6 ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

6.1 Introduction

Section 21 of the OPGGS(E) Regulations require Pilot to identify, analyse and evaluate the risks and potential environmental impacts associated with the Eureka 3D MSS.

Pilot's impact and risk management process is based on the principles, framework and processes defined by the International Standards Organization (ISO) 31000:2018 Risk Management – Guidelines. The following sections describe the steps in the risk management process, including the legislative framework, approach taken to identify and evaluate potential impacts and risks associated with the activity, and risk treatment (control) measures that will be adopted to reduce the impacts and risks to as low as reasonably practical (ALARP) and to acceptable levels.

6.2 Communication and consultation

Communication and consultation with internal and external stakeholders are carried out during all stages of the management process. This is to ensure that those accountable for implementing the risk management process (namely, Pilot and any appointed contractors) and stakeholders understand the basis on which decisions are made, and the reasons why particular actions are required.

Pilot is committed to consulting with relevant persons who may be affected by the activity to identify and understand any concerns and issues, to mitigate impacts and risks highlighted in meritorious submissions and to openly communicate the process with the relevant persons. Input from relevant persons will help to inform the preparations for, and execution of, the Eureka 3D MSS as appropriate. The process of relevant person consultation is described in Section 0.

6.3 Establishing the context

The purpose of establishing the context in the risk management process is to define the external and internal parameters to be considered when managing risk, and to define the risk criteria. This requires assessment of the external and internal environments in which Pilot seeks to achieve its objectives.

The external context comprises the description of the activity (Section 3), the physical, biological, socio-economic and cultural environments (Section 4) and associated potential impacts and risks specific to the nature and scale of the activity (Section 7 and 8), the legislative framework, applicable management plans, standards and guidance (Section 2) and the perceptions and values of external relevant persons (Section 0, Appendix D. The internal context relates to Pilot's culture, processes, structure and strategy, and includes anything within the organisation that can influence the way in which environmental risk is managed. Pilot's commitment to minimising environmental harm and to operating and maintaining a safe and healthy work environment for its employees, contractors and project partners is reflected in its corporate Environment and Sustainability Policy (Appendix A) and HSE management framework (Section 10.2).

6.4 Impact and risk assessment

The environmental impact and risk assessment process uses a systematic, evidence-based approach to evaluate and interpret the impacts and risks associated with its activity and the potential for harm to physical, biological and human receptors. The environmental impacts and risks associated with the Eureka 3D MSS have been assessed using the following steps:

- Definition of the activity (Section 3) and identification of associated aspects and hazards with potential for environmental harm (i.e., physical, chemical or biological entity or incident that induces an adverse response or impact e.g., operation of airguns)
- Identification of the environmental, socio-economic and cultural values within the area that may be affected by the activity, i.e., the existing environment context of the activity (Section 4)

- Identification of aspects of the activity with potential for environmental harm (e.g., underwater noise, light, seabed disturbance) in the context of its nature, scale, and location (Section 7)
- Definition of acceptable levels for each impact and risk (Section 7 and 8)
- Identification of impacts from routine aspects and risks from unplanned/accidental events, and the inherent impact or risk (Section 7 (planned events) and Section 8 (unplanned risks))
- Identification of the 'decision context' and 'assessment technique' relevant to the impact or risk (Section 7 and 8)
- Identification of control measures to be implemented for each aspect to reduce the impacts and risks to ALARP (Section 7 and 8)
- Determination of the residual risk of each environmental impact and risk with identified control measures adopted (Section 7 and 8)
- Determination of whether the residual risk is acceptable
- If an impact or risk is not considered acceptable, further practical control measures are considered and adopted until the impacts and risks are considered ALARP and acceptable (Section 7 and 8).

6.4.1 Hazards, impact and risk identification

Information used in identifying the impact and risks associated with the activity has been obtained from the following sources:

- Pilot's description of the location and timing of the survey, and activities to be undertaken in acquiring seismic data (e.g., airgun discharges, sail lines)
- An understanding of general vessel activities/operations during seismic surveys and the potential threats and hazards to stakeholders and the marine environment and where appropriate, terrestrial environments
- Literature reviews on the environmental sensitivity of the receiving environment with respect to species' presence, "biological calendars", habitat distribution and location of biologically important areas (breeding, migration, resting, foraging areas); identification of environmental, socio-economic and cultural values at risk within and adjacent to the OA
- Feedback from relevant persons (onshore and marine) to understand socio-economic and cultural activities and values that may be affected by the proposed activity.

The identified environmental, socio-economic and cultural impacts and risks associated with activities proposed under this EP are listed in Table 7-1 and Table 8-1 along with the residual risk ranking of each, as determined within Sections 7 and 8.

6.4.2 Impact and risk analysis and evaluation

The hazards for each potential environmental aspect were identified using a qualitative assessment process in accordance with the methods and principles described by the ISO 31000:2018 Risk Management – Guidelines (last reviewed and confirmed in 2023), and Standards Australia Handbook HB 203:2012, Managing Environment-related Risk (2012).

The Eureka 3D MSS impact and risk assessment is based on the evaluation of impacts and risks that are credible, realistic and appropriate to the nature and scale of the activity, and the values and sensitivities of the environment that may be affected (EMBA).

Each impact and risk associated with the planned seismic activity has been evaluated by determining the consequences or effects (Table 6-1), including the extent, duration, timing and potential for recovery, and assessing the likelihood or probability that those consequences may occur (Table 6-2).

Potential maximum quantities released, timescale of release, biological exposure and sensitivities, and regulatory requirements were considered in determining the consequence of the impact/risk. The likelihood of the effect or consequence is based largely on professional judgement of the conditional likelihoods leading to the effect, including the presence of the stressor (impact/risk), the exposure of receptors to the stressor and the sensitivity of the receptors to the stressor.

Table 6-1: Definition of consequence terms

Term	Meaning
Localised	Operational Area extent
Extensive / Medium scale	Within EMBA extent
Regional / Large scale	South-west marine region extent
Short-term	Days to weeks
Medium-term	<12 months
Long-term	>12 months

Table 6-2: Definition of likelihood

Category		Definition/experience (history of occurrence)	Probability
A	Very Unlikely	Conceivable only under extreme circumstances	Event occurs once within ten years
B	Unlikely	A very rare event by standards of industry.	Event occurs once within five years
C	Possible	Has happened in similar businesses but not Pilot	Event occurs once a year
D	Probable	May occur in our business	Event occurs monthly
E	Very Likely	Expected to occur in most circumstances / has occurred at the location	Event occurs weekly

All identified impacts and risks associated with the activity were analysed and evaluated in accordance with the Pilot modified risk matrix (Table 6-3, Figure 6-1). The coloured region signifies the tolerability of the risk criteria. Environmental impact and risks ranked as Low or Moderate are considered generally ALARP and acceptable (i.e., acceptable providing that it can be shown that all practicable impact and risk reduction measures have been taken, and they will continue to be taken). Impacts and risks ranked as Significant, or High are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual level of risk to ALARP and acceptable.

The outcome of this evaluation provides the 'inherent' impact or risk ranking, i.e., the impact/risk without the application of control measures. The shaded region of the risk matrix signifies the tolerability of the risk ranking.

Table 6-3: Pilot consequence description for environmental and socio-economic/cultural aspects*

Consequence	Environment	Socio-economic/cultural
Low	No impact or negligible impact (<1 month) to localised area and not significant to environmental receptors Full recovery expected in days to weeks	Minor, short- term to no lasting effect, or low-level repairable damage to a community, social infrastructure
Minor	Minor, detectable but insignificant localised change to ecosystems, habitats and local species populations Full recovery expected in days to weeks	Minor disruption, localised scale and temporary effect (days to weeks) on commercial and/or recreational users and community, social infrastructure or areas/items of low cultural or heritage values
Moderate	Moderate disruption and short-term effect on a proportion of a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations Medium scale and medium-term effect on other habitats/ communities No effects on ecosystem function Recovery in months to one year	Moderate disruption, medium scale and short-term effect (weeks to months) on commercial and/or recreational users and a community, social infrastructure or areas/items of low cultural or heritage values
Major	Major disruption and medium-term effect on a significant proportion of a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations Medium scale and medium-term effect on other habitats/ communities No effects on ecosystem function Recovery >1 to three years	Moderate disruption, medium scale and effect (months to years) on commercial and/ or recreational users, and to a community, social infrastructure or areas/items of high cultural or heritage significance
Severe	Severe disruption and medium to long-term effect (on a protected species' population, including impacts on health, critical habitats or critical behavioural processes Injury or death of individuals of a protected species. Large scale and long-term effect on other habitats/ communities Effects are at an ecosystem function level. Recovery three to >10 years	Major disruption and medium to long-term effect (years to decades) leading to loss of commercial and/or recreational use and destruction to a community, social infrastructure or areas/items of high cultural or heritage significance

*The word 'significant' used in this table has been defined using the significant impact criteria set out in the MNES significant impact criteria guidelines 1.1. https://www.dcceew.gov.au/sites/default/files/documents/nes-guidelines_1.pdf

Risk Matrix Table		LIKELIHOOD				
		• Unlikely to happen here or elsewhere. • Conceivable under extreme circumstances.	• Unlikely to occur. • A very rare event by standards of industry.	• Possibility of occurring. • Has happened in similar businesses but not Pilot	• May occur in our business.	Expected to occur in most circumstances / has occurred at the location
SEVERITY (CONSEQUENCE)	Severity Level	Very Unlikely	Unlikely	Possible	Probable	Very Likely
		A	B	C	D	E
	5 - Severe	SIGNIFICANT 15	HIGH 19	HIGH 22	HIGH 24	HIGH 25
	4 - Major	MODERATE 10	SIGNIFICANT 14	HIGH 18	HIGH 21	HIGH 23
	3 - Moderate	LOW 6	MODERATE 9	SIGNIFICANT 13	SIGNIFICANT 17	HIGH 20
	2 - Minor	LOW 3	LOW 5	MODERATE 8	SIGNIFICANT 12	SIGNIFICANT 16
	1 - Low	LOW 1	LOW 2	LOW 4	MODERATE 7	MODERATE 11

Figure 6-1: Pilot's risk matrix

6.5 Impact and risk treatment

The treatment of the inherent impacts and risks identified in the assessment process requires application of control measures to reduce them to ALARP and acceptable levels. Pilot has taken the following approach for each of the identified impacts and risks during the assessment:

- Determination of inherent risk (potential risk) without controls
- Identification of appropriate control measures aligned with the decision type (refer to Section 6.5.1)
- Demonstration of ALARP (and determination of the residual risk)
- Demonstration of acceptable level of impact or risk
- Determination of residual risk rating (including controls aligned with decision type).

6.5.1 Decision context and assessment techniques

Pilot applies the Oil and Gas UK (OGUK) (2014) Guidance on Risk Related Decision Making to determine the assessment technique applied for each impact or risk. Pilot has considered previous impact and risk assessments for similar activities, review of relevant published studies (peer reviewed and grey literature) and relevant person consultation concerns/feedback. Wherever possible, site-specific and activity-specific data has been used in the impact/risk assessment; however, to address areas of uncertainty, a precautionary approach has been taken, and a conservative or "worst case" approach has been applied where there is uncertainty in the level of harm.

The extent to which identified relevant persons have an interest in the decision depends upon the nature of the impact/risk (e.g., magnitude, complexity, uncertainty) and their perception of the impact/risk. The values, views, attitudes, perceptions and concerns of relevant persons consulted for the Eureka 3D MSS have been used in the determination of the decision context. Relevant person concerns have been assessed for merit and adopted control measures (where relevant) are summarised in Section 0.

Once the decision context is established for the impact/risk, this determines the assessment technique to use to identify appropriate control measures. The arrows in Figure 6-2 show the assessment technique(s) likely to be needed to make the decision. Good practice forms the basis of the assessment for all decision contexts. Moving from decision context A to B to C increases the relevance for additional assessment techniques and the role these play in the identification of control measures and decision-making.

- Good Practice: In accordance with recognised guidelines, standards and control measures that are used to manage well-understood impacts and risks arising from activities. This also includes control measures required to meet legislative requirements, codes and standards, including guiding principles such as the principles of ESD as defined in the EPBC Act.
- Engineering (or Environmental) Impact and Risk Assessment: This method may involve application of a range of techniques such as engineering analysis (e.g., underwater sound modelling), impact/risk assessment, cost benefit analysis, professional judgement.
- Precautionary Approach: This method requires uncertainty in the analysis to be addressed by using conservative assumptions that may result in a control measure being more likely to be adopted.

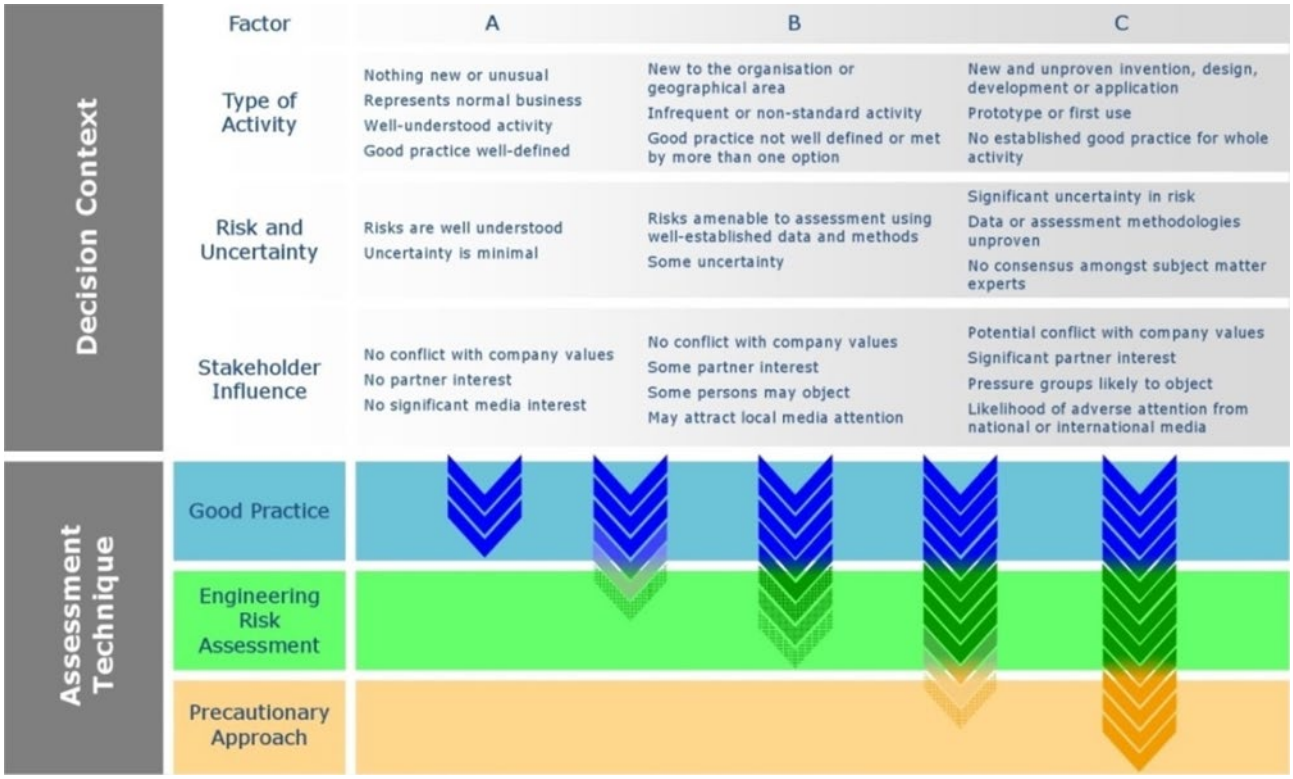


Figure 6-2: Risk related decision support framework (source: OGUK 2014)

6.5.2 Hierarchy of control measures

Pilot has established a hierarchy of controls in accordance with their impact and risk management process as part of their HSE Management System.

Table 6-4: Hierarchy of controls

Control type	Description
Eliminate	Selection of method based on appropriate design, elimination of methods with higher risks, e.g., eliminating seabed damage from anchors by using dynamically positioned vessels.
Substitute	Replace with a lower risk situation, e.g., use gel-filled streamers instead of fluid-filled streamers.
Reduce	Reduce the impact/ risk, e.g., soft starts during operation of the seismic source to encourage marine fauna to move out of the area, thereby reducing exposure to elevated noise levels.
Engineering/Isolation	Engineer out the impact/risk, e.g., automatic flotation devices to aid in recovering lost streamers.
Administration	Provide instructions, procedures or training to reduce the risk, e.g., waste management and marine fauna interactions, training of crew through environmental inductions.
Protective	Use appropriate protective equipment, (including emergency response and contingency planning), when other control measures are not practical or have not totally removed the hazard.

6.5.3 Demonstration of ALARP

For planned and unplanned events, an 'as low as reasonably practical' (ALARP) assessment is undertaken to demonstrate that the standard control measures adopted reduce the impact (consequence level) or risk to ALARP. This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort in order to reduce the level of impact or risk. If this cannot be demonstrated, then further control measures are adopted. The

level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk. For example, more detail is required for a risk ranked as 'Moderate' compared to a risk ranked as `Low'.

6.5.3.1 Practicability

Additional control measures were assessed to demonstrate whether the impact or risk could be further reduced, or if the impact or risk level is ALARP. Treatments considered by Pilot to be reasonably practicable have been implemented, while those considered to be not reasonably practicable have not been implemented, e.g., the cost, time and effort required to implement the measure is grossly disproportionate to the benefit gained.

6.5.3.2 Effectiveness

Pilot's Risk Management Procedure (PE-03-PRO-001) requires that the effectiveness of control measures must be assessed before they are implemented. Determination of effectiveness is subjective and thereby based on professional judgement, considering:

- Availability – will the control exist and be available when and where you need it?
- Reliability – will the control work as it was designed and intended?
- Impact – what will be the scale of effect if this control works perfectly?
- Duration – what will be the duration or time that the control will have its effect?

6.5.3.3 Cost benefit analysis

The estimated cost criterion consisted of a qualitative assessment by people familiar with the practicalities of implementing the control measures, to evaluate and rate the estimated cost impact of the additional control measure. Monetary values were not quantified; however, the cost was qualitatively ranked as follows:

- High – Very significant or disproportionate cost associated with the implementation of this measure and the cost may be prohibitive or not warranted based on the potential benefit gained. The level of cost is likely to compromise the Eureka 3D MSS objectives and viability.
- Medium – Significant cost associated with implementation of this measure, however it is not considered prohibitive, when compared to the potential risk reduction benefit.
- Low – No significant cost associated with implementation of this measure.

The expected net benefit of the additional control measure in reducing either the likelihood or the consequence of the impact or risk, beyond that achieved by the previously identified control measures was evaluated on a qualitative basis. If a control measure reduced the potential impact or risk significantly, but did not change the residual risk ranking, it may still be considered as a net benefit and a contribution to reaching ALARP.

The potential for each additional control measure to generate negative environmental impacts, health and safety issues or operational risks was considered. Where effects were considered to negate the potential benefit partially or fully, the control measure was not considered for implementation, as it had no net benefit and contribution to reaching ALARP.

Where the benefit (i.e., reduction in impact or risk) of an additional control measure was considered grossly disproportionate to the cost of implementation or the effect on survey efficacy, the control measure was not accepted. As such, the control measures presented in the impact and risk assessment constitute only those that were deemed to result in a reasonable, practicable and effective reduction in the likelihood or consequence of an impact or risk becoming realised and thereby demonstrating ALARP whilst achieving the objectives of the survey.

6.5.4 Residual impact and risk ranking

The residual impact and risk ranking process is undertaken to assess the effect of control measures in mitigating the inherent risk levels. It follows the identification of the decision context type, ALARP process and establishing appropriate control measures.

Residual risk rankings were based on re-assessment of the likelihood and consequence of the impacts with the mitigating controls in place. Residual risk was assigned using Pilot's risk matrix in Figure 6-1. All identified impacts and risks associated with the activity were analysed and evaluated in accordance with Pilot's risk matrix. The coloured region signifies the tolerability of the risk criteria Environmental impact and risks ranked as low or medium are generally considered ALARP and acceptable (if it can be shown that all practical impact and risk reduction measures have been taken, and they will continue to be taken). Impacts and risks ranked high are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual risk to ALARP and Acceptable.

6.5.5 Demonstration of acceptability

Section 21 of the OPGGS(E) Regulations requires a demonstration that residual environmental impacts and risks are ALARP and of an acceptable level. Acceptance is often represented as an inverted triangle (Figure 6-3) where the level of risk increases from a low risk or "broadly acceptable region" through a "tolerable region" (if impacts/risks are demonstrated to be higher, but ALARP) and then to an "unacceptable region". Acceptability criteria for the different levels of risk are as follows:

- Low: Broadly Acceptable. Good industry practice (including legislation and standards) has been applied, and the impact/risk is acceptable without further reduction measures being required. Further effort towards impact/risk reduction is not reasonably practicable without sacrifices (costs, loss of opportunities, or loss of technical quality) grossly disproportionate to the impact/risk reduction benefit.
- Moderate: Acceptable (acceptable / tolerable), providing that it can be shown that all practicable control measures have been implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, with continual review of these measures and any potential new ones.
- Significant (Undesirable): Pilot management decision required to accept impacts/risks and proceed. Additional control measures are required to be considered and implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, to prevent or reduce the impact/risk to ALARP and be acceptable.
- High (Unacceptable / intolerable): May require redesign of project and/or its parameters, additional control measures are required to be implemented (regardless of sacrifice) to prevent or reduce the impact/risk to ALARP and be acceptable.

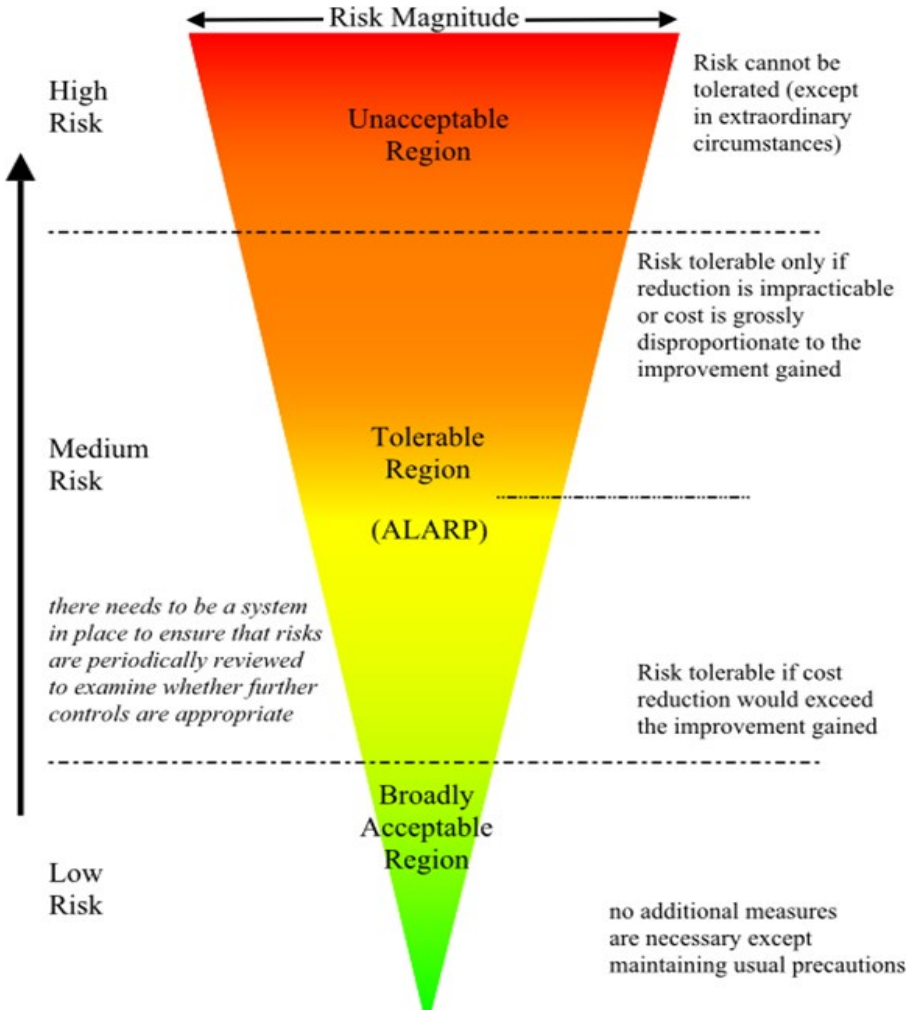


Figure 6-3: Approach to demonstrating ALARP and acceptable levels (source: IEC 31010:2019 Risk management – risk assessment techniques)

Pilot's model for demonstrating acceptable levels of impacts and risks for the Eureka 3D MSS is based upon the criteria described in Table 6-5. Using the appropriate criteria from Table 6-5, acceptable levels of impact were defined prior to conducting the evaluation of individual impacts and risks in Sections 7 and 8. However, not all the criteria for acceptance in Table 6-5 will apply to defining levels of acceptability for all impacts and risks assessed within this EP. Pilot has therefore distinguished between higher and lower order environmental impacts and risks.

Higher order impacts/risks are generally more complex and include those where the environment or receptor affected is protected/threatened, vulnerable to the impact/risk, not widely distributed, or where there is uncertainty in the effectiveness of adopted control measures. Such impacts/risks relevant to the Eureka 3D MSS include underwater noise from seismic operations, accidental oil spill (vessel collision/grounding) and physical interaction with other marine users. It is expected that reasonable effort has been used to identify and evaluate alternative, additional, and improved control measures that may further reduce impacts and risks (NOPSEMA Guideline N-4750-GL1721). Lower order impacts include atmospheric emissions, routine discharges, light emissions, accidental loss of materials, introduced marine species and fuel spills.

Following demonstration in Sections 7 and 8 that all reasonable and practicable control measures have been adopted to reduce the impacts and risks to ALARP, the pre-defined acceptable levels of impact have been compared with the residual levels of impact and risk. If the residual impact levels lie within the boundaries of the pre-defined acceptable levels, the impact or risk is considered acceptable.

Table 6-5: Criteria for defining acceptable levels of impact

Criteria for acceptance	Definition of criteria
Pilot's Internal Context	Alignment with Pilot's Environment Policy for the Eureka 3D MSS described in Appendix A. Pilot's impact/risk matrix defines 'Low risk' as acceptable, 'Moderate risk' as acceptable providing ALARP has been demonstrated, 'Significant risk' as undesirable (i.e. Requiring ALARP demonstration and decision to accept based on Pilot management decision), and 'High risk' as unacceptable (Figure 6-1). As such, have all reasonable and practical control measures been adopted to reduce the risk or impact without sacrifices being disproportionate to the benefit of the risk reduction?
Legislative Requirements	The impact/risk is being managed in accordance with existing Australian or international legislation, conventions and/or standards, such as MARPOL 73/78, AMSA Marine Orders, and Marine Notices, EPBC Policy Statements (refer to Section 2) Aligned with the Principles of Ecologically Sustainable Development (ESD), including application of the precautionary principle and/or how uncertainty has been reduced The proposed management of the impact/risk is aligned with species-specific or protected area management plans/conservation advice actions or conservation objectives.
Industry Good Practice	The impact/risk is being managed in accordance with industry good practice (APPEA Code of Environmental Practice and IAGC/IOGP guidelines), and national and international standards (ISO 31010:2018 Risk Management, Standards Australia / Standards New Zealand Risk Management Guidelines)
Social Acceptance	Concerns raised during relevant person consultation have been assessed for their merits and control measures developed, if appropriate, to manage those concerns. There are no outstanding merited concerns that have not been assessed.
Existing Environmental Context	Is the effect on the environment or receptor localised, short-term and recoverable? Have potential impacts to environmental values or sensitivities been assessed as local, regional (and if applicable global) level in terms of population level and long-term effects? As such, are adopted controls appropriate and adequate in avoiding such effects and thereby reducing risks to ALARP.

6.6 Environmental performance outcomes and standards

Section 5 of the OPGGS(E) Regulations provides definitions for the following

- Environmental performance outcome (EPO): A measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level
- Environmental performance standard: A statement of the performance required of a control measure.

Environmental performance outcomes, standards and measurement criteria for each aspect of the activity that has the potential to cause adverse environmental impacts or risks are detailed in the assessments presented in Sections 7 and 8. Environmental performance will be measured and reported against these standards and measurement criteria, as part of Pilot's commitment to continuous improvement of environmental, health and safety performance.

Pilot will develop and maintain an Environmental Commitments Register (ECR) for the activity, which details the environmental commitments, performance outcomes and criteria outlined in this EP. The ECR is an audit tool to be used during the activity to demonstrate conformance of the activity with the environmental performance commitments made by Pilot. This ECR will be submitted to NOPSEMA as part of the Post-survey Environmental Performance Report (PEPR) within two months following the completion of the survey (Section 10.8.1).

6.7 Principles of ESD

For all impacts and risks identified in Sections 7 and 8 an assessment was conducted to determine if the Seismic activity was consistent with the relevant principles of ESD. The assessment determined that the activity is consistent with principles of ESD a, b, c, and d. Principle e is not relevant to the activity.

6.8 Monitoring and review

Ongoing monitoring and review are essential to ensure the impact and risk assessments within this EP remain relevant. Introduction of new impacts/risks due to changes in the activity or context, changes in the consequence of impacts/risks, and maintaining effectiveness of adopted controls are addressed in Pilot's Management of Change Procedure (Doc. PE-03-PRO-002) described in Section 10.2.1.