



**Antarctica
New Zealand**

Scott Base Redevelopment Project Risk Management Plan



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Intended audience

Name	Title / Project Role
	Risk Manager (Project Controls Manager)
	Senior Project Manager
	CEO / Acting Project Director
	Business Performance Manager
SBR Project Team	Various



SBR Project Steering Group (PSG)	Various
SBR Project Control Group (PCG)	Various
Antarctica NZ Senior Leadership Team (SLT)	Various

Associated documents

Name	Link
SBR - Risk Register	
SBR - Project Management Plan	
Antarctica New Zealand Risk Management Policy	
SBR – Project Governance Terms of Reference	
Antarctica New Zealand Risk Management Reference Guide	
Antarctica New Zealand Risk Management Process	



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1 Terms and Definitions

Term	Definition
Current risk	Current risk is the level of risk, considering any mitigations and key controls implemented to date.
Establishing the context	Defining the external and internal parameters to be considered when managing risk, and setting the scope and risk criteria for the project risk management policy.
Monte Carlo simulation	A technique used to model the probability of different outcomes in a process that cannot easily be predicted due to the intervention of random variables.
Opportunity	A risk that can have a positive effect on one or more objectives.
Raw risk	Raw risk is the base risk level prior to any mitigations or key controls being implemented.
Residual risk	The expected level of risk once proposed (future) risk mitigations and key controls have been implemented.
Risk	The effect of uncertainty on objectives.
Risk appetite	Amount of risk that the organisation is willing to pursue or retain.
Risk breakdown structure	A structured approach to organise sources of risks into categories which are then presented in hierarchal order.
Risk categories	A group of potential causes of risk.
Risk management	Coordinated activities to direct and control an organisation with regards to risk.
Risk management framework	The set of components that provides the foundations and organisational arrangements for designing, implementing, monitoring, reviewing and continually improving risk management throughout the project.
Risk Management Plan	The document which outlines the risk management framework, specifies the approach and strategies, the management components and resources to be applied to risk management within the project.
Risk Management Policy	Statement of overall intentions and direction of an organisation related to risk management.
Risk and opportunity register	A register which records the outputs of the risk management processes.
Risk lead	Person or entity responsible for managing a risk.
Risk treatment	The process of selecting and implementing measures to modify risk.
Secondary risk	Risk that arises as a direct result of implementing a risk mitigation or key control.
Sensitivity analysis	A process to determine which individual risks or other sources of uncertainty have the most potential impact on project outcomes by correlating variations in project outcomes with variations in elements of a quantitative risk analysis model.

Table 1: Risk management terms and definitions

2 Introduction

2.1 Purpose of this Document

The purpose of this Risk Management Plan is to define how project risks are identified, assessed and managed to produce the most favourable result for the SBR Project. It provides a standard procedure for team members on managing, reporting and mitigating project risks. The plan will be reviewed periodically throughout the project's lifecycle to confirm its effectiveness and for continual improvement.

This document should be read in conjunction with the SBR - Project Management Plan.

2.2 Risk Management Objectives

The objectives of risk management within the SBR Project are to minimise the adverse effects of potential events on the project's objectives and enhance the impact of any opportunities. This will be achieved through the following objectives:

- Generation of a proactive risk management culture throughout the project's lifecycle
- Effective evaluation and efficient management of identified risks at all levels within the project team
- Relevant and robust analysis and reporting to support decision making
- Ongoing monitoring and review of the risk management process to ensure mitigation mechanisms are maintained and improvement opportunities are identified, evaluated and developed.

2.3 Risk Management Scope

This SBR - Risk Management Plan covers the management of all risks associated with the establishment, planning, design, logistics, construction, demolition, health, safety and environmental activities of the SBR Project. Each of these are required to safely and successfully support, deliver and handover the project. This SBR - Risk Management Plan addresses all aspects of the project risk management process including risk identification, risk analysis, treatment, reporting and close-out.

2.4 Risk Management Standard

Aligned with Antarctica New Zealand's Risk Management System, the ISO 31000:2018 Standard has been adopted as the framework for managing risk within the SBR Project. The SBR - Risk Management Plan is also guided by the following Antarctica New Zealand corporate documentation:

- Risk Management Policy
- Risk Management Process
- Delegations Manual

The risk management tools and techniques identified in the PMI PMBOK and the Practice Standard for project risk management will also be adopted into the SBR Project.

2.5 Framework of Documents

Figure 1 outlines the setting of the Risk Management Plan within the suite of Project Management Plans that aligns with the PMI PMBOK.

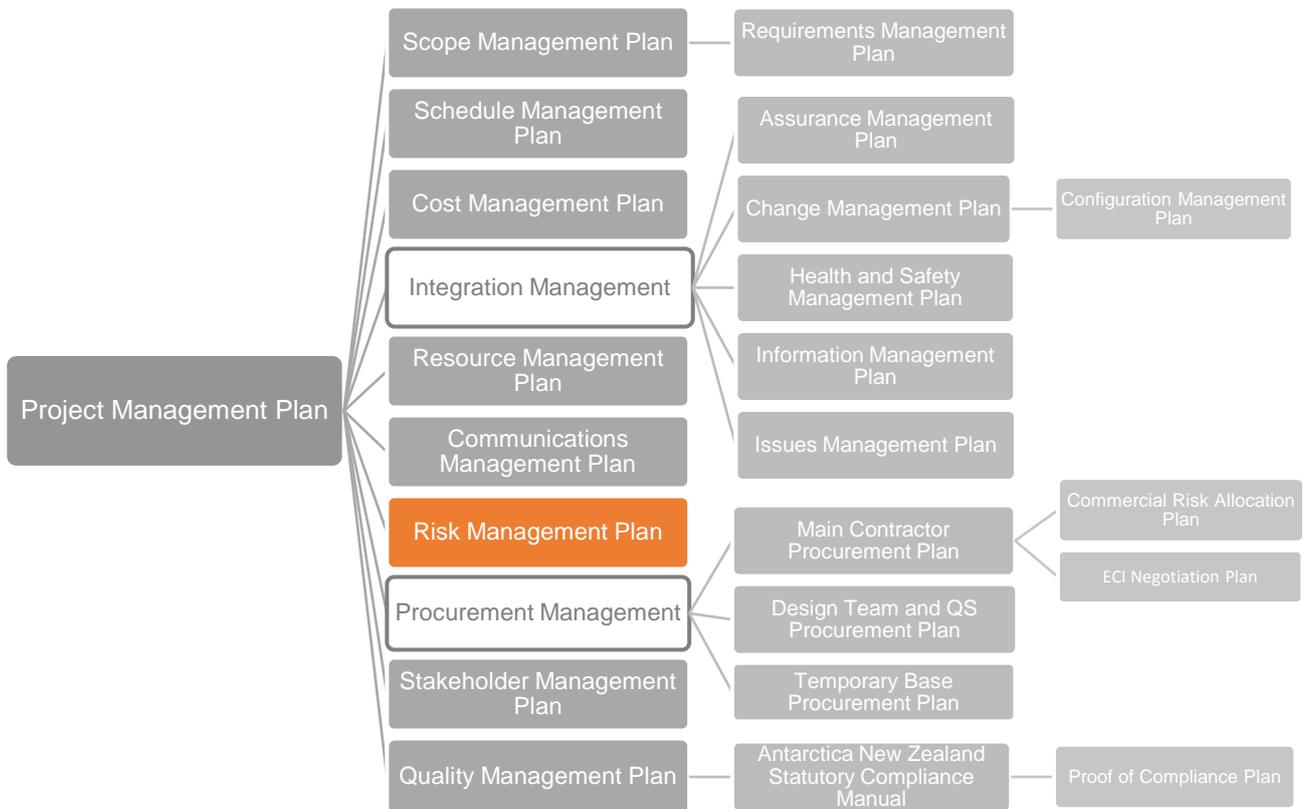


Figure 1: Framework of project management plans

2.6 Roles and Responsibilities

Role	Accountabilities/Responsibilities
PSG	<ul style="list-style-type: none"> Enforcing the Antarctica New Zealand Risk Management Policy Providing strategic governance and risk leadership to the project Escalating critical risk items to Antarctica New Zealand's Board and Ministry of Foreign Affairs and Trade (MFAT) as necessary Monitoring of the critical risk items
PCG	<ul style="list-style-type: none"> Implementing the Antarctica New Zealand Risk Management Framework Escalating critical risk items to the PSG as necessary Monitoring of the critical risk items
Project Director	<ul style="list-style-type: none"> Approval of the Risk Management Plan Escalating critical risk items to the PSG as necessary Monitoring of the high-risk items
Senior Project Manager	<ul style="list-style-type: none"> Implementing the SBR Risk Management Plan Approval of the proposed risk responses Escalating critical and high-risk items to the Project Director and PCG and/or PSG as necessary
Risk Manager (Currently filled by Project Controls Manager)	<ul style="list-style-type: none"> Development of the SBR - Risk Management Plan Developing and maintaining the SBR - Risk Register Facilitating qualitative risk analysis Performing quantitative risk analysis Reporting the status of overall project risks to the Senior Project Manager/project team Managing the Project Risk Breakdown Structure (RBS)
Risk Lead	<ul style="list-style-type: none"> Managing assigned risks, including monitoring, mitigating and reporting Developing mitigation plans Reporting eventuating risks Escalating emerging risks to the Senior Project Manager The "Responsible" person in the Risk Register
Relevant Stakeholder	<ul style="list-style-type: none"> Identifying and reporting risks to the Risk Manager
Assistant Project Manager	<ul style="list-style-type: none"> Chairing the risk review meetings Ensuring the risk register is kept up to date Assigning risk ownership as appropriate
Project Administrator	<ul style="list-style-type: none"> Ensuring all documents are in Antarctica New Zealand's corporate style Uploading relevant documents such as the approved risk documents to SharePoint Performing administrative duties to assist with risk management Taking and distributing risk workshop minutes Ensuring risk discussions are on the agenda for relevant meetings Owning risks applicable to information management Updating relevant project documents such as the lessons learned register
Team Members	<ul style="list-style-type: none"> Participating in the risk workshops Raising new risks and opportunities Managing assigned actions

Table 2: Risk Management Roles and Responsibilities

3 Risk Management Overview

The standard defines the risk management process as the systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, and identifying, analysing, treating, monitoring and reviewing risk. Figure 2 summarises the Risk Management Process (ISO 31000:2018) to be used in the project.



Figure 2: Risk Management Process

3.1 Establishing the Context

During the Project initiation phase, the scope and objectives of risk management have been defined to develop the Risk Management Plan. Both the internal and external project environment in which Antarctica New Zealand seeks to achieve its objectives have been and will be considered when managing risk on the SBR Project.

3.1.1 External context

- The economic and dynamic political environment which could impact the approval and funding to achieve the project's objectives.
- External stakeholders' expectations which could impact the objective of maintaining credibility within the Antarctic Treaty System.
- Geographical and climatic conditions which could impact logistics and timely delivery of the project.

3.1.2 Internal context

- Internal stakeholders' expectations, organisational structure, business processes, resources and capabilities which could impact the objectives of safe, within time and budget delivery of a modern and fit-for-purpose facility that enhances quality Science.
- Construction activities which could impact the objective of maintaining the science programme throughout the project delivery



3.2 Risk Classifications

Risks are classified as follows:

- Organisational risks
- Delivery risks
- Government risks

Identified risks which can be managed at a project level are classified as Delivery risks, and those contributing to the business and requiring organisational governance are classified as Organisational risks. Risks that require escalation beyond the organisation, are classified as Government risks.

3.3 Risk Categories

The context against which identified risks are likely to exist is in the following major categories:

- Technical
- Management
- Financial
- Commercial
- External
- Uncertainties
- Opportunities.

3.4 Project Objective Categories

Risk will be assessed in terms of the impact to the following SBR Project key objectives:

- Harm/health and safety
- Environmental impact
- Cost impact
- Schedule impact
- Operational impact
- Reputational impact
- Legal and compliance.

3.5 Risk Appetite

The threshold for risk tolerance follows the guidelines defined in Antarctica New Zealand Risk Management Policy:

- **Risk Averse (Low tolerance)** means that it is not deemed appropriate to take any level of risk beyond those that are routinely accepted as both unavoidable and reasonable.
- **Cautious (Limited tolerance)** means that it may be acceptable to take limited manageable risks where the potential benefits to achieving organisational success significantly outweigh the risks being undertaken.
- **Accepting (High tolerance)** means that the risk owner acknowledges that the potential loss from a risk is not great enough to warrant spending money to avoid it.

3.6 Critical Success Factors

The following are the critical success factor criteria for the SBR Project risk management process:

- Recognise the value of risk management
- Individual commitment/responsibility
- Open and honest communication
- Organisational commitment to managing risk
- Risk effort and resource scaled to meet project needs
- Integration with project management.

3.7 Key Performance Indicators

To ensure risk management success, the key performance indicators are:

- Timely identification and assessment of risks
- Implementation of action or treatment plans by specific due dates
- A reasonable number of risks materialise into issues only.

3.8 Constraints and Freedoms

The constraints and freedoms shown in Figure 3 have been identified for the SBR Project. These constraints and freedoms form the basis of the risk management process and was a key component of the initial risk identification process. It is important to occasionally refer back to these constraints and freedoms to see if, as the project progresses, more risks can be identified from these high-level constraints and freedoms.

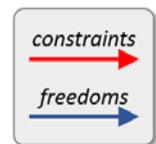


Figure 3: Constraints and freedoms for the SBR Project

4 Risk Identification

4.1 Identifying Risk

Risk identification is the process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics. Risk identification is performed as early as possible in the project's lifecycle, recognising the paradox that uncertainty is high in the initial stages. As not all risks can be identified at any given point, risk identification will be done on an ongoing basis.

A broad range of risk sources will be considered to ensure that as many threats as possible are identified. The risk identification process will also ensure opportunities are properly considered.

A broad range of SBR stakeholders will have input, so that all perspectives are represented and considered. Each identified risk should relate to at least one project objective. Identified risks must be clearly and unambiguously identified and described.

A consistent risk identification format has been developed for the SBR Project for use in all risk descriptions as follows:

- **Event:** what is the event that could happen?
- **Cause:** what is the cause of the identified event?
- **Result:** what is the result of this event occurring?

Responsibility for identifying and raising potential and real project risks primarily lies with all project staff, contractors and consultants. In addition to risk identification from business as usual activities, project risks will be generated with input from a variety of sources:

- Internal monthly risk review workshops to discuss any updates to identified project risks
- Regular risk review and discussion at PCG and PSG meetings, design workshops, etc.
- Lessons learned from previous projects
- Externally facilitated risk workshops either specifically or at designated phases and decision points in the project
- Use of project audit reports
- Project Management Plan
- Project documents including the Assumption Log, Issues Log, Stakeholder Register
- Relevant information from other construction projects in Antarctica
- General consultation with Other National Antarctic Programmes (ONAP)
- Use of risk management tools from previous projects
- Work Breakdown Structure (WBS) analysis
- Review of health and safety incidents from Antarctica New Zealand's HSE reporting system

The following tools and techniques may be used in the risk identification process:

- Brainstorming
- Checklists
- Interviews with subject matter experts and other stakeholders
- Root cause analysis
- Assumption and constraint analysis
- Strengths, weaknesses, opportunities and threats (SWOT) analysis
- Document analysis.

All identified risks are populated in the SBR – Risk Register. The risk register should not be a static record of risks, but regularly reviewed and challenged, creating a dynamic action plan that includes current risk treatments and levels, and details of further planned actions. Decisions around considered but discarded risk treatments can also be included for future reference. Likewise, decisions to close out risks need to be captured, including the circumstances that gave rise to the risk closure.

4.2 How to Raise Risks

Anyone can assist with the identification of project risks, regardless of whether they are involved in the delivery of the project or not. Project team members can raise risks in the following ways:

- During the risk discussion at the weekly project team meeting
- During the new risks/opportunity discussion at the monthly risk review meeting

- During the fortnightly design team meetings
- By speaking to either the Senior Project Manager, the Project Controls Manager, or any member of the project team
- During the PCG and PSG meetings
- During any other project meeting

Additionally, for any member outside the project team, the risk can be raised in a number of ways:

- During the weekly staff meetings
- At the Scott Base Redevelopment drop in sessions
- By speaking to either the Senior Project Manager, the Project Controls Manager, or any member of the project team
- By sending an email to the project team email address – sbrproject@antarcticanz.govt.nz

To raise a risk item/s, the Project Controls Manager who manages the Risk Breakdown Structure must first be consulted to confirm no duplication of risk items in the Risk Register. The Project Controls Manager will identify the risk category and subsequently update the SBR – Risk Breakdown Structure. The risk's location in the Risk Breakdown Structure will inform the risk's number and location in the SBR – Risk Register. The Assistant Project Manager will update the SBR – Risk Register with the new risk. The new risk will be assigned a risk lead who will populate the mitigation strategies and own the risk. If necessary, the risk will be discussed at the Monthly Risk Review Meeting.

4.3 Organising Risk

A structured approach has been adopted to organise sources of risk into categories which are then presented in hierarchal order. This is called a Risk Breakdown Structure. Organising risks in this way ensures risks can be identified holistically, then arranged in an order that supports the identification of potential common linkages between risks factors. It helps to effectively and efficiently manage a large number of risks with the same resultant impact on the project. It is also helpful in identifying areas of the project where risk identification may be incomplete or insufficient (gap analysis).

Figure 4 below illustrates the hierarchy of risks from overarching project risks down to the lowest level individual risks.

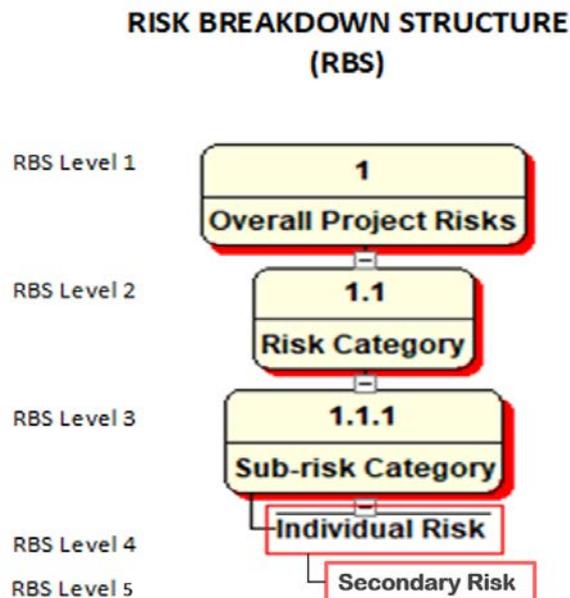


Figure 4: RBS Project Risk Hierarchy

4.4 Populating the Risk Register

Once the risk has been assigned a position in the RBS, The Risk Manager or the Assistant Project Manager will populate the risk register. This is done by completing all columns in the risk register. If a print out for a risk is required, the tab “Risk Sheet” within the risk register shall be updated with the Risk Number in cell C4. The sheet will automatically populate with all relevant information.

	A	B	C	D	E	F	G	H				
1	Individual Project Risk Sheet											
2	CELL C4:D4 HIGHLIGHTED IN RED IS THE ONLY EDITABLE CELL IN THIS WORKBOOK. IF YOU NEED TO CHANGE SOMETHING, CHANGE IT IN THE RISK REGISTER											
3	Project Title		Scott Base Redevelopment Project		Project Code		SBR					
4	Risk Number		2.2.2		Date Raised		2-Aug-17					
5												
6	Detailed Risk Description		What is the event?		Construction activities significantly impacting science programme.							
7			Caused by?		<ul style="list-style-type: none"> • Poor construction planning. • Poor operational planning • Lack of valuable information from the Science Community • Changes to assumed funding options (i.e. funding not granted until later) 							
8			Resulting in?		<ul style="list-style-type: none"> • Delay or cancellation of Science events. • Additional cost to deconflict • Delay to construction 							
9			Risk Classification		Delivery Risk							
10	Project Stage Impacted			Stage 4	Impact Category	Cost Impact, Operational Impact, Reputational Impact						
11	Risk Response			Escalate	Risk Tolerance	Cautious (limited tolerance)						
12												
13	Qualitative Assessment - Pre Mitigation				Consequence		Likelihood					
14					Major		Possible					
15												
16	Quantitative Assessment - Pre Mitigation				Financial Consequence							
17					Raw Risk		Optimistic Cost \$	Most Likely Cost \$	Pessimistic Cost \$			
18							\$ -	\$ -	\$ -			
19					Critical				Duration Impact			
20	Optimistic Time (Days)	Most Likely Time (Days)	Pessimistic Time (Days)									
21	0	0	0									
22	QRA P85				0							
	Risk Mitigation and Control Strategy		<ul style="list-style-type: none"> • Engage SBLT and operations team in construction planning. • Develop a construction strategy which minimises impact on existing base operation. • Engage with operational science team. • Ensure phasing of work is undertaken to minimise interruption. 									
	ListData		Risk Sheet		SBR Risk Register Ver.2.0		Temp. Base - Risk Reg. Ver.1.0		Wind Farm - Risk Reg. Ver.1.0		Cost Impact Estim	

Figure 5: Individual Risk Sheet

4.5 Assigning Risk Leads

Roles and responsibilities will be defined as appropriate to the characteristic of the risk identified. A responsibility assignment matrix known as RACI model will be adopted for SBR project, and will live within the SBR – Risk Register. RACI stands for:

- Responsible – those who manage the risk and implement mitigation action.
- Accountable – the one ultimately answerable for the correct implementation of mitigation action.
- Consulted – those whose opinions are sought to inform decision making.
- Informed – those who are kept up-to-date on the progress status.

The Assistant Project Manager will assign a suggested risk or opportunity Lead in the SBR Risk Register and then discuss this new item with the responsible person.

5 Risk Analysis

5.1 Qualitative Risk Analysis

Qualitative risk analysis is the process of prioritising individual risks for further analysis or action. It involves assessing their probability of occurrence and impact as well as other characteristics. The key benefit of this process is that it focusses efforts on high priority risks which inform the Plan Risk Responses process. Performed throughout the project's life cycle, this process is used each time a new risk is identified, and assesses the impact that the risk could potentially have on the project.

The following tools and techniques may be used in the qualitative risk analysis process:

- Educated opinion and expert judgement
- Probability and impact assessment
- Influence diagram
- Expected value calculators.

5.1.1 Risk likelihood

Risk likelihood is a time-based measure used to classify risks by how often they are likely to occur. Antarctica New Zealand's standard risk likelihood classifications are shown in Table 3.

RATING	LIKELIHOOD DEFINITIONS (12 months or within project lifetime)
Almost certain	Significant probability (annual event). History of regular occurrence, the event is expected to occur in most circumstances.
Likely	Some certainty of occurrence (1 in 5 year event). History of frequent occurrence, the event will probably occur.
Possible	Could occur at some time (1 in 10 year event). History of infrequent occurrence, the event may occur in typical circumstances.
Unlikely	A small chance of the event occurring (1 in 50 year event). Little history of occurrence, the event may occur in unusual circumstances.
Rare	Improbable (1 in 100 year event). No history of occurrence, the event is not expected to occur or only in conditions previously not seen.

Table 3: Risk Likelihoods

5.1.2 Risk impact categories and consequence definitions

Risk consequence is an effect/impact-based measure used to classify the risk in terms of the most probable impact it would have on the project if left untreated. The SBR project risk impact classification follows the criteria defined on Antarctica New Zealand Risk Management Reference Guide apart from the cost and schedule categories which are project context specific.

Table 4 explains each of these risk categories in detail:

Risk Impact Category	Insignificant	Minor	Moderate	Major	Catastrophic
Health and Safety / Harm The risk that Antarctica NZ does not adequately protect people (staff, contractors, visitors, public) from harm.	Pain or Discomfort; or First Aid treatment;. Not affecting work or daily life activities. Minor reversible irritation. Not affecting work or daily life activities.	Injury that requires medical treatment beyond First Aid. Not affecting work or daily life activities. A diagnosed reversible illness/ health impact, that responds to medical treatment. Not affecting work or daily life activities.	Injury affecting work and daily activities - unable to perform normal duties or hours or unable to work for more than 1 day. May have also required medical treatment for the injury. A diagnosed reversible work-related illness/health impact. Affecting work and daily life activities, needing up to 5 days to fully recover.	Single fatality; or permanent disability Injury; or serious/notifiable Injury. Refer to notifiable injury definitions Single diagnosed work-related illness/health impact; irreversible damage/long-term disability. Affecting work and daily life activities for more than 5 days.	Multiple fatalities; or more than 1 serious/notifiable injury. Refer to notifiable injury definitions Fatality resulting from work-related illness/health impact; Multiple diagnosed work-related illness/health impact, irreversible damage/ongoing significant disability
Environmental impact The risk associated with environmental events, impacts, or pollutions.	Any impact to the environment is transient, confined to the site of activity or occurs on an already heavily impacted site.	Any minimal, short term impact to the natural functions and processes of the environment. Impacts confined to the area of activity. Recovery is definite	Any moderate, medium term impact to the natural functions and processes of the environment, not subject to long lasting changes. Impacts confined to medium sized area. Recovery is likely	Any major, long term impact to the natural functions and processes of the environment, major sized area is affected. Recovery is slow or uncertain	Any permanent impact to the environment. Irreversible or chronic changes to natural functions or processes, or occurs at a highly sensitive location Recovery is unlikely
Operational Impact The risk of Antarctica NZ not being able to provide the necessary support	No measurable impact to programme, negligible performance impact.	Noticeable disruption to programme for up to 1 day. Experience delays and / or performance reduction.	Obvious disruption to programme for up to 1 week. Experience delays and reduced performance quality.	Programme is compromised for up to 1 month. Some activities are delayed or cancelled.	Programme is compromised for greater than one month. Many activities are delayed or cancelled.

Risk Impact Category	Insignificant	Minor	Moderate	Major	Catastrophic
to achieve event objectives					

<p>Legal, Regulatory and Compliance The risk that Antarctica NZ is not complying with contracts, existing laws, regulations or Treaty.</p>	<p>Minor non-compliances, able to be remedied without penalty or notification, unlikely to result in adverse regulatory response or legal action.</p>	<p>Minor non-compliances to legislation or regulation, which may result in infringement notice.</p>	<p>Significant legislative or regulatory non-compliance, resulting in possible regulatory action.</p>	<p>Major legislative or regulatory non-compliance, expected to attract regulatory attention or resulting in some censure by a regulator. Investigation, prosecution and/or major fine possible.</p>	<p>Serious compliance breach, or multiple breaches that result in prosecution, litigation, maximum penalty or sanction by regulatory body</p>
	<p>Minor contractual breach, with no interruption to services, which can be remedied within a reasonable period. No compensation required</p>	<p>Contractual breach resulting in: minor interruption to services or potential for dispute. Involves procurement specialist in finding resolution and potential for proportionally small compensation.</p>	<p>Material breach of contractual obligation resulting in non-supply (for defined period but remedied), and mediation. Requires proportionally moderate settlement</p>	<p>Major breach of contract resulting in non-supply (unable to be remedied); alternate supplier called in and dispute resolution proceedings. Requires proportionally large settlement</p>	<p>Material breach of contract resulting in contract cancellation and/or litigation.</p>

Table 4: Risk classifications based on impact of consequences

5.1.3 Risk severity matrix

The impact of each risk or opportunity is determined by aligning the ‘likelihood’ rating with the ‘consequence’ rating in the risk matrices below. The matrices allow each risk or opportunity to be categorised and then separated by priority group. Each risk or opportunity is assigned a priority level based on its severity and is managed accordingly using the Plan Risk Responses framework detailed in the corresponding section of this SBR – Risk Management Plan.

Two risk severities are recorded on the SBR – Risk Register against an individual risk and determined using the matrix in Table 5. They consider the point in time and extent of controls implemented. The two categories are:

- **Raw risk:** this is the base risk level prior to any mitigations or key controls being implemented. This rating will likely remain unchanged throughout the duration of the project.
- **Current risk:** this is the level of risk at any point in time, considering any mitigations and key controls that have already been implemented. Any risk where the current level of risk severity exceeds agreed tolerances will require further risk mitigations to be implemented. As the project progresses, the current level of risk will need to be updated to reflect the impact of any additional risk mitigations implemented or not.

Table 5 (risk matrix) follows the criteria defined on Antarctica New Zealand Risk Management Reference Guide.

LIKELIHOOD	Almost certain	Med	High	Critical	Critical	Critical
	Likely	Med	Med	High	Critical	Critical
	Possible	Low	Med	High	Critical	Critical
	Unlikely	Low	Low	Med	High	Critical
	Rare	Low	Low	Med	High	High
	Insignificant	Minor	Moderate	Major	Catastrophic	
CONSEQUENCE						

Table 5: Risk Matrix

Table 6 (opportunity matrix) has been developed specifically in the context of SBR.

LIKELIHOOD	Almost certain	Very high	Very high	Very high	High	Med
	Likely	Very high	Very high	High	Med	Med
	Possible	Very high	Very high	High	Med	Low
	Unlikely	Very high	High	Med	Low	Low
	Rare	High	High	Med	Low	Low
	Highly significant	Significant	Slightly significant	Negligible	Insignificant	
BENEFIT						

Table 6: Opportunity Matrix

5.2 Quantitative Risk Analysis (QRA)

QRA is the process of numerically analysing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives. The key benefit of this process is that it quantifies overall project risk exposure, and it can provide additional quantitative risk information to support risk response planning.

The following tools and techniques may be used in the QRA process:

- Monte Carlo simulation
- Decision trees
- Sensitivity analysis.

5.2.1 Risk frequency

The risk register captures the frequency at which a risk occurs so that it can be accurately assessed in the Quantitative Risk Analysis. The different frequency types are:

- **One-off** – Can only occur once.
- **Multi One-off** – Could occur more than once, but the impact each time will remain the same.
- **Multi-State** – Likely to only happen once, but the severity of the impact varies depending on the nature of the event.
- **Unlimited** – Could occur an unlimited number of times throughout the project.

5.2.2 Monte Carlo simulation

Monte Carlo simulation will be used as the primary method for quantitative risk analysis. It involves determining the impact of identified risks by running simulations to identify the range of possible outcomes for multiple scenarios. The key feature of a Monte Carlo simulation is that it identifies, based on how ranges of estimates are created, how likely the resulting outcomes are to inform decision making.

5.2.3 Cost risk analysis using Monte Carlo simulation

The Monte Carlo simulation uses standard deviation to determine the likely financial effect from the impacts occurring. This is based on a 3-point estimate of impact cost and the probability/likelihood of the impacts occurring both pre- and post-mitigation. The tool (@Risk) uses random numbers over a pre-determined number of iterations (generally 10,000+) to find likely values at key points of statistical probability. Cost risk analysis will be performed using either of the following statistical distributions depending on the nature of the estimates:

- Uniform – all probabilities have an equal chance of occurrence
- Triangular – the simulation favours the most likely value.

Each risk impact will be estimated from first principles to give the following key values:

- **Minimum** – This value must be greater than \$0 and, in alignment with the statistical probability value, would only have a 10% chance of not being exceeded (so inversely it has a 90% chance of being exceeded). There is theoretically no 0% value as that would suggest no impact. This level is generally referred to the P10 risk value.
- **Most Likely** – This value is the assumed ‘most likely’ value of the impact and is generally the average of likely impact values. This probability would be a 50% chance of not being exceeded and is referred to as the P50 value.
- **Maximum** – This is the reasonable maximum value of the impact and is not the absolute maximum as theoretically this would be infinite. This would have an 85% probability of not being exceeded and is referred to as the P85 value.

The likelihood values in the Risk Register are aligned with the following % probability in the model:

LIKELIHOOD	Almost certain	90%
	Likely	70%
	Possible	50%
	Unlikely	30%
	Rare	10%

Table 7: Probability and Likelihood Values

Figure 6 illustrates sample outputs of Monte Carlo cost analysis.

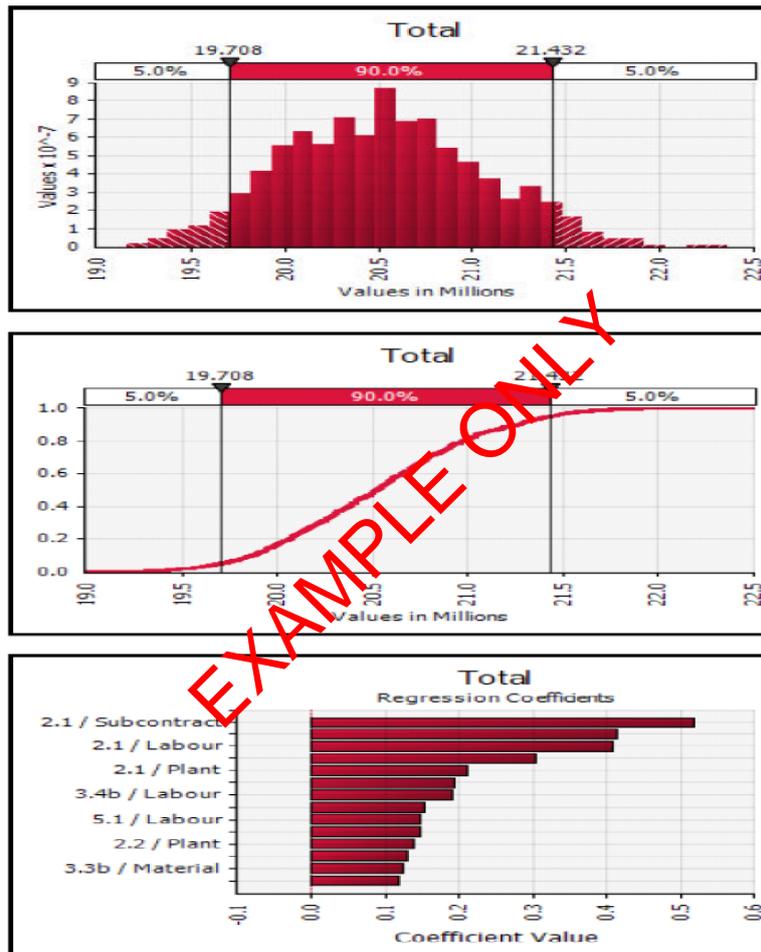


Figure 6: Cost Risk Analysis Output – Sample

5.2.4 Schedule risk analysis using Monte Carlo simulation

Overall project risk analysis will be performed within the integrated schedule-cost-risk model. The key benefit of calculating the cost with the same assumptions that drive schedule dates, is that cost uncertainty is determined by uncertain duration.

Discrete schedule risks will be integrated in the project schedule, and activity durations will be modelled using 3-point estimating (optimistic, most likely and pessimistic) to account for duration uncertainties. Project costs will be loaded into the schedule model following the Cost Breakdown Structure (CBS) which is aligned with the Work Breakdown Structure. Schedule risk analysis will be performed using Project Evaluation Review Technique (PERT) statistical distribution, and simulated at 10,000 iterations using the Latin hypercube sampling method.

With the schedule, costs and risks all integrated within the schedule model, Monte Carlo simulation will determine the likely project duration under different scenarios considering schedule risks and uncertainties. It addresses how potential triggers will impact the overall schedule, particularly the schedule critical path and subsequently the variable project costs. The integrated schedule-cost-risk analysis also helps determine the likelihood of the project running over time or budget compared with the current baseline. The final benefit is that it helps set the required project contingency reserve, to achieve a desired level of certainty.

Figure 7 illustrates sample outputs of the Monte Carlo integrated cost and schedule analysis.

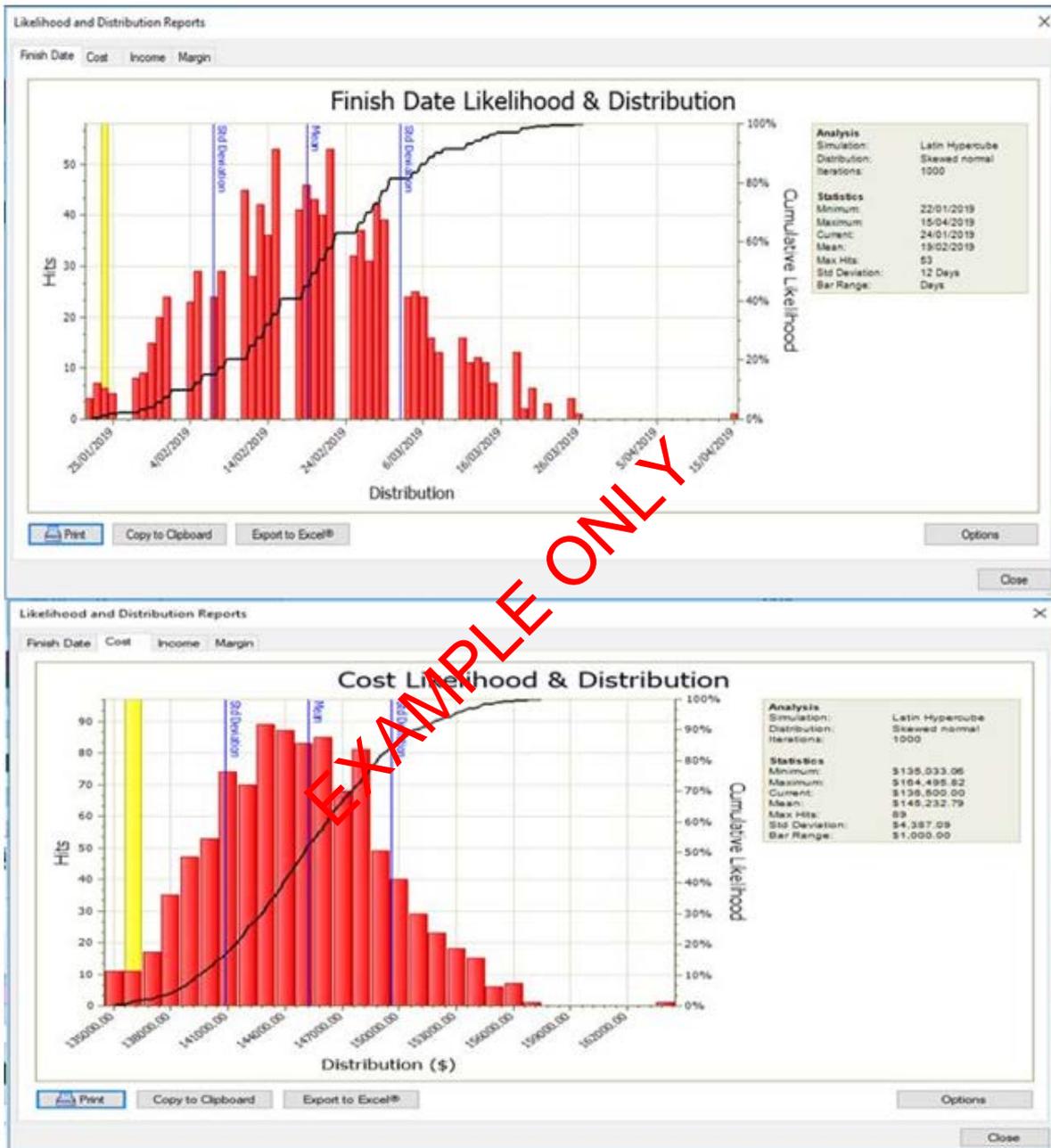


Figure 7: Integrated Cost-Schedule Risk Analysis Output – Sample

5.3 Risk Evaluation

Risk evaluation of analysed risks is used to determine which risks are to be treated and also to define the prioritisation for treatment. Each risk is ranked within the Risk Register by its current risk exposure score. To facilitate ranking of risks, the scoring system provided in Antarctica New Zealand's Risk Severity Matrix (Table 5) and Antarctica New Zealand's risk tolerance threshold are used.

6 Risk Treatment

6.1 Plan Risk Responses

Plan risk responses is the process of developing options, selecting strategies, and agreeing on actions to address project risk exposure. The objective of this process is to determine the appropriate response to risks. Treatment strategies are highlighted below:

6.2 Risk Treatment Strategies

The following risk treatment categories will be utilised as risk response strategies:

- Escalate the risk- either because it is outside of the project's scope or the proposed risk response exceeds the risk owners delegated authority level or role responsibility.
- Avoid the risk- either eliminate the activity or select a less risky alternative
- Transfer the risk- by outsourcing to another agency or insuring against an adverse result
- Mitigate the risk- by reducing the potential likelihood or consequence of the occurrence
- Accept potential consequences- with a contingency to respond should the risk occur.

6.3 Opportunities Treatment Strategies

In a similar manner, the following strategies can be used to capitalise on potential opportunities:

- Escalate the opportunity- done when the opportunity is outside the scope of the project but could have a positive outcome
- Exploit the opportunity- to ensure that it definitely occurs
- Share the opportunity- when opportunity can be shared with other parties.
- Enhance the opportunity- by adding resources to an activity to ensure it is completed early
- Accept the opportunity- in a similar way that a negative risk is accepted, allowing a contingency of time or cost to take advantage of the opportunity should it occur.

6.4 Risk Mitigation and Contingency

6.4.1 Mitigation

Once treatment strategies have been decided, these are included in the Risk Register. Each treatment option is assessed for its impact on likelihood/consequence and balanced against any cost and or schedule impact. The most appropriate treatment option involves balancing costs against benefits, together with due regard to legal, regulatory compliance, the safety and security of our people and Antarctica New Zealand's objectives. Any risk treatment which creates a new scope of work will be managed through the SBR change management process with any associated cost approved in accordance with Antarctica New Zealand's Delegations Manual. After careful considerations, risk treatments may also involve decisions to take or increase the risk in order to pursue an opportunity.

6.4.2 Contingency

Probabilistic estimating approach will be utilised to determine the amount of financial contingency reserves. Project risk model will be developed taking the characteristics of individual risk into account and then simulated as a group using Monte Carlo analysis to provide a statistical quantitative assessment of overall project risks impact.

As the Risk Register is updated, the risk simulation will be re-run including new impacts and likelihoods while excluding any closed risks. This should be carried out on a monthly basis to inform the PCG and PSG report on current status and trends.

If appropriate, the simulation can also be run on the 'in progress likelihoods' in that a risk may only be partially mitigated so the benefit is not realised in totality.

Reserves are calculated for both risks, uncertainties and opportunities. The final contingency reserve is the additional funding allocated to address potential risk events minus the expected benefit from opportunities plus the allowance to cover the uncertainties.

6.4.2.1 Uncontrollable Risks

Uncontrollable risks are risks that if they were to eventuate the consequence would mean a delay of one whole season or more. They are low likelihood, but high consequence risks. Due to the uncontrollable nature of these risks, a provision for them has not been made in the QRA contingency. If they do occur, then the full extent of the impact will be felt, and a risk generated provision will not be sufficient to mitigate the cost. Should such an event occur, then Antarctica New Zealand will seek further Ministerial direction.

6.5 Current Risk Notification and Escalation

Once further risk treatment has been agreed and defined, a current risk score is calculated. The current risk level is the most likely level of risk after agreed/approved mitigations and key controls have been implemented. It is the responsibility of the Senior Project Manager to ensure current risks are managed, which means identifying and following through on these actions:

- When risk mitigations and key controls are expected to be implemented allowing these to be loaded into the schedule or actions register.
- Communicating when the risk is likely to occur.
- The timeframe for knowing if a mitigation has worked or not.
- When any contingency plan will be put into action, should a risk eventuate/mature.

Risks also need to be reported at the appropriate level, in line with Antarctica New Zealand's Risk Management Policy and the established SBR Project Management Plan. Table 8 outlines the monitoring and mitigating requirements for all current risks.

Severity	Priority	Monitoring and Mitigation
Critical	Requires active management and/or immediate action.	Monitored and reviewed by the risk owner and Project Director. Escalated to PSG (and PCG for information), Antarctica New Zealand's Board and MFAT notified as necessary.
High	Requires prompt intervention and active management.	Monitored and reviewed by risk owner and the Senior Project Manager. Escalated to PCG (or PSG) as necessary.
Medium	Requires active management.	Reviewed and managed at an operational level by the risk owner or other members of the project team and escalated to the Senior Project Manager or Project Director as necessary
Low	Requires regular monitoring.	Noted on Risk Register

Table 8: Risk Monitoring and Mitigation

6.6 Implement Risk Responses

This is the process of implementing agreed risk response plans. The key benefit is it ensures that agreed risk responses are executed as planned to address overall project risk exposure, minimise individual project risks, and maximise project opportunities. It is the responsibility of each risk lead to implement the identified risk responses. Only if the required level of proactive effort is applied to implementing these responses, will the overall project risks and opportunities be appropriately managed.

6.7 Further Treatment

Oftentimes, mitigations may be raised that are unable to be implemented during the current project Stage or phase. These mitigations are added to the risk register under the Further Treatment / Pursuit Column. The mitigation is assigned to either:

- **The Project Schedule** – If the mitigation is a large project activity it will be added to the project schedule and Work Breakdown Structure as a scope item. For example, to mitigate the risk of
- **The Actions Register** – The project Actions Register captures items that are not large enough to add to the schedule, but are above and beyond the Responsible person's regular BAU activities.
- **BAU** – Mitigating the risk falls within the risk owner's (or their staff) regular work activities.

7 Monitoring, Reporting and Closing Out Risks

This is the process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analysing new risks, and evaluating risk process effectiveness throughout the project. The key benefit of this process is that project decisions are made based on current information about overall project risk exposure and individual project risks. The purpose of the monitoring risks process is to:

- Determine if the implemented risk responses are effective
- Identify secondary risks in a timely manner
- Determine if the level of overall project risk has changed
- Determine if the status of identified individual project risks has changed
- Identify if any new individual project risks have arisen
- Decide if the risk management approach is still relevant
- Test that project assumptions are still valid
- Ensure risk management policies and procedures are being followed
- Verify if contingency reserves for cost or schedule require modification and
- Verify that the strategic project objectives are still valid.

Any items that can be addressed by the project team will be dealt with during either the SBR monthly risk review meetings or the responsible person's review of their risks. The more difficult items such as deciding whether the project strategy is still valid, will be escalated to the PCG and PSG meetings.

7.1 Risk Review Meetings

The SBR risk monitoring process will occur continuously throughout the project's lifecycle. To aid in the process of ongoing risk management and reporting, risk review meetings will be held on a monthly basis. Participants include members of the SBR Project team, members of the design team, consultants, contractors and other stakeholders as necessary. These meetings will engage all of the risk management processes including plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk responses, implement risk responses and monitor risks.

The purpose of these meetings is to:

- Identify any new risks that may have arisen
- Assess the likelihood and consequence of new risks using the SBR risk severity matrix
- Allocate responsibility for mitigation to appropriate people
- Plan risk responses to new risks and monitor whether the responses that have been implemented for known risks are effective
- Define and review the status of active, inactive, incoming and closed risks
- Track progress of mitigations and key controls for all active risks with risk owners and escalate these to the PCG/PSG as set out within this plan
- Review emerging risks and agree mitigations or key controls to action
- Close-out risks
- Audit the project's risk management process, suggest improvements and update lessons learned.

An agenda is circulated one week prior to the meeting. Minutes are taken and include the action items that arise from the workshop. The actions from the previous month's meeting are also circulated with the new agenda and reviewed at the meeting. As not all risks are relevant to all parties, there is time reserved at the

7.4 Ongoing Risk Management and Reporting

The risk management process is a critical part of day-to-day project management activities for the Senior Project Manager and project team. They will constantly evaluate pathways and options to monitor a dynamic, complex project risk profile.

Project risk forms a fundamental part of the monthly PCG dashboard report, and is a standing agenda item at the PCG meetings. It is also a fundamental component of PSG meetings, where there is a stronger focus on strategic, organisational and governance risks. The role of the PSG participants, is to draw on their expertise, knowledge and experience, to support the project team, and to help the overall project succeed in managing organisational and strategic risks as far as practicable.

Due to the project's size, complexity and profile, it is expected that the PSG will provide periodic updates on project risk to Antarctica New Zealand's Board of Directors and MFAT as necessary. The notification and reporting of particular risks will be determined by its severity. This is set out in Table 8.

Risk management reporting within the PCG and PSG dashboard report will include as a minimum:

- The top five active risks as determined at the monthly risk review meeting (or by individual risk owners) requiring attention or support with mitigations and/or key controls
- A reference number against the risk as identified in the project Risk Register
- Ongoing actions for risk mitigation or key controls
- Risks which have actually impacted on the project, and the consequence in terms of project deliverables, schedule, cost etc. These will be reported as issues. See the SBR – Issue Management Plan for more information
- Identifying whether the overall risk profile for the project has increased, decreased or remained the same since the previous month's review.

In addition, the below will be consider when providing more detailed reporting as required:

- New risks which have arisen or been identified during the reporting period
- The development of new contingency plans in readiness for emerging risks
- Any updates to the risk management framework, key roles or documentation.
- Risk close-out

7.4.1 Links to Organisational Risk Management

Antarctica New Zealand has a number of risk registers, which have been established for a specific purpose and audience (i.e. strategic risk register; organisational risk register; Antarctic Science Platform risk register; etc.). Each of these risk registers follows the Antarctica New Zealand risk management framework (based on ISO 31000: 2018). However, these individual risk registers are intrinsically linked.

In order to achieve a successful delivery of the SBR project, a holistic approach is required so as to consider the entire risk profile of the organisation, instead of focusing on each risk register individually, to ensure full visibility over strategic, organisational and project activity related risks. The Senior Leadership Team are given oversight to the SBR risks (as part of the PSG meetings) and are encouraged to consider the impacts of SBR risks on the organisation as a whole and visa-versa.

7.5 Closing Out a Risk

At certain times, a risk can be officially closed as it no longer requires active management. This might occur in circumstances such as:

- The risk mitigation is deemed to have been successful in whole or in part
- The event which would have triggered the risk has passed without causing the risk to occur
- The risk has occurred and contingency plans have been implemented with some success
- The risk was a perceived risk and a different understanding/approach has de-classified it as a risk.

When this decision is made, it must be recorded in the register, with a note including:

- Date of closure
- Who made the decision that the risk can be closed
- The circumstances in which the event/circumstance expired, resulting in risk closure.



7.6 Managing Issues

There may be a time during the project that one of the risks identified eventuates. This is now an issue. At this point key controls may be futile and alternative management strategies will need to be implemented. The eventuating risk will then be transferred to the Issues Log within the project control log for escalation and management. Refer to SBR – Issue Management Plan for more details on how issues are being managed.

7.7 Project Completion and Close-Out

When the project's strategic objectives have been achieved, the project risk management process will end. As part of the project close-out, remaining risks should be assessed to see if there is any possibility of them continuing through to normal operations. Any that are should be handed over to the applicable functional team within Antarctica New Zealand.

A review must be conducted into the effectiveness of the risk management process used, focusing particularly on:

- Any risks which arose that were not identified and prepared for, causing unanticipated impacts to the project deliverables
- Any shortfalls identified in the risk management process which affected how well the process worked and ways that this could be improved in the future
- Any mitigation actions which performed better or worse than expected
- Any risks that were identified but never materialised even without mitigation actions, i.e. overly pessimistic items that never happened
- Any risk management lessons learned for future projects.

Appendices

Appendix A: Individual Project Risk Sheet

Individual Project Risk Sheet						
CELL C4:D4 HIGHLIGHTED IN RED IS THE ONLY EDITABLE CELL IN THIS WORKBOOK. IF YOU NEED TO CHANGE SOMETHING, CHANGE IT IN THE RISK REGISTER						
Project Title	Scott Base Redevelopment Project		Project Code	SBR		
Risk Number	1		Date Raised			
Detailed Risk Description	What is the event?					
	Caused by?					
	Resulting in?					
	Risk Classification					
Project Stage Impacted			Impact Category			
Risk Response			Risk Tolerance			
Qualitative Assessment - Pre Mitigation			Consequence	Likelihood		
Quantitative Assessment - Pre Mitigation			Raw Risk	Financial Consequence		
				Optimistic Cost \$	Most Likely Cost \$	Pessimistic Cost \$
				Duration Impact		
				Optimistic Time (Days)	Most Likely Time (Days)	Pessimistic Time (Days)
QRA P85						
Risk Mitigation and Control Strategy						
Mitigation Actions Implemented to Date						
Risk Owner & Responsible For Mitigations						
Responsible		Accountable		Consult		Inform
Qualitative Assessment - Post Current Mitigations			Current Consequence	Current Likelihood		
Quantitative Assessment - Post Current Mitigations			Current Risk	Financial Consequence		
				Optimistic Cost \$	Most Likely Cost \$	Pessimistic Cost \$
				Duration Impact		
				Optimistic Time (Days)	Most Likely Time (Days)	Pessimistic Time (Days)
Future Mitigation Plan						
Actions Required						
Date of risk closure:					Risk Status- Active, Inactive, Closed	
Notes/Reason for closure						

Appendix B: Risk Register Template

ID	Risk / Opportunity Description			Classification	Project Stage Impacted	Impact Category	Raw Risk / Opportunity			Corporate Tolerance / Appetite	Treatment / Pursuit Strategy	Actions Implemented to date	Current Status	Rationale	Date of Closure	Current Risk / Opportunity			Response Strategy	Further Treatment / Pursuit			Roles & Responsibility Matrix			
	Event	Cause	Result				Consequence / Benefit	Likelihood	Impact							Consequence / Benefit	Likelihood	Impact		Treatment / Pursuit Plan	Actions Category	Specific Actions Required	Responsible	Accountable	Consulted	Informed
1	Risk Category																									
1.1	Risk Sub - Category																									
1.1.1	Risk Event	Risk Causes	Resulting impact	Delivery, Organisational or Government Risk	Stage 4 Stage 5	Schedule Impact, Cost Impact	Major	Possible	Critical	Accepting, Cautious or Risk Averse	Mitigation Strategies	Actions already implemented	Active			Moderate	Unlikely	Medium	Mitigate or Accept	Future mitigations	BAU	What specific actions are required?	Construction Manager	Senior Project Manager	Main Contractor	Project Team
1.1.1.1	Risk Event	Risk Causes	Resulting impact	Delivery, Organisational or Government Risk	Stage 4 Stage 5	Schedule Impact, Cost Impact	Major	Possible	Critical	Accepting, Cautious or Risk Averse	Mitigation Strategies	Actions already implemented	Closed	This risk is similar to risk 1.1.3 and has been closed in favour of that event.	1/10/2020	Moderate	Unlikely	Medium	Mitigate or Accept	Future mitigations	BAU	What specific actions are required?	Construction Manager	Senior Project Manager	Main Contractor	Project Team