipe through which oil or gas flows from the reservoir to the surface
casing string	The casing string is the entire length of all the joints of casing in a well
Christmas tree	An assembly of valves and pipework fitted to the wellhead that control the flow of oil or gas production from the well
coal seam gas (CSG)	Natural gas that is formed within coal seams, adsorbed within the coal
conventional gas	Natural gas that is trapped in rock that is porous and permeable enough to allow it to flow naturally up a wellbore
cuttings	Cuttings, or drill cuttings, are chips of formation rock removed from a borehole to the surface by drilling fluids circulating up from the drill bit
DAA	Department of Aboriginal Affairs
DoE	Department of the Environment (Commonwealth)
DER	Department of Environment Regulation
DoH	Department of Health
DMP	Department of Mines and Petroleum
DPaW	Department of Parks and Wildlife
DoP	Department of Planning
DoW	Department of Water
DAP	Development Assessment Panel
dewatering	The removal of groundwater, often in order to produce CSG
directional drilling	The practice of controlling the direction and deviation of a wellbore to a predetermined underground target or location
drilling rig	Machine used to drill the well or borehole. Petroleum drilling rigs are generally larger than those used to drill water bores or mineral holes
EP	Environment Plan
EPA	Environmental Protection Authority
ERA	Economic Regulation Authority

exploration	The first stage in petroleum extraction. Includes the search for undiscovered petroleum
FMP	Field Management Plan
flowback fluids	The flow of injected fluids back to the surface following hydraulic fracture stimulation. This fluid is normally water
formation	A rock layer with similar composition and properties. Each formation is unique to a location on Earth
fracture	Any break in a rock formation or layer. Generally on the order of centimetres to metres in length. May be naturally occurring or man-made
fugitive emissions	Releases of gas (such as methane, carbon dioxide and hydrogen sulphide) to the atmosphere from the leakage or venting of that gas from the earth or from man-made facilities (e.g. pipes)
Gm³	Giga or billion (10 ⁹) cubic metres. Metric unit of measure for volumes of natural gas
groundwater	Water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers
horizontal drilling	Drilling into the earth in an initially vertical direction, followed by a change in drilling direction to the horizontal at a suitable depth
hydraulic fracture stimulation	The fracturing of rock with a liquid under high pressure to create artificial openings and cracks in the rock to increase the rock's permeability and allow more fluid to flow into a wellbore
induced seismicity	Refers to typically minor earthquakes and tremors that are caused by human activity. Most induced seismicity is of a low magnitude and cannot be felt by humans on the Earth's surface
instrument holder	The person who holds the legal authority (instrument) to do the activity
liner (ie production liner)	A liner is the innermost casing string in which the productive zones of a well are completed. The liner does not extend to surface, but overlaps the bottom of the previous casing string
integrity (of a well)	Application of technical, operational and organisational solutions to reduce risk of uncontrolled release of formation fluids throughout the life cycle of a well
NORM	NORM is the acronym for Naturally Occurring Radioactive Material. NORMs are radioactive material containing no significant amounts of radionuclides other than naturally occurring radionuclides. ¹⁸
OEPA	Office of the Environmental Protection Authority
operator	Person or company responsible for undertaking an activity. This is normally the registered holder of the title
permeability	The ability, or measurement of a rock's ability, to transmit fluids. A measure of the connectedness of pores within a rock
porosity	The amount of space between the particles that make up a rock
prescribed premises	Under the Environmental Protection Regulations 1987, refers to premises (category 10, meaning wells or category 11 meaning other, e.g. facility) where commercial oil or gas design or production capacity is greater than 5000 tonnes per year
produced formation water	Refers to water trapped in underground rock formations that is brought to the surface during oil and gas production
production	The stage of petroleum extraction that follows exploration. Involves bringing the hydrocarbons up the wellbore for removal
proof of concept	To demonstrate the feasibility of an idea or method, to verify that the concept or theory has the potential of being used. For shale and tight gas projects, it is the potential for being commercial

¹⁸ The Australian Radiation Protection and Nuclear Safety Agency Radiation Protection Series 15, Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM) (2008). www.arpsa.gov.au/publications/codes/rp515.cfm

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