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1 Summary

This chapter explains the approach to risk management (including insurable risk), including the methodology and supporting research, processes for risk identification, management and accountabilities; and an overview of the key Project risks (the ***Top 12***).

1.1 Introduction

The purpose of this chapter is to detail the risk management framework including the approach, methodologies and mitigants of the risks associated with the Project.

A robust risk management framework must ensure a project-wide understanding of the corporate and project risks Snowy Hydro and the Project face. It must provide a consolidated picture of the status of all Project-related corporate and project risks. It will allow effective allocation, monitoring and management of risks and increase the transparency of mitigation strategies. This, in turn, will enable informed and timely decisions to achieve the Project's corporate and project objectives and outcomes.

A project of this nature and scale will have many inherent risks. As the Project has developed, an exhaustive due diligence exercise has given the Owner's Team and Snowy Hydro visibility of how those risks are being managed to an acceptable level, or indeed, retired completely.

This chapter describes the comprehensive Project risk management framework:

1. In the phase leading up to Final Investment Decision (***FID***) (including the development of that framework since the Feasibility Study); and
2. Proposed for the post-FID delivery phase of the Project.

Risks can be either retained or transferred. Risks can be transferred primarily through contract risk allocation and insurance. This chapter does not consider the transfer of risk through contract (see *Supporting Chapter Three - Contracts and legal*).

Risk transfer through insurance (for the Snowy Hydro-retained risks and contractor risks) is described in the *Insurance against Project risks* section of this chapter. That section describes the proposed transfer of key insurable risks through a Principal-Procured Insurance Program (***PPIP***).

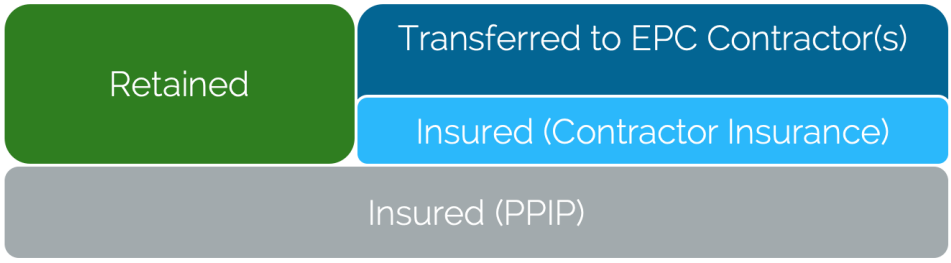

Figure 1: Project and corporate risks (Consolidated Risk Register)

1.2 Activities undertaken

In mid-2018 Snowy Hydro appointed an independent advisor to build on the existing risk management framework to support the future risk management process for the Project.

The advisor facilitated a risk assessment process which identified potential significant adverse events and major risks to the Project's objectives. This process will continue as the Project progresses through its development lifecycle.

AS/NZ ISO 31000:2009 Risk Management – Principles and Guidelines and associated guidance will continue to form the basis for ongoing risk management as in the Feasibility Study.

1.3 Risk management framework up to FID

The focus of the risk management framework development up to FID has been on understanding the Project and corporate risks across the Project life cycle, developing the risk identification, management and reporting processes.

The approach adopted to the subsequent management of identified risks includes recognition of existing controls and identification and implementation of additional mitigation that needs to be undertaken.

In addition to ensuring the integration of the updated risk management framework across all workstreams, a bespoke monitoring and reporting process was developed to ensure governance bodies are provided timely and relevant advice and oversight of key and emerging project risks and trends.

1.4 Risk management approach

The objective of the risk management approach is to minimise the effect of uncertainty on the delivery of the Project. A bespoke Risk Rating Matrix was used to assess the risks. Risks were identified from:

1. Previous experience with megaprojects;
2. Interviews with executives from other projects; and
3. Structured engagement with the Owner's Team and Snowy Hydro leadership.

Existing controls and potential mitigations were identified. The monitoring and reporting process referred to in the *Risk monitoring, review and reporting section* below was developed.

1.5 Risk management as an ongoing process

This risk management process will continue to be used to aggregate risk for the Project. This will contribute to and inform required procedures and documentation during the planning and delivery phase.

1.6 Risk Assessments

A bespoke likelihood and consequence table and thus a Risk Rating Matrix for the Project was developed that appropriately reflects the Project's expected risk profile (see Table 5 below).

These ratings were then applied to the identified risks.

Identified risks were assessed in terms of the need for treatment or mitigation. The independent risk advisor undertook a risk network analysis to understand correlation and interconnectedness of risks.

Mitigation actions are ongoing and risk ratings for mitigated risks are regularly assessed to determine treatment effectiveness.

The risk management framework provides a single point and process for monitoring, reviewing and reporting relevant corporate and project risks.

Project risk management, monitoring, review and reporting will inform the inherent, current and target risk rating, heat maps, risk trends and mitigation actions. The risk reporting is prepared by the independent risk advisor independently of the Owner's Team to provide management and governance bodies with assurance around the transparency and independence of risk reporting and disclosure.

The Top 12 risks as at FID as identified and analysed through the risk management process are outlined in Table 1. Each of these risks has been assessed and mitigated in accordance with Snowy Hydro's risk management processes.

Ref.	Category	Risk Description
TT1	Safety	Serious incident on Snowy 2.0
TT2	Delivery capability	Inadequate organisational capability
TT3	Technical	Inadequate design and construction; uncertainty of ground conditions and groundwater
TT4	Interfaces	Ineffective management of interfaces between Civil and E&M packages
TT5	Procurement and Contracts	Credibility and rigour of the procurement process is compromised
TT6	Procurement and Contracts	Poor contractor management
TT7	Commercial	Insufficient certainty of business case assumptions
TT8	Transmission connections	Compromised deliverability of deep and/or shallow transmission connections
TT9	Technical	Inability to achieve or test fit-for-purpose technical outcomes
TT10A	Tenure	Tenure: Delays or unforeseen changes in legislative amendments for land access; and/or delays in and/or unfavourable lease terms;
TT10B	Planning Approvals	Approvals: Delays in planning approvals and/or onerous conditions
TT11	Corporate	Inability to fund Snowy 2.0 or subsequent liquidity challenges
TT12	Deliverability	Significant force majeure or other events

Table 1: Top 12 risks

1.7 Risk management framework post-FID

The risk management framework will continue to develop post-FID. Risk management for the delivery phase of the Project will have specific objectives:

1. Safety as a primary objective;
2. Clarity of management responsibility and risk transfer;
3. Consistent application of practices;
4. Guide the targeting of risk assessment;
5. Risk management as a normal practice;
6. Continuous improvement;
7. Transparency and objectivity;
8. Informed decision-making; and
9. Reinforce contractual risk allocation.

The risk management process will be maintained by the Owner's Team, with regular reporting to the governance bodies.

The Contractors will provide periodic inputs into the risk management process as contractually and procedurally required, and as specified in the Employer's Requirements (see *Supporting Chapter Fifteen*).

The Project Owner's team will conduct risk identification and mitigation workshops with the Contractors prior to the commencement of a new stage of the Project or in the lead-up to a significant project milestone.

1.8 Post-FID risk management responsibilities

The Owner's Team will work with the Civil and Electrical/Mechanical (***E&M***) contractors to prepare an overarching Risk Management Plan having reviewed the risk submissions required from all Project participants. Responsibilities for the Owner's Team will include:

1. Review and approval of management plans;
2. Verification of risk management activities; and
3. Assessment and assurance of key risks.

1.9 Insurance against Project risks

1.9.1 Insurance program

The Feasibility Study recommended Snowy Hydro adopt a Principal-Procured Insurance Program (***PPIP***) for Project insurance. Pre-FID, a competitive process was followed to select an insurance broker for the Project. The selected broker has undertaken a comprehensive insurable risk review and an insurance market Expression of Interest (***EOI***) process. These processes have reinforced the appropriateness of a PPIP for the Project.

A PPIP provides Snowy Hydro with the ability to control the insurances and tailor them to the specific nature, scale and duration of the Project and to Snowy Hydro's corporate risk profile as Project owner, rather than accepting insurance arranged for the Contractor's business needs. Importantly, it also provides Snowy Hydro the option to place Delayed Start-Up (***DSU***) insurance and greater flexibility in its financing options.

Working with management, bidders and the insurance markets, the broker has designed a program to address the specific needs and attributes of the Project. The program dovetails with the project procurement process to best identify and address key insurable risks to the Snowy Hydro business that might arise from undertaking the Project.

1.9.2 Preparation for placement

As mentioned, the broker for the Project was selected following a competitive process and took a leading role in identifying project insurable risks and creating a plan for risk mitigation and cost-effective risk - transfer solutions.

A five-staged process was followed to identify insurable risks, maximum probable losses, recommended cover limits, policy extensions and design of the overall PPIP program, comprising:

1. Collate and assess source data;
2. Develop insurable risk profile working in conjunction with the independent risk advisor- -led risk process;
3. Conduct risk assessment workshops with Snowy Hydro utilising expert subject-matter risk advisors;
4. Engage with bidders and conduct an insurance market EOI process; and

5. Develop the optimum program.

Some risks are feasibly insurable and other risks are not, in which case other risk management mitigants and controls must be implemented by Snowy Hydro. The insurance status of each Project risk and Corporate risk has been captured, ensuring integration between the risk management process and the PPIP.

A key reason for utilising the insurance EOI process was the emerging significant pressure on some aspects of the Project insurance market due to recent claims, in particular for contract works losses resulting from damage to hydro dam projects in construction. The EOI process afforded the Project the opportunity to approach a broad range of domestic and international insurance markets and to present the Project (based at that time on the reference design) to those markets so as to drive market knowledge of, and interest in, the Project and demonstrate how it is materially different in risk profile from those offshore projects where losses have occurred, ahead of firm commitments being sought.

2 Activities undertaken

2.1 General

During the Feasibility Study, a pragmatic and relevant risk management framework was adopted for the Project. In mid-2018 Snowy Hydro appointed an independent advisor to support the future risk management process for the Project.

With Snowy Hydro, the advisor undertook a risk identification process. This process produced a comprehensive overview of all potential significant events that could have adverse effects on the achievement of the Project's objectives and identified the major risks to the Project's targeted objectives and outcomes. The process included extensive and structured consultation with the Owner's Team and Snowy Hydro leadership.

Risk identification will continue as the Project progresses through its development lifecycle.

Risk management during the Feasibility Study was governed by *AS/NZ ISO 31000:2009 Risk Management – Principles and Guidelines* and associated guidance. *AS/NZS ISO 31000:2009* also forms the basis for ongoing risk management.

The independent advisor applied research and insight from other projects, and corporate governance principles, to broaden the risk management framework to:

1. The whole-of-project lifecycle - from preparation for FID through delivery and commissioning and up to the handover to operations; and
2. Both corporate and project level risks related to the Project.

2.2 Risk management

The risk management activities undertaken are described in more detail in the following sections of this chapter. In summary, they comprised:

1. Compilation of all existing risk assessments;
2. Identification of the need for independent expert assistance able to draw from experience on other comparable projects;
3. Appointment of an independent expert advisor following a competitive process;
4. Creation of a bespoke Project Risk Rating Matrix and risk management framework;
5. Structured risk management workshops informed by comprehensive review of all existing risk assessments;
6. Design of bespoke reporting and monitoring regime, centred around identification of the Top 12; and
7. Integration of risk management into project management and governance structures with regular reporting.

2.3 Insurance

As mentioned, in July 2018 Snowy Hydro appointed a broker to provide broking services for the Project after a competitive process. This broker had demonstrated expertise in brokering insurance requirements for large civil infrastructure projects.

For FID, Snowy Hydro requested that the broker design a fit-for-purpose insurance program for the Project. As at FID, the following activities have been undertaken:

1. Source data - review existing risk and supplement from Aon risk library;
2. Develop insurable risk profile - assess and rank defined risks by severity through risk consulting, engineering surveys and loss modelling especially for DSU cover;
3. Gap analysis - review risks against existing coverage, identify gaps and opportunities;
4. Develop program - determine ideal program coverage and structure;
5. Obtain Govco approval of the proposed insurance strategy and program;
6. Draft wordings - prepare draft insurance wordings for the various policies;
7. Engagement on insurance issues and risks with bidders and provision of draft policy wordings and insurance schedules to all bidders;
8. Pre-tender insurance due diligence;
9. Insurance markets EOI process; and
10. Roads package insurance program designed and ready to place subject to Board approval.

3 Risk Assessment and Review

3.1 Risk assessment

Working with Snowy Hydro, the independent advisor undertook a comprehensive risk identification process for the Project to identify the major risks in relation to achieving the Project's targeted objectives and outcomes. They applied best-practice insights and strategic advice throughout this process to shape the development of the risk management framework.

The process of identifying risks included consultation with all levels of governance structures for the Project.

Risk management includes a risk assessment process, followed by looking at the treatments of the identified risks. This will continue to be consistently monitored, reviewed and reported on to ensure that there is effective risk management which will improve decision-making for all essential aspects of the Project.

The risk assessment process includes three main stages:

1. Identification;
2. Analysis; and
3. Evaluation.

Effective risk assessment requirements call upon team members at all levels of the Project to ask standard questions to identify, assess and evaluate risks:

1. What can happen and why?
2. What are the consequences?
3. What is the probability of the event occurring? and
4. What factors mitigate the probability or consequence of the event?

The objective of effective risk identification is to have a comprehensive understanding of all significant potential events that could have adverse effects on the achievement of the Project's objectives, including whether the risk is caused by a factor under Snowy Hydro's control, and an early estimation of the potential consequences of the risk if it is not managed adequately.

In the lead-up to FID, project and corporate risks throughout the whole lifecycle of the Project were identified through a number of activities which incorporated a combination of 'top-down' and 'bottom up' perspectives to capture a complete view of risk. The activities conducted included the following:

1. Internal consultation and validation through management and governance boies
2. Risk workshops to identify and discuss key project risks across various areas of the Project;
3. Confidential interviews with Senior Project Executives from other megaprojects;
4. Project-wide insurable risk workshops led by the selected broker and the preparation of an insurable risk library; and

5. Consolidated risk analysis by leveraging all of the above and insights from other risk assessments and studies conducted for the Project.

The risk identification process will continue as the Project progresses, utilising the updated risk management framework.

3.2 Due diligence review

During the Feasibility Study, a pragmatic and relevant risk management framework was adopted for the Project. The framework's risk processes and methodology were built up utilising relevant standards and guides, in addition to utilising information, both research and practically based, for the application of risk management on similar-scale projects. The relevant standards utilised in the development of the risk management processes included:

1. AS/NZ ISO 31000:2009 Risk Management – Principles and Guidelines; and
2. ISO Guide 73 Risk Management Vocabulary.

These standards have formed the basis of the risk management practices for the Project from inception and continue to do so.

As part of the preparation for FID, external expertise and independence was introduced through the appointment specialist independent advisors. This enabled the Project risk management framework described above to be developed, in particular by taking into consideration common themes and experience from other megaprojects. The learnings and input from this specialist advice, the reference projects and the experience allowed the Project risk management framework to be updated, customised and developed accordingly. The updating process also facilitated expanding the focus of the risk management framework to address:

1. The whole-of-project lifecycle - from preparation for FID through delivery and commissioning and up to the handover to operations; and
2. Both corporate and project level risks related to the Project.

The risk management framework used aligns with the recommendations outlined in the Australian Stock Exchange Corporate Governance Council Principle Seven: Recognise and Manage Risk.[1]

4 Risk management framework up to FID

The objective of the updated risk management framework leading up to FID has been to gain a comprehensive understanding of the Project and related corporate risks throughout the whole life cycle of the Project, not just to FID. This means the updated risk framework is designed to apply beyond FID throughout the life of the Project.

[1] ASX Corporate Governance Council, 2014. Corporate Governance Principles and Recommendations 3rd Edition., ASX Corporate Governance Council. Available at: http://www.asx.com.au/documents/asx-compliance/cgc-principles-and-recommendations-3rd-edn.pdf

As a result, Snowy Hydro and its governance bodies can better plan for the delivery of the Project, and implement treatments in real time at both corporate and project levels that can alleviate the effects of the risks going forward. This also means the risk management process and analysis is able to inform key recommendations.

Central to the updated approach has been the the risk identification, analysis, reporting and management processes. These are now being used as effective tools to assist with identifying, managing and monitoring project risks.

5 Risk management approach

As noted above the approach adopted commenced with a robust risk identification process to ensure relevant and consistent analysis and presentation of all risks and treatments. The ongoing aim of this approach is to allow the potential effect(s) of risks to be identified, managed and treated before they are realised.

The approach adopted to the subsequent management of identified risks includes recognition of any existing controls and identification and implementation of additional treatments that need to be undertaken.

In addition to ensuring the integration of the updated risk management framework across all workstreams, a bespoke monitoring and reporting process was developed to ensure governance bodies are are provided timely and relevant advice and oversight of key and emerging project risks and trends.

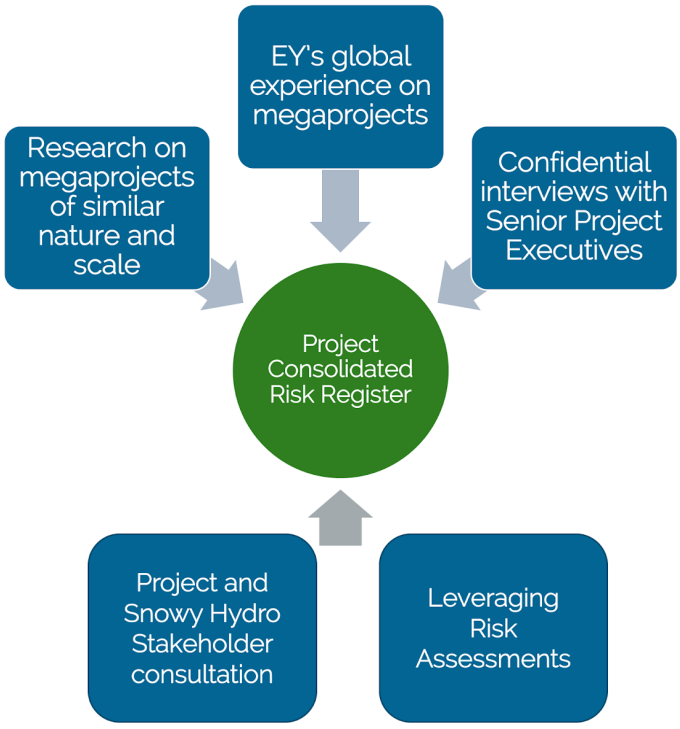

Figure 2: Inputs into the development of the Project Consolidated Risk Register

The objective of the risk management approach for the Project is to minimise the effect of uncertainty on the delivery of the Project. The approach described in this section has and will continue to be applied comprehensively across the Project. It will apply at all project levels, including work streams, project and corporate functions of Snowy Hydro as they relate to the Project across the project life cycle.

6 Risk management as an ongoing process

6.1 Overview

The risk management process will contribute and inform various other activities during the planning and delivery phase as a part of the risk management processes for the Project such as:

1. Retained risk management and ongoing development of the Project;
2. The development of a comprehensive and auditable living risk framework set out in this chapter;
3. Contingency and cost estimation (see *Supporting Chapter Four*);
4. Delivery phase strategy including owner's team design;
5. Engineer-Procure-Construct (***EPC***) Contractual documentation (see *Supporting Chapter Three*); and
6. Project insurance programme.

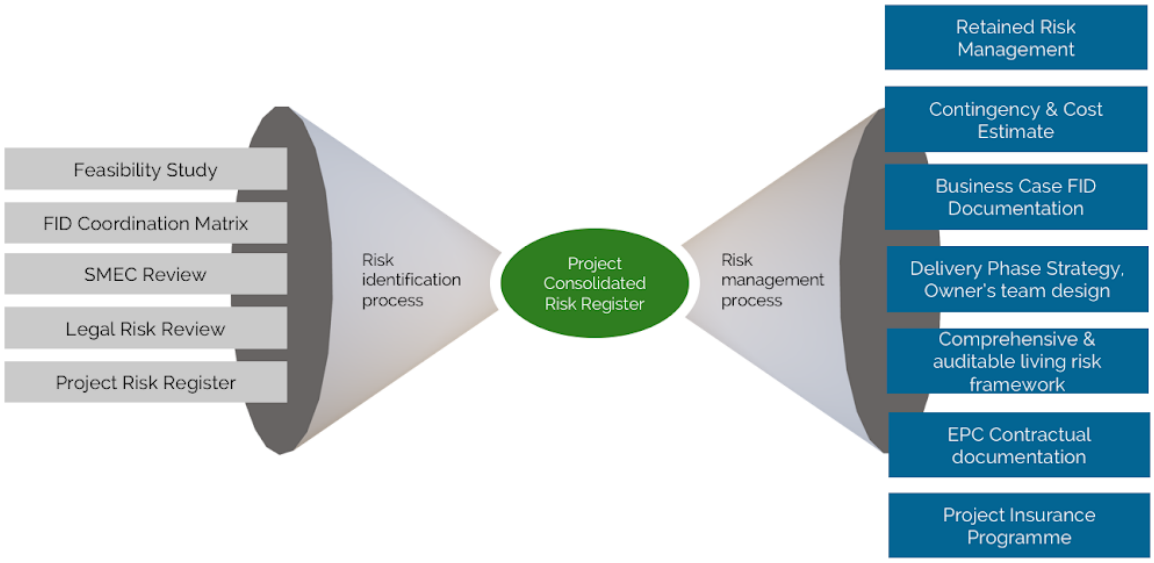

Figure 3: Identification and risk management processes for the Consolidated Risk Register

The risk assessment findings also informed the Quantitative Risk Analysis (***QRA***) undertaken to develop the Project Estimate Contingency. The results of that analysis can be found in *Supporting Chapter Four - Schedule, cost estimate and contingency*.

6.2 Risk methodology

6.2.1 Risk analysis

The bespoke Project Risk Rating Matrix was developed with appropriately quantifiable measures for the consequence categories and likelihood levels that were aligned with projects of similar scale and nature. This ensures that Project risks are reviewed and assessed at a suitable level.

Risk analysis examines the risks identified earlier, developing an improved understanding of the likelihood and positive and negative consequences associated with each risk. Comprehending likelihood and consequences allows a more accurate assessment of the level of risk. These two assessments driven from the bespoke Project Risk Rating Matrix inform the the identification of the Top 12 risks discussed below.

The Project Risk Rating Matrix in the Table below categorises the severity of each risk through a combination of its likelihood and potential consequence.

		Likelihood				
		1 - Rare	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain
Consequence	5 - Severe	5 - Medium	10 - High	15 - High	20 - Extreme	25 - Extreme
	4 - Major	4 - Medium	8 - Medium	12 - High	16 - High	20 - Extreme
	3 - Moderate	3 - Low	6 - Medium	9 - Medium	12 - High	15 - High
	2 - Minor	2 - Low	4 - Low	6 - Medium	8 - Medium	10 - Medium
	1 - Negligible	1 - Low	2 - Low	3 - Low	4 - Low	5 - Low

Table 2: Project Risk Rating Matrix

6.2.2 Risk treatment

The final step of the risk management process is the consideration of treatment factors that reduce the probability of the identified risks or increase the effect of opportunities. This stage involves considering the necessity of treating identified risks and planning how to prioritise applying treatments. Consideration is given to the effectiveness of any existing controls that are already in place. This evaluation is crucial for facilitating decision-making relating to risk treatment.

In determining the treatments for risks the independent advisors along with Snowy Hydro,undertook a Risk Network analysis to understand the correlation and interconnectedness of the Top 12 risks. That analysis showed that the risks with the maximum interconnecting nodes when treated would provide secondary benefits to the interconnected risks. Therefore the treatment of these risks was prioritised.

The independent advisor and Snowy Hydro have identified and implemented treatment options to address risks identified and evaluated previously. This process is ongoing with a continual reassessment of the effectiveness of risk treatments and the levels of risk which exist after applying those treatments relative to the overall target risk ratings.

The following possible actions in respect of each risk have been and continue to be evaluated and reviewed:

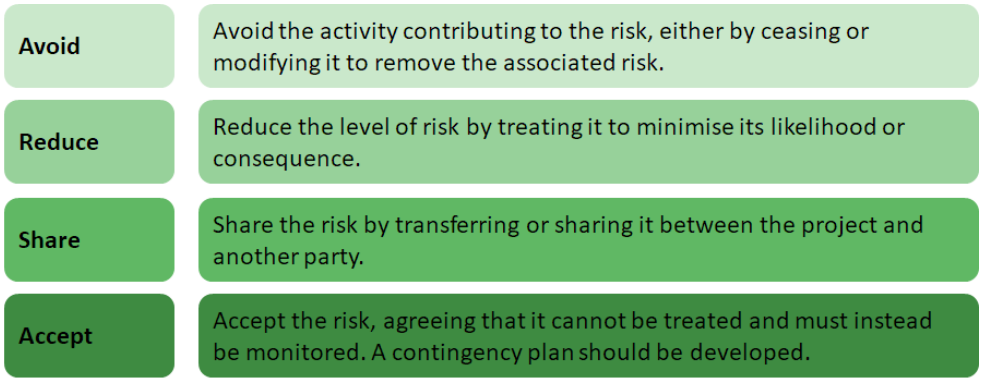

Figure 4: Treatment actions of the identified risks

Where a risk is to be transferred or shared, the target state for the risk transfer has to be determined. The risk management framework must then ensure the extent and effectiveness of the risk transfer actually proposed or negotiated is measured and reported on. This is done through formal review of key risks every six months together with the regular updating that occurs every month as part of the normal risk reporting process. This allows informed decisions through procurement, contingency setting and project approvals on the costs and benefits of transfer and retention of relevant risks.

6.2.3 Risk monitoring, review and reporting

Under the updated risk management framework there is a single point and process for monitoring, reviewing and reporting both corporate and project risks relating to the Project.

The bespoke Project risk management, monitoring, review and reporting informs the inherent, current and target risk ratings and, heat maps, risk trends, and mitigation/treatment. The risk reporting is prepared independently of management to provide management and governance with a level of practical assurance around the transparency and independence of risk reporting and disclosure.

6.2.4 Top 12 risks

The list of Top 12 risks created in the independent risk assessment process sets out the most significant risks of the project at each reporting interval. Re-assessment over the life of the Project will inevitably lead to escalating other risks at different points in the Project life cycle. This could happen due to an altered internal or external environment or the natural retirement of certain risks over time, such as procurement.

7 Risk management framework for the post-FID project delivery phase

7.1 Overview

This section details the ongoing risk management framework that will sit alongside and effectively form part of the post-FID delivery phase project control processes and procedures (see *Supporting Chapter Fourteen - Project controls* for other controls).

The updated framework of risk management outlined above will, of course, continue to be tailored over the life cycle of the project and will leverage current risk information to ensure a comprehensive best practice risk management framework is maintained. The framework has been designed specifically so that it will apply equally to the post-FID delivery phase of the Project. This ensures consistency and rigour of approach, minimises gap risk between project phases and better informs project approvals and decision-making.

Risk management for the Delivery Phase of the Project will have specific objectives:

1. **Safety as a primary objective** - ensure safety at all times remains the primary risk management objective for the Employer, all contractors, subcontractors, advisors and others working on the Project;
2. **Clarity of management responsibility and risk transfer** - provide a clear definition, scope and allocation of management responsibility for all retained risks and for management of arrangements under which relevant risks are transferred,;
3. **Consistent application of practices** - provide guidance for the consistent application of risk identification and management practices for all project activities and processes;
4. **Guide the targeting of risk assessment** - provide guidance as to the areas where risk is to be assessed and ensure a comprehensive understanding of risks that may impact Project objectives;
5. **Risk management as normal practice** - promote the embedding of risk management throughout the Project as part of normal business practice;
6. **Continuous improvement** - support and seek to continually improve the Project's risk management practices and culture across the Employer and all contractors, subcontractors, advisors etc;
7. **Transparency and objectivity** - support corporate governance by providing comprehensive, transparent, and objective risk and controls disclosure to governance bodies; an
8. **Informed decision-making** - enable informed decision-making about any trade-off between risk and reward.

The nature and description of risks will evolve as the Project progresses, however, a holistic view of risks and key mitigations will always be provided.

7.2 Post-FID risk management responsibilities

Management will ensure compliance with the Project's risk management requirements throughout the Project lifecycle. Key risk management responsibilities will include:

1. **Review and approval of management plans** - Reviewing and approving the risk management plans submitted by the Contractors and providing assurance that the plans meet or exceed the relevant requirements;
2. **Verification of risk management activities** - Verification for the duration of the Project that the Contractors are taking the necessary and appropriate steps to manage risk as defined in their plans and under their contracts;
3. **Assessment and assurance of key risks** - retaining risk and subject-matter specialists to undertake timely risk assessments and assurance on all key risks; and
4. **Communicating significant risks to BAU** - Ensuring significant risks with the potential to impact Project objectives are monitored and reported t in a timely manner.

8 Definitions and abbreviations

BAU	Business-As-Usual
CCIP	Contractor-Controlled Insurance Program
DSU	Delayed Start-Up
EOI	Expression of Interest
EPC	Engineer-Procure-Construct
EWR	Exploratory Works - Roads
FID	Final Investment Decision
NER	National Energy Regulations
NPWS	National Parks and Wildlife Service
QRA	Quantitative Risk Analysis

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