



New South Wales
TREASURY

TOTAL ASSET MANAGEMENT

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RISK MANAGEMENT GUIDELINE

1 Introduction

Managing risk is an integral part of good management and is something many managers do already in one form or another. Sensitivity analysis or scenario planning for a project or economic appraisal are familiar examples, as are assessing the contingency allowance in a cost estimate or budget, buying insurance, revising contract provisions or undertaking community consultation during project planning.

Although the term 'risk' may not be used when these activities are undertaken, the concept of risk is central and the activities share a common objective, namely to recognise and prepare for a range of possible future outcomes.

Many NSW Government agencies undertake projects involving significant capital outlays. Three aspects of these projects make Risk Management desirable:

- their size implies there may be large potential losses unless they are managed carefully. Such projects may also involve unbalanced cash flows, when large initial investments are necessary before any returns are obtained.
- for assets with potentially long lives, risks associated with changing economic conditions, varying levels of demand for services, new competition and maintenance and disposal requirements must be analysed and managed to ensure the investment is worthwhile.
- large investments that lie outside the Government's ability or desire to fund from its own resources and involve private sector participation may require an additional focus to identify and manage the residual risks for Government.

Size is not the only consideration. Projects or programs, which are inherently complex or risky will also benefit from particular attention to Risk Management. This might occur when there are important political, economic or financial aspects, sensitive environmental or safety issues, or complex regulatory and licensing requirements.

Asset procurement involving the development or use of new technology, or unusual legal, insurance, underwriting or contractual arrangements are further suitable applications.

There is also a relevant standard for Risk Management, titled, "Australian and New Zealand Standard– AS/NZS 4360"

2 What is Risk Management?

2.1 General

Risks arise because of limited knowledge, experience or information and uncertainty about the future or through changes in the relationships between parties involved in an undertaking. This latter category is particularly relevant to current reforms in the supply, ownership, operation and maintenance of assets for public purposes where contracting out and private sector participation initiatives are being undertaken.

Risk Management provides a structured way of identifying and analysing potential risks, and devising and implementing responses appropriate to their impact. These responses generally draw on strategies of risk prevention, risk transfer, impact mitigation or risk acceptance. Within a single project or proposal each of these strategies may have application for different individual risks.

Risk analysis is a part of Risk Management. It addresses the question: *What might go wrong as compared with expectations?* While Risk Management, as well as asking this question, seeks to resolve: *What should be done about this?*

Risk Management processes assist planners and managers to systematically identify risks and develop measures to address them and their consequences. The aim is to produce more reliable planning, greater certainty about financial and management outcomes and improved decision making.

NSW Government asset planning and procurement strategies implemented in recent years have led to:

- different allocations and specifications of responsibility
- innovative forms of financing
- new forms of control and accountability, and
- increased choice of contractual arrangements.

These changes have exposed agencies to a range of new risks. They have increased the importance of incorporating Risk Management when undertaking strategic planning and testing project viability.

Risk Management should begin at the strategic planning stage of a proposed project or program and continue through its life.

2.2 Guideline terminology

The following terms are defined in the context of this guideline and the application of Risk Management to the proposal planning/service strategy and Total Asset Management (TAM) process:

Risk

The possibility that an expected outcome is not achieved or is replaced by another, or that an unforeseen event occurs. This broad view of risk includes both uncertainty due to future events and the consequences of limited knowledge, information or experience. It is measured in terms of consequences and likelihoods.

Risk exposure

Arises from the possibility of economic, financial or social loss or gain, physical damage or injury, or delay. The significance of risks is the impact they may have on the achievement of proposal objectives, delivery goals or management effectiveness.

Risk consequences

The impacts on desired outcomes from the risk event occurring. The concern focuses on loss as although windfalls may result they do not create a liability or cost. These consequences create the need for management attention.

Risk analysis

The process of identifying risks, estimating their likelihoods and evaluating potential consequences.

Risk Management

The set of activities concerned with identifying potential risks, analysing their consequences and devising and implementing responses to ensure that proposal or project objectives and delivery goals are achieved. This includes management of on-going risks associated with ownership of assets.

Contract or project Risk Management

The management of risks for the procurement, construction phase and lifetime use of a capital asset.

2.3 Asset management implications

In asset management, it is convenient to think about two principal categories of Risk Management applications:

Strategic/feasibility

Risk Management as applied in the strategic planning stages of the TAM process, from the corporate plan, service and asset strategy to the feasibility of the more specific capital investment, asset maintenance and acquisition/disposal plans.

- Risk Management at this level is concerned with:
- ensuring corporate, service and strategic objectives will be achieved
- confirming risk consequences do not compromise the viability of the proposal for any stakeholder, and
- ensuring that the best planning options are selected.

Procurement to disposal

In the procurement, maintenance and disposal stages, the focus is on efficient and effective project and service delivery. Here, Risk Management is directed towards achieving more favourable and reliable outcomes in terms of:

- timeliness
- cost and quality of the asset
- functional and service delivery requirements, and
- ensuring that the best procurement option is selected

These different applications impose different requirements for Risk Management at different project stages. Risks may change as a project progresses and there will be a need to review and update management provisions as risks change to match project requirements. For major projects, several risk analyses may be conducted:

- at concept development and appraisal stages of the proposal
- for the procurement and construction of the approved project, and
- for maintenance and disposal strategies.

2.4 Legislative requirements

Risk Management is mandatory under legislation for some classes of hazardous facilities and activities. The Risk Management processes described in this guideline are supplementary to the standards set by the legislative requirements. They do not replace or supersede them.

3 Risk Management requirements

TAM is part of a larger reform program within NSW aimed at improving value from public sector assets and increasing productivity in capital works investment. Risk Management can contribute to these objectives through more economic service delivery, opportunities to reduce uncertainty and costs, and more effective contingency planning.

3.1 Policy requirements

NSW Government agencies are required to adopt a structured and systematic Risk Management process within their asset and capital works management procedures.

The policy requirements for Risk Management responsibilities of NSW public sector agencies are as follows:

Risk Management Plan

For designated proposals, a Risk Management Plan is to be prepared and included in documentation submitted to NSW Treasury for the Budget Committee of Cabinet.

Designated proposals include:

- all new projects valued in excess of \$20 million
- all proposals which involve private sector financing
- proposals which are characterised as being significantly sensitive in economic, environmental or political terms, and
- complex or innovative projects where significant risks in terms of viability, procurement or Government commitment can be identified.

Where agencies are uncertain as to designated status, they should consult with their Agency Relationship Manager in NSW Treasury.

Central agencies also retain discretion for designating particular projects as circumstances require. For Private Sector Participation proposals, the Risk Management Plan should detail the impact on State Government borrowing requirements and recurrent outlays. Details about Private Sector participation proposals are outlined in the NSW Government Guideline titled “ Guidelines for Private Sector Participation in the Provision of Public Infrastructure”. A link to this document is available from the private sector participation section of this document

Risk Evaluation and Risk Management Responses

For other major asset management activities, including new projects valued from \$5 million to \$20 million, procurement selection, maintenance and disposal strategies, agencies are required to undertake risk evaluation and prepare Risk Management responses, but external formal reporting will not be required.

Risk Management procedures for these activities should form part of the normal asset management processes and provide input to agency strategic management and planning. In these cases, risks and their associated management proposals should be evaluated as part of value management studies and economic appraisals.

Unless exempted by NSW Treasury, all Budget dependent and nominated non-budget dependent agencies are required to utilise the NSW Department of Public Works and Services to manage the private sector interface on Capital Projects over \$500,000 in value.

Table 1 Policy requirements summary

Projects	Action required	Who by	Application
Designated	Develop a Risk Management Plan	Agency	Report to Budget Committee via Treasury Input to Agency planning process
\$5M - \$20M	Identify risks and prepare management responses	Agency	Input to Agency planning process (including economic appraisals and value management studies)
Less than \$5M	No formal requirements		

Note:

The term “projects” includes any major asset-related activities from feasibility to disposal stages.

3.2 Linkages with Total Asset Management

TAM reflects priorities for whole-of-life asset management, extended planning requirements for new works and new relationships between services planning and asset procurement activities.

Risk Management needs to be a part of the asset management process as a program or project progresses. Provisions made to manage risk should be reviewed and updated as circumstances and risk exposure change over time.

A major project may need several risk studies at the various stages of concept development, construction, operation and maintenance, and at disposal.

3.3 Integrating with other decision tools

When significant planning decisions are involved, Risk Management should be combined with an Economic Appraisal (or Financial Appraisal where appropriate) and a Value Management study. Co-ordination of these tools is depicted at Appendix E.

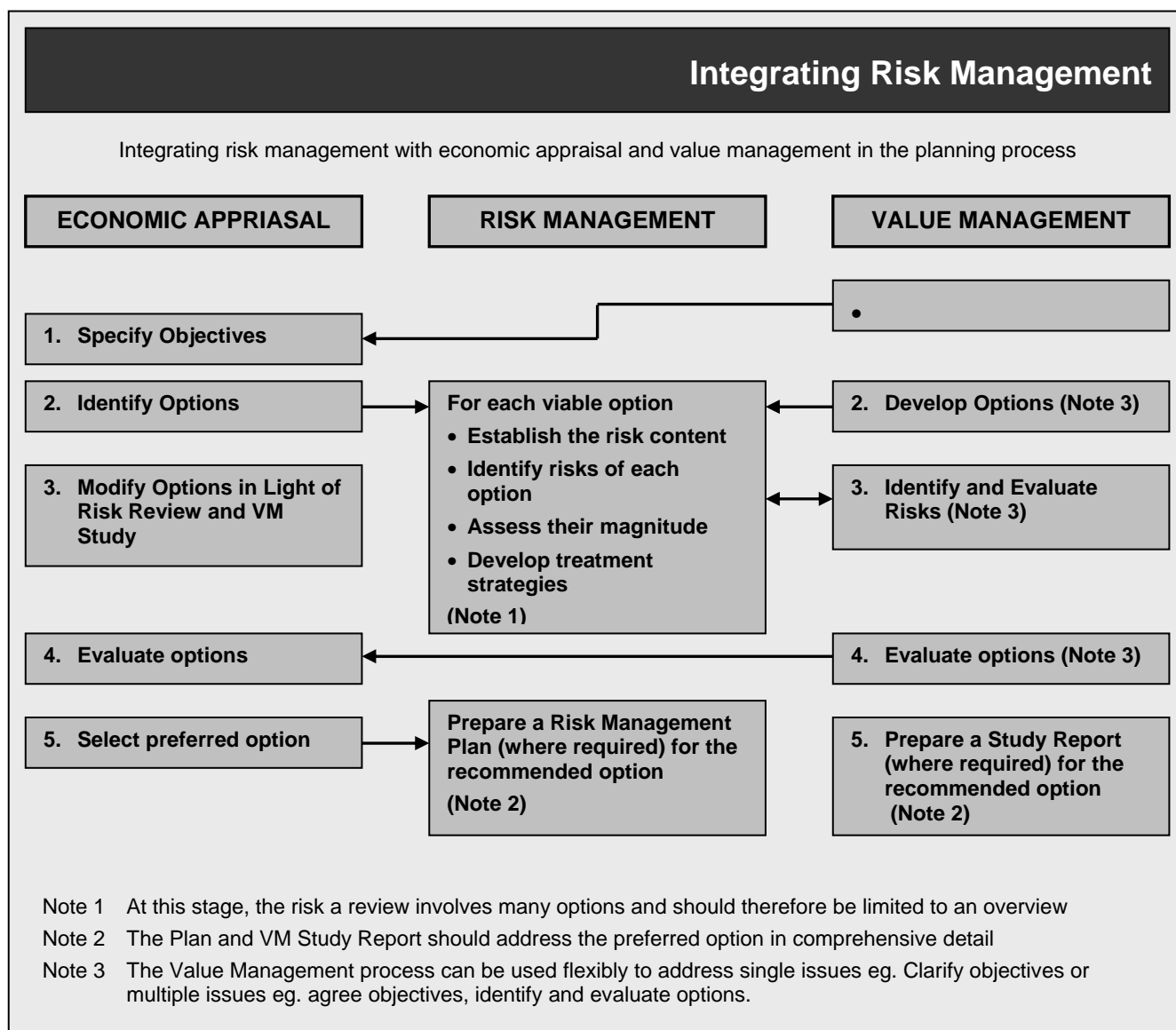
The Economic Appraisal should include an evaluation of economic, investment and finance risks and propose suitable management measures. Value management studies should address risk factors relevant to the topic of the study. This may concern project concept, feasibility, functional and design aspects or risks associated with the procurement, delivery and contracting arrangements.

The integration of Risk Management with economic appraisal and value management provides a strong foundation for effective decision-making.

Agencies should apply the Risk Management approach appropriate to the scale of the risk and reporting should be incorporated within established documentation procedures.

Figure 1 (below) demonstrates the interaction of those tools and how they can complement each other in the planning process.

Figure 1 Integrating Risk Management



3.4 Agency roles and responsibilities

The roles of the principal agency groups in reference to Risk Management are as follows:

NSW Treasury

NSW Treasury has developed a “Risk Management and Internal Control Toolkit” (Treasury Document TPP 97-3) to assist agencies implement an efficient and effective Risk Management and internal control framework.

The kit consists of:

- Risk Management and Internal Control Assessment Guidelines
- Risk Management and Internal Control Assessment Matrix

The toolkit is part of the NSW Treasury's Policy and Guidelines Papers, and is available online at: <http://www.treasury.nsw.gov.au/pubs/rmic/rmicfram.htm>

NSW Treasury provides assistance to agencies in the management of financial and economic risk, government budgetary strategy and implications on Loan Council guidelines, including risk-sharing principles. NSW Treasury will also be involved in the nomination of designated proposals.

Department of Public Works and Services

The Department of Public Works and Services (DPWS) provides assistance to central agencies on technical and procurement risk generally, and provides Risk Management services to agencies in development, management, procurement and asset management programs.

DPWS manages the interface with the construction industry and provides contract or project Risk Management services for projects over \$500,000.

Contract or project Risk Management relates to procedural aspects of procurement and project delivery and is aimed primarily at ensuring probity, independence and efficiency for Government in these processes.

Service Agencies

Service agencies must ensure Risk Management procedures for major projects are completed and comply with designated and new project requirements, including the nomination of designated proposals.

4 Risk Management Process

The objective of Risk Management is to identify and analyse risks and manage their consequences. Risk Management involves several key steps that have general application and can be applied at various stages of the asset cycle. The process outlined below should serve as a guide to agencies but can be adapted to individual needs.



The process of Risk Management should commence at the strategic planning stage of a proposed project. The steps in the process are:

Proposal familiarisation

- Define proposal/project scope and objectives
- Identify criteria for assessing the proposal or project
- Define the key elements and issues

Risk analysis

- Identify all risks that might impact on the proposal or project
- Assess the potential likelihood and consequences of each risk
- Screen risks to discard the minor risks having low impacts and low likelihood of occurrence
- Identify moderate and major risks that require management attention

Risk response planning

- Identify the feasible responses to moderate and major risks. Risk responses will include:
 - risk prevention
 - impact mitigation
 - risk transfer
 - risk acceptance
 - select the best response
- Develop risk action schedules for major risks
- Develop management measures for moderate risks

Reporting

- For major undertakings, prepare a Risk Management Plan
- For other projects, compile and collate risk action schedules and measures

Risk Management implementation

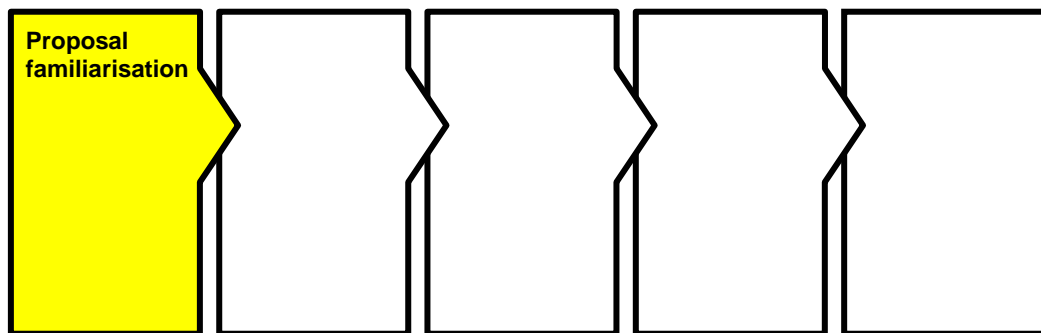
- Implement the action schedules and management measures
- Monitor the implementation
- Periodically review risks and evaluate the need for additional Risk Management

The main output from the process is the definition of action schedules and management measures and assignment of responsibility for implementation.

For designated undertakings, the Risk Management Plan summarises the risk analysis process and documents in detail the action strategies for managing individual risks.

Monitoring and evaluating implementation is essential.

4.1 Proposal familiarisation



As a preparatory step, gain familiarity with the proposed project or activity and identify key parameters and assumptions. This should follow definition of the Risk Management brief and assignment of responsibilities for undertaking the Risk Management evaluation. Familiarisation can be seen to comprise three activities:

Define objectives

This involves the Risk Management group becoming familiar with:

- the nature and scope of the proposal, its key objectives, and
- the relationship between these and the agency's objectives and strategies.

This step links Risk Management into the agency's main strategic plans, including its service, capital investment, asset maintenance, and disposal strategies and into the agency's procurement, operating, maintenance and disposal procedures.

Identify criteria

The assessment criteria for a proposal or project are concerned with how well its objectives will be met and how appropriate are these objectives. They will reflect the principal purposes of the proposal and its means of execution and assist in defining key elements.

In the planning stages of the asset cycle, the criteria will reflect strategic concerns, while in the delivery, maintenance and disposal stages the criteria are likely to concern the efficient completion of procurement, cost control, service delivery, and quality.

Define key elements

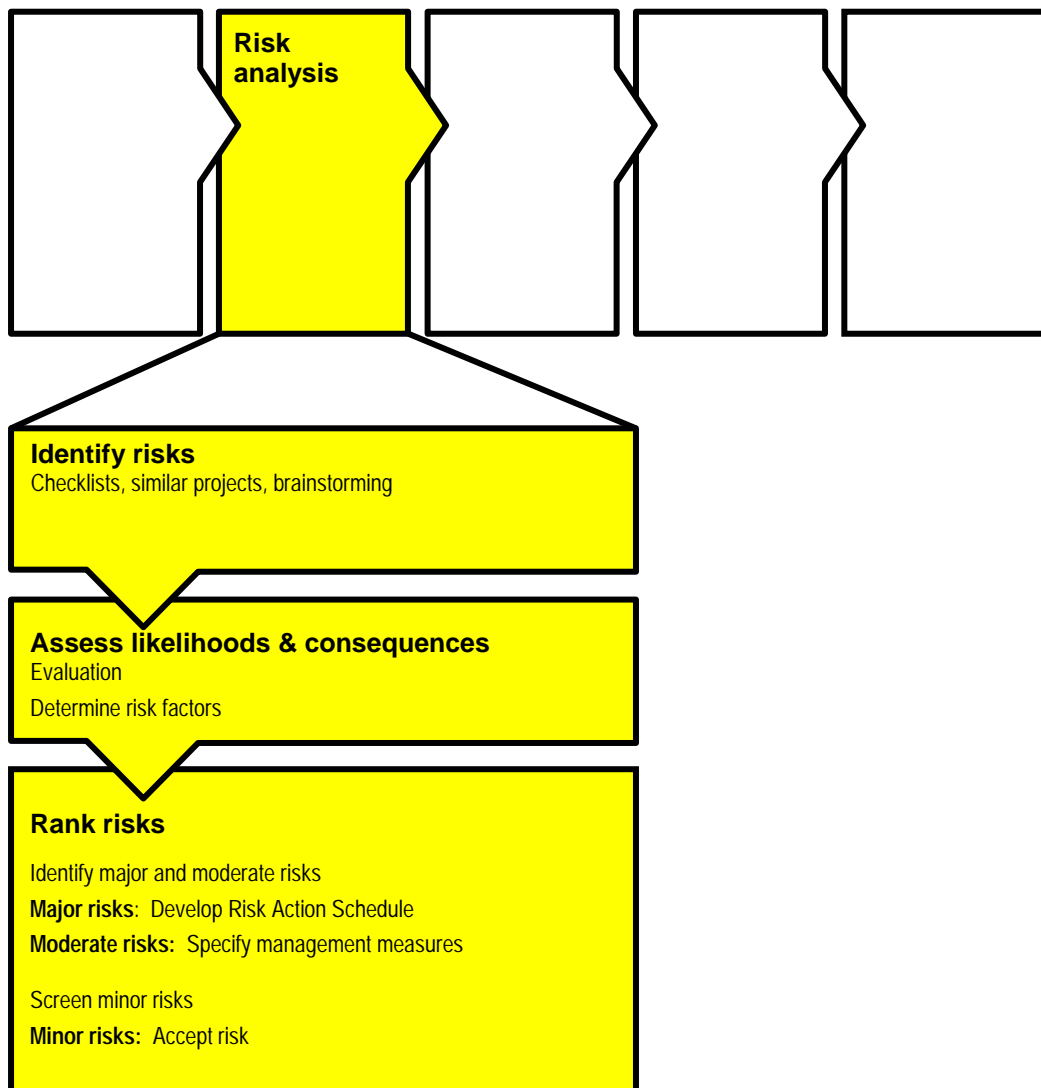
This involves separating the proposal or project into a set of base elements for structuring the analysis.

The initial separation is usually into the major items or activities, but the detailed structure depends on the nature of the associated risks.

A broad view of the asset or activity at this stage is more appropriate than a detailed one to concentrate focus on the main issues and to establish a balanced framework for the analysis.

In practice, a range of 20 to 50 items or elements is commonly targeted. The items should be distinct and meaningful, and cover the entire proposal scope or procurement and operational aspects.

4.2 Risk analysis



Identify risks

The analysis begins with listing the risks that might affect each key element of the project. The aim is to generate a comprehensive list of the relevant risks and document what each one involves. The analysis should include a description of the risk and how it might arise, possible initiating factors, the main assumptions and a list of the principal sources of information.

There are several ways to identify risks:

- risk checklists provide a useful starting point for some projects. Agencies carrying out many similar projects can construct their own checklists based on their experience or project databases, and/or draw on information from specialist industry, research, insurance, or management expertise.
- examining similar current or previous projects, risk analyses or project evaluations.
- brainstorming or workshopping may be valuable for projects involving new or unusual risks, innovative management arrangements or to develop initial checklists.

Risk Management teams comprising multi-disciplinary backgrounds are well suited to this phase. They can be supported by the many specialist techniques applicable to particular kinds of projects or risks. For example, hazard analysis may be directed to specific safety issues or complex

environmental applications, while failure modes analysis can be used for examining risks in technical systems.

Some of the main risk areas appropriate to different proposal or project stages are listed in the table below. A more detailed list is provided in Appendix D.

Table 2 - Main risk areas

Planning and proposal stages	Project procurement & management stages
<ul style="list-style-type: none"> • commercial • technological • contractual • economic • environmental • financial • political 	<ul style="list-style-type: none"> • construction and maintenance • health and safety • human factors • natural events • organisational • systems

Assess risk likelihood and consequences

The second step of the analysis is to determine or estimate both the likelihood of a risk arising and its potential consequences.

All available data sources should be used to understand the risks. These may include: historical records; procurement experience; industry practice; relevant published literature; test marketing and market research; experiments and prototypes; expert and technical judgement and independent evaluation.

The assessment involves:

- estimating the likelihood of each risk arising. This might be done initially on a simple scale from 'highly unlikely' to 'almost certain', or using numerical assessments of probability might be made
- estimating the consequences of each risk, in terms of the proposal/project criteria. This might be done initially on a simple scale from 'negligible' to 'very severe', or using quantitative measurements of impacts.

Determine significant risks

The objective is to identify significant risks that must be managed, and to screen those *minor risks* that can be accepted and so excluded from further consideration.

To compare risks a ranking mechanism is used.

For straightforward risks, qualitative assessment estimates the likelihood and impact of each risk, and to set cut-off points for the determination of major, moderate or minor status.

A more formal structured approach is recommended for more complex assessments. There are many suitable methods available, including the preparation of risk factors. Risk factors are a simple instrument for ranking risks and are based on scaling and then combining the likelihood of a risk and the severity of its impact. A risk factor will be high if the risk is likely to occur or its impacts large, and highest if both are present.

Appendix E illustrates two simple techniques for calculating risk factors.

A risk-ranking matrix (Figure 3) can provide a graphic presentation of risk classes and assist reporting.

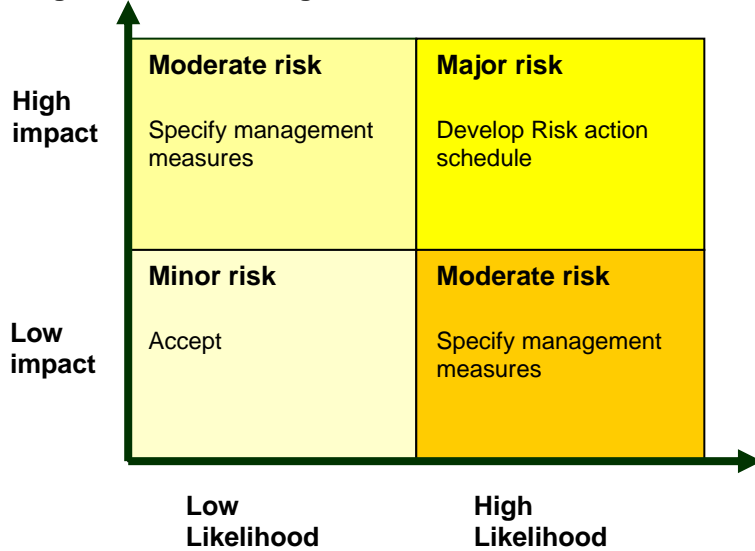
The risk ranking and risk factors provide a basis to set cut-off points to determine which risks may be discarded (minor) or identified as major and moderate risks.

As a working definition:

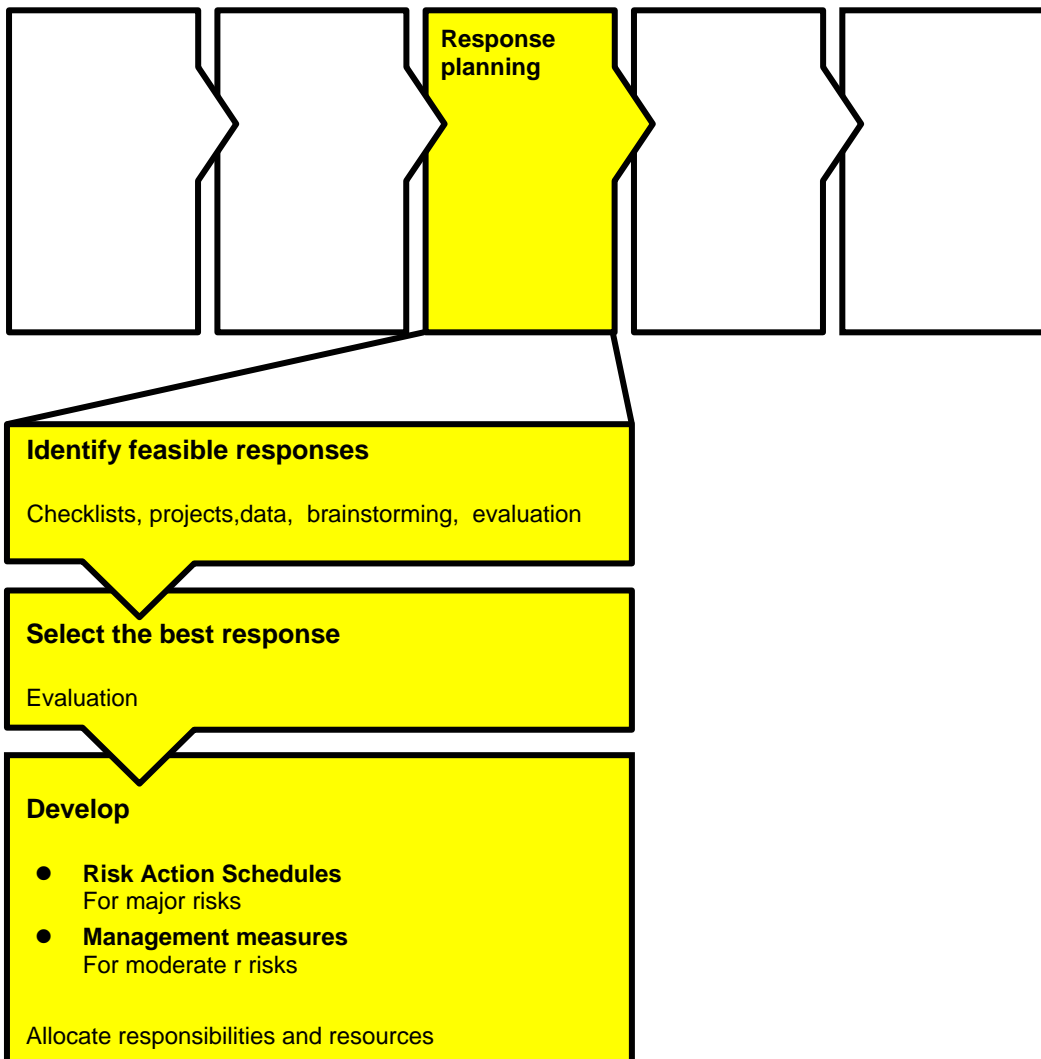
- minor risks can be accepted or ignored

- moderate risks are either likely to occur or to have large impacts but not both. Management measures should be specified for all moderate risks
- major risks are those risks with both a high likelihood of arising and a large impact. These risks will require close management attention, and the preparation of a formal risk action schedule

Figure 3 Risk ranking matrix



4.3 Risk response planning



Identify feasible responses

Overall strategies for managing classes of risks should be determined at the agency level, where policy decisions must be made about the extent to which the agency is prepared to accept or tolerate risk.

There are four broad strategies for dealing with risks and their consequences:

Risk prevention

Risk prevention is directed to eliminating sources of risk or substantially reducing the likelihood of loss from their occurrence. Examples include the selection of alternative proposals, design and engineering changes, quality assurance procedures, asset utilisation studies, operations reviews, regular audits and checks and preventive maintenance.

Impact mitigation

Impact mitigation is directed to minimising the consequences of risks. Some risks, such as those associated with market variations or weather, cannot be avoided. Risk Management must then be directed to coping with their impacts. Impact mitigation measures include contingency planning, contract terms and conditions, inspections and checks to detect technical compliance or security breaches, and recovery programs.

Risk transfer

Risk transfer shifts responsibility for a risk from the agency to another party, who ultimately bears the consequences if the risk arises.

The agency will normally incur a cost for the other party assuming the risk.

Insurance is a well-known risk transfer strategy for physical and other assets and activities and for a limited range of commercial risks.

In procurement, contracts and agreed procedures entered into between an agency and its contractors or suppliers are the primary means of allocating risk between the parties involved.

The specific terms of a contract also provide a means of transferring risk. The aim is to place or neutralise significant sources of risk via contractual measures between the agency, the prime contractor and insurance providers.

A general principle of Risk Management is that risks should be the responsibility of those best able to control them. Equally, reward should be commensurate with accepting risk responsibility.

The risk analysis process, in identifying how risks might arise, can provide the initial guide to which party is best able to manage risks and the most appropriate form of contract. The analysis also identifies the potential impacts, and so may aid in determining a fair price for taking the risks involved. Most risk transfer strategies require decisions to be taken very early in the life of a project, usually in the pre-tender phases.

Risk acceptance

Risk acceptance occurs when risks cannot be avoided or transferred, or the costs of doing so would not be worthwhile. Risks must then be accepted. Impact mitigation measures and monitoring may be appropriate and should be recommended in these circumstances.

Select the best response

Selecting the best response involves trade-offs between the potential benefits of a response and the actual costs of implementing it. Established practice may assist in selecting alternatives but the

overall objective is to recognise which risks to address and which risks to accept and to confidently select the best value response.

As part of this process, examine risks at the project or program level to develop wider decision rules for controlling and managing risk at a strategic level. Identify common risks and general responses that occur in more than one circumstance or that have wide potential effects.

Selecting the most appropriate option involves balancing the cost of implementing each option against the benefits it offers. Generally the cost of managing the risk needs to be commensurate with the benefits derived.

Develop management measures and risk action schedules

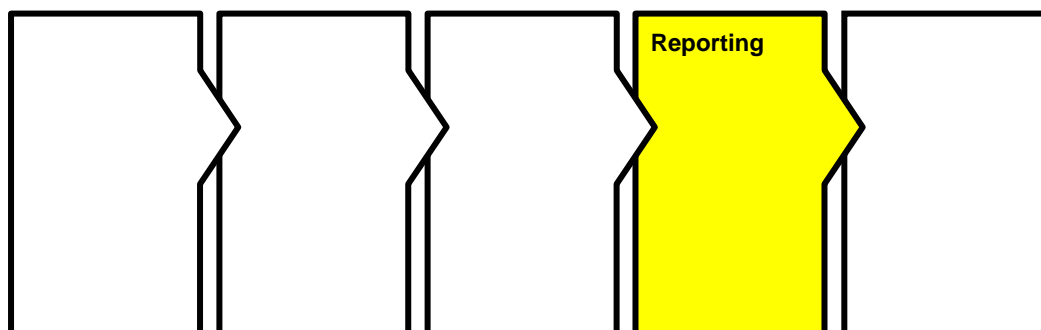
For moderate risks, management measures should be prepared. These are simple action statements that specify the activities necessary to meet the risk event.

For major risks, risk action schedules should be developed to enable successful Risk Management in practice and over time.

Appendix C provides the outline of a typical risk action schedule. The risk action schedule should assign individual responsibilities and time frames and identify those who are responsible for follow-up. Risk action schedules may be applied by the agencies responsible for undertaking or overseeing large procurements or for managing assets.

Alternatively, or in addition, agencies might require them to be developed and implemented by contractors providing products or services to the public sector, as part of their control and oversight procedures.

4.4 Formal reporting



Formal reporting is an important phase of the Risk Management process, particularly given what may be long project lead times, complex procurements and lengthy operational life cycles.

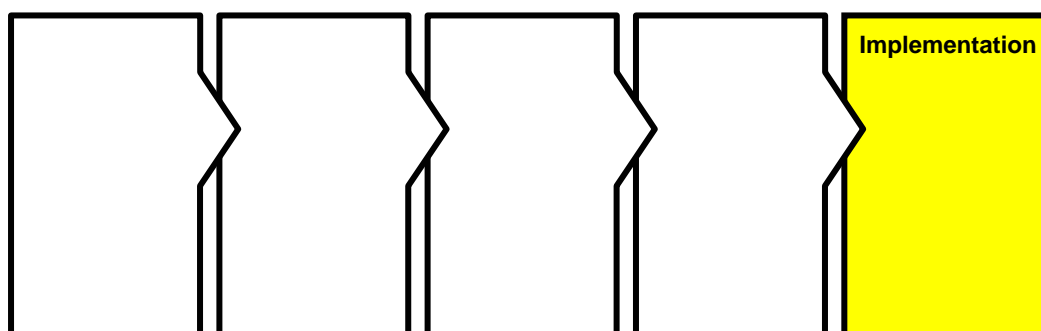
For formal reporting of designated or major undertakings, a Risk Management Plan summarises the results of the Risk Management process, action strategies and implementation framework. In particular, it describes the Risk Management measures and action schedules to be implemented to reduce and control risks.

The Plan includes provision for implementation and ongoing reporting. Appendix A provides a typical format for a Risk Management Plan.

For projects that are not designated, collation and summary of action schedules and management measures provides an adequate basis for reporting.

For a summary of reporting requirements see Table 1 Policy requirements summary, (Page 7).

4.5 Risk Management implementation



The most important task in Risk Management is implementing the action schedules and management measures and allocating management resources. This should be followed by monitoring the effectiveness of these measures over time. Planning for implementation requires particular attention to resources required, management responsibilities and timing of tasks.

Monitoring of risks and Risk Management effectiveness should be a routine and recognised activity. The frequency of monitoring, and the responsibility for it, should be specified in either the Risk Management Plan or summary documentation.

Review and evaluation

Ongoing review of the proposal or project and the evaluation of risks is essential to ensure a Risk Management Plan or action schedules remain relevant. As the proposal or project proceeds and the focus changes from strategic concerns to more operational ones, different forms of risk analysis and Risk Management may be needed. The review process should be specified in the Risk Management Plan or summary documentation.

4.6 Advanced techniques and software

Many specialised techniques have been developed to assist managers undertaking risk analyses and Risk Management. Some have wide application, while others are specific to particular kinds of assets or risks. The table below summarises a few of them.

These techniques and tools enhance the role of the manager. They provide assistance in analysis and evaluation tasks, but do not substitute for good judgement and management experience.

Table 3 Risk Management: specialist techniques

Techniques	Applications
Sensitivity analysis	Very wide application, from economic appraisal and financial feasibility to operations and maintenance models
Scenario analysis	Economic appraisals and feasibility studies
Decision analysis	Choice amongst uncertain alternatives
Risk engineering	Wide application to proposals, projects and budgets, through all stages in the life of an asset
Failure modes, effects and criticality analysis	Analysis of designs and operating plants; may be directed to safety, plant integrity or ensuring production is maintained
Fault tree analysis	Identifies the causal factors that may lead to a risk arising
Event tree analysis	Identifies the consequences of an initiating event
Hazard analysis, HAZOP	Safety analysis for operating plant
Probability assessment	Quantification of risk probabilities and consequence distributions
Risk surveys	Continuing monitoring of risk in a project or a pool of assets, to identify high-risk areas

5 Checklist for Risk Management

Stage 1 Initiation

- Assemble Risk Management resources
- Appoint the team leader and ensure a breadth of skills/experience within the team
- Assign Risk Management responsibilities appropriate to task

Stage 2 Proposal familiarisation

Specify objectives and criteria

- Familiarise the team with the proposal, assemble documentation and define the key objectives
- Assess the proposal in relation to the Agency's objectives and strategies
- Determine assessment criteria for proposal

Define key elements

- Define key elements (target 20-50 elements, items or activities) to structure risk analysis

Stage 3 Risk analysis

Identify risks

- Prepare a comprehensive schedule of risks for each element
- Describe each risk and list the main assumptions

Assess risk likelihoods and consequences

- Assemble data on risk and their consequences
- Assess risk likelihoods
- Assess risk impacts

Identify significant risks

- Rank risks to reflect impacts and likelihoods
- Where applicable, estimate risk factors
- Discard/accept minor risks
- Identify moderate risks for management measures

Identify major risks for detailed risk action planning

Stage 4 Risk response planning

Identify feasible responses

- For each moderate and major risk, identify the feasible responses
- Responses may include:
 - risk prevention
 - impact mitigation
 - risk transfer and insurance
 - risk acceptance
- Describe each feasible response and list main assumptions

Select the best response

- Evaluate the benefits and costs for each response
- Select the preferred response

Develop management measures and action schedules

- Specify Risk Management measures for moderate risks
- Develop risk action schedules for major risks
 - Actions required (what is to be done?)
 - Resources (what and who?)
 - Responsibilities (who?)
 - Timing (when?)

Stage 5 Reporting

- For designated proposals, produce the Risk Management Plan
- For other projects, collate and summarise risk action schedules and measures

Stage 6 Risk Management implementation

- Implement measures and action strategies
- Monitor the implementation
 - Assign responsibilities
 - Timing
- Undertake periodic review and performance evaluation

Appendix A Risk Management plan

Typical format

For designated proposals, a Risk Management plan must be prepared by agencies and submitted to NSW Treasury and to the Budget Committee of Cabinet as part of project approval procedures. A typical format for an RMP is presented below.

Risk Management Plan

- 1 Proposal familiarisation
 - 1A Scope, issues and objectives
 - 1B Criteria
 - 1C Key elements

 - 2 Risk analysis
 - 2A List of risks
 - 2B Table of impacts, likelihoods and risk factors
 - 2C Priority list of major, moderate and minor risks

 - 3 Risk Management
 - 3A Major risks: summary of risk action schedules
 - 3B Moderate risks: summary of management measures
 - 3C Schedule of discarded minor risks
 - 4 Implementation monitoring
 - 4A Resources and responsibilities
 - 4B Implementation monitoring plan
 - 4C Review and evaluation plan
-
- Appendices
Detailed risk action schedules for major risks (see Appendix C1)

Appendix B Case studies

This section provides brief summaries of case studies illustrating a range of Risk Management applications. These have been drawn from various agency and corporate experience. They include identified risks, estimated consequences and proposed risk measures.

Case #1 Arterial road extension

Proposal familiarisation

The project involved a dual-lane carriageway extension, with grade-separated interchange and linkage bridgework, pedestrian and landscaping elements. Procurement was to be on the basis of a design, construct and maintenance tender, supported by Agency financing.

The objectives of the project were to achieve functional and cost effective outcomes, encourage innovation, provide for substantial private sector involvement, and trial a new procurement strategy. Assessment criteria for the procurement included compliance with design specifications and value-added innovations.

The key elements of the procurement were the sixteen stages of the project from concept development, through community consultation and briefing to construction, operation and maintenance of the road.

Risk analysis

Risks were identified on behalf of the client by drawing on a systematic consideration of the key elements from concept development through to post-completion reviews and maintenance operation in workshop forums. The workshops involved multi-disciplinary teams reflecting a breadth of experience. Risks included aspects of the new procurement approach and the availability of suitable tenderers, oversight of design development and delineation of maintenance responsibilities.

Likelihoods and consequences were estimated for each significant risk. Consequences ranged from additional cost or time penalties to impacts on project viability.

Risk Management

Risk measures were set out as remedial activities either to be undertaken by the contractor or agency. They included procedural arrangements, contract provisions or revised procurement conditions. They are set out against the individual risks in the table below.

Risk Management table: Arterial road extension

Risk	Consequences	Risk measures
Industry does not respond to procurement strategy	No responses received to Expressions of Interest/tender Substantially higher costs than anticipated Non-conforming bids are offered	Alter the conditions and/or documents. Industry consultation Invite responses from selected contractors Revise/discard procurement concept
No legal precedents exist for new conditions of contract	Time and cost of legal disputes	Use proven conditions of contract Nominate alternative dispute resolution methods
Difficult to price maintenance component because scope of the maintenance task is not known (eg axle loads may vary and increase maintenance demands)	High tender costs	Insure against the unknowns in the maintenance period Provide for traffic volume adjustment across the maintenance period Nominate risks to be addressed by contractor
Utilities not completely identified	Cost (repairs and/or relocation). Geometrical constraint	Review concept Conduct utility survey of site/areas Hold discussions with utility authorities
Geotechnical status of the site is unknown	Cost increase Remediation delays	Investigate sub surface conditions Advise tenderers of history of site
Current environmental standards change	Cost Project viability affected	Review/monitor environmental standards
Environmental review process too narrow	Project viability affected Time and/or cost impacts of required design changes Oversights in the Environmental Review may necessitate the process being repeated Community resistance to concept	Review concept design changes Conduct an EIS Form and liaise regularly with a community committee
Tenders are in different formats	Difficult to compare tenders	Require schedule formats for critical data Nominate format for other responses

Risk	Consequences	Risk measures
Insufficient or inadequate information provided on which to base tender	Poor pricing No responses Inadequate design	Initiate early contact with utilities Provide all known and available information to tenderers Include PC provisions for third party costs
Total project costs not identified	Low construction but high overall project costs High construction but low overall project costs	Conduct discounted cash flow analysis of total project costs Ensure appropriate risk apportionment Include statement of assumptions in tenders Include schedules for tenderers to break up their costs
Tender exceeds the cost limit for the project	Project not viable	Review project or DCM concept including the following: <ul style="list-style-type: none"> • Funding • Concept • Design • Scope
Design is deficient	Legal problems/unclear liability Reduced asset life Safety problems Inconsistent with user expectations	Develop a review/ acceptance process Ensure code and performance criteria compliance Pay for changes requested
Project construction adversely impacts on local community because of: <ul style="list-style-type: none"> • Access • Noise • Dust 	Community resistance Poor project image	Limit types of construction equipment to be used Require a sedimentation control plan for construction and operation Document standards to be maintained during construction in tender Comply with EPA requirements Maintain community information and liaison
Maximum permissible axle loadings increase	Reduced pavement life Increased maintenance cost Structural damage	Obtain increased funds for maintenance
Contractor's ongoing financial viability	Bankruptcy Takeover/merger Lower maintenance activity	Require ongoing bond from contractor for maintenance costs Include step in rights and criteria in contract Include termination rights and criteria in contract

Case #2 Commercial budget and business plan

Proposal familiarisation

An Australian communications equipment and service provider had prepared a business plan and budget for the next financial year. The objectives were to:

- reduce costs
- withstand an anticipated substantial increase in competition, and
- generate a significant improvement in profitability.

Management was concerned that the key risks had been addressed adequately in the business plan and that the budget projection was reasonable.

Assessment criteria were:

- the level of profitability, and
- the level of residual risk to which the company was exposed.

Key elements of the project were the main revenue and expenditure items in the budget.

Risk analysis

Risks were identified in a workshop involving the senior managers of the company. Examples of risks are shown in the tables.

Likelihoods, consequences and risk priorities were not identified separately. Risk priorities were assessed directly by the responsible managers

Risks	Risk ranking
1 Increased competition	Major (likely, severe impact): develop action plan as key part of the Marketing Plan
2 Price changes	Moderate (result of Item 1): monitor
3 Negative customer price perception	Moderate: include in Marketing Plan
4 Lack of product penetration	Minor (mature product)
5 Competing product, product substitution	Major (related to Item 9): review with R&D and include in Marketing Plan
6 Shift in pattern of demand	Moderate (unlikely but high impact): monitor
7 Slow fault correction response	Moderate: include monitoring in Operations plan
8 Industrial action	Major (due to staff reductions): include in HR Plan
9 Technological change	Major: include with Item 5.
10 Fee for service leakage	Major (likely, potentially large impact on revenue)
11 Price change processes inadequate	Moderate (large impact): review
12 Insufficient cross-selling	Moderate (likely, but low impact): include training in HR Plan

Risk Management

Options for managing risks were developed by the senior managers in a team workshop. The following table summarises the responses to Item 10, the fee-for-service leakage risk (revenue loss from under-charging by customer service personnel), and the recommended actions.

Management plans, which were in effect risk action schedules, came to form an important part of the Business Plan. The table shows responses to risks in one area may appear in the action plans of several different managers. The action proposed included provisions for monitoring and reporting together with progress and completion dates.

Risk action schedule (extract)

10 Fee for service leakage: Major risk	
Risk measures	Management actions
1 Managers to identify sources of leakage	Review Fee-for-service usage and billing, to be assessed by managers responsible
2 Better QA	QA Manager tasked to ensure billings aspects covered in procedures
3 Improve computer systems to link work and account records	MIS Manager tasked to provide feasibility estimates for further assessment
4 Show staff how loss can be measured	Incorporate in staff training
5 Follow up and audit fee-for-service quotes	Delay action until tasks 8.1.1 and 8.1.3 completed
6 Contract out activities	Not feasible yet, no current action
7 Provide additional training and support	Training Manager tasked to modify training for relevant customer service staff

Case #3 Health services facility

Proposal familiarisation

A major new health facility was proposed for a greenfields site in regional NSW. A design, document and construction procurement method applied.

The objective of the project was to provide an up-dated facility with substantial private sector involvement in both the areas of planning and construction, and service provision. The assessment criteria for the procurement concerned the capability of the tendering parties and cost competitiveness of both construction and recurrent costs.

The key elements of the project were the main project phases including concept development, design briefing and contract, expressions of interest and tender, stakeholder consultation, design development, construction, operation and maintenance.

Risk analysis

A schedule of procurement risks was prepared reflecting contract conditions, contractor performance and client and principal responsibilities. Risks included inadequate performance by the contractor, client service specifications and communication and key contract provisions.

Consequences of individual risks were itemised and their significance rated. Generally the consequences represented either additional cost implications, delays to construction or facility commissioning or the potential for dispute under the contract.

A sample of identified risks and consequences are included in the following table.

Risk Management

Risk responses ranged from briefings and confirmation of contingencies to the client to procedural provisions, confirmation and adjustment of contract provisions and requirements placed on the project management team or contract principal.

An extract of individual risk measures are included in the table below.

Risk Management table (extract): Health facility

Risk	Consequences	Risk measures
Design fails to meet Client requirements	Additional cost and delays for the Client	Produce accurate design brief and check tender submissions for compliance
Poor consultant performance	Deterioration of relationships, delay to project	Performance monitored and reported and eligibility for future commissions controlled
Design or documentation errors/omissions	Rework or extra work necessary	Risk placed with contractor under terms of contract
User group changes design	Cost and delay to project	Manage changes to ensure only essential changes are made and that they are made in adequate time
Currency fluctuation excessive	Equipment costs become prohibitive	Methodology for adjustment incorporated in contract and early ordering of equipment

Risk Management table (extract): Health facility – continued.

Risk	Consequences	Risk measures
No interest rate on overdue payments stated	Unrealistic rates charged	Rates stated under standard documentation and within General Conditions of Contract
Public liability and contract works insurance policy not taken out by contractor or lapses	Principal exposed to cost of loss	Insurance taken out by Principal
Subcontractor/subconsultant insolvency	Contractor attempts to pass on loss	Risk stays with contractor under terms of contract
Progress payment delays	Breach of contract by Principal	Notices of breach received and payment delegation can be withdrawn or revised
Variation disputes	Deterioration of relationships, recourse to arbitration	Contract structure requires review and determination before arbitration can proceed Process to include Client participation
Access denied for private sector participation	Client in breach of separate contract	Contract structure provides for access to work and for progressive handover Project Director to concur in clauses relating to interface with contractor
Principals equipment not delivered	Commissioning delayed	Program monitored and contract structure allows for conditional completion and handover Project Director required to report status of Principal supplied items each month
Faults during defects liability period	Facility operation hindered	Security deposit retained and contract structure gives right to repair and recover costs
Budget overruns	Client dissatisfaction	Onus placed with Project Manager to provide suitably skilled staff to monitor and manage the budget process
Unfavourable media reports	Client dissatisfaction	Contractual restriction on media releases

Case #4 Toll road development (feasibility stage)

Proposal familiarisation

The proposal involved extensive improvement of a regional road system on a major corridor. Two main options were under consideration — developing a new tollway or upgrading the existing road system.

The project objectives were to improve safety, reduce travel times and costs and provide opportunities for private sector participation.

Assessment criteria for the project included the timeliness and viability of the upgrade and flow-through effects on safety, traffic flow, regional development, requirements for Government support and the environmental and community impacts of the development.

Key elements of the project were drawn from the major phases of the project including concept development, economic and financial analysis, environmental assessment, procurement and tendering, community consultation and construction planning.

Risk analysis

Five major areas of risk were identified. These were:

Risk areas	Examples of risk
Economic	Population and traffic growth forecasts, discount rates, benefit values
Financing	Ownership, funding sources, debt / equity ratios, residual risks for Government
Environmental	Environmental approval processes, community involvement, potential need for new legislation
Political	Taxation, toll charges, parliamentary support
Construction	Physical construction problems, site access, spoil locations, disruption to community services, contractor insolvency, industrial disputes

Likelihood and priorities

Likelihoods and impacts were assessed for the principal risks. The following matrix (figure 4) shows the assessments for a sample of the risks.

Figure 4 Risk ranking matrix

The diagram is a 2x2 matrix with 'High impact' and 'Low impact' on the vertical axis and 'Low Likelihood' and 'High Likelihood' on the horizontal axis. The quadrants are: Top-Left (Moderate risk, Specify management measures), Top-Right (Major risk, Develop Risk action schedule), Bottom-Left (Minor risk, Accept), and Bottom-Right (Moderate risk, Specify management measures). The matrix is color-coded: light yellow for Moderate risk (Low Likelihood), bright yellow for Major risk (High Likelihood), and orange for Moderate risk (High Likelihood).

High impact	Moderate risk Specify management measures	Major risk Develop Risk action schedule
Low impact	Minor risk Accept	Moderate risk Specify management measures
	Low Likelihood	High Likelihood

Some risks, like construction risks, were identified as of minor impact and required no further action in this phase of the project. Moderate and major risks required more detailed analysis. The financing structures created for implementing the project were identified as providing the greatest potential risks for the Government.

Risk Management

An extended Risk Management schedule was developed to cover all moderate and major risks. As an example, the extract below summarises some of the risks and risk measures considered in the environmental planning and tender processes. For many risks, multiple responses were appropriate, particularly when there were several parties involved.

Risk action schedules were developed for all major risks, with recommendations on implementation covering resources, timing and monitoring. The principal measures for environmental risks, for example, were included in a detailed Environmental Strategy Plan.

Risk Management table (extract): toll road

Risk	Consequences	Risk measures
<i>Environmental Planning</i>		
Delayed start to process	Delay, cancellation	Start planning early
Public consultation fails	Delay	Develop explicit management plan
Additional studies needed	Delay and additional costs	Prepare contingency plans
Appeals or challenges	Delay	May be reduced by SEPP conditions
Departmental liaison problems	Delay	Create Steering and Working Committees
Large number of submissions	Delay, depends on number	Arrange adequate support resources
Cabinet approval delayed	Delay, cancellation	Start ministerial briefing early
<i>Tender Process</i>		
Insufficient information provided by tenderer	Cannot evaluate tenders	Tender cost subsidy Clear specification requirement
Too much information provided by tenderer	Time and cost	Limit tender period Nominate level of information
Tenders in different formats	Difficult to compare	Include schedule for key data Specify format for responses
Design differs from concept	Delay	Reject bid Change tender Negotiate to obtain conforming tender

Case #5 Tender risk assessment

Project familiarisation

The project involved demolition of an overhead roadway where significant implications for continuing use of adjoining infrastructure arose. These implications included loss of life and disruption to major services.

The objectives of the project were the timely and safe removal of the obsolescent roadway, at the lowest practical cost. Tenders had been called and assessment criteria included compliance with tender requirements, capacity to meet programming deadlines and restricted site access and procedures to minimise adverse risk impacts.

The key elements of the project concerned the main phases of work and precautions proposed by tenderers to address the sensitive aspects of the demolition. These included craneage provisions, removal of debris and excess material, precautions to retain structural integrity and preparatory measures prior to site access.

Risk analysis

As part of the tender documentation, major risks of the demolition project were identified by agency staff, impacts assessed and likelihoods estimated. These risks included damage to adjoining infrastructure, protracted interruption to services, failure to complete within time frame and injury to works personnel.

Reference to these factors was included within tender documentation. As part of the tender evaluation an assessment was made of how well each tenderer addressed these factors and the risk measures proposed. An additional measure outlined in tender submissions was also considered. An outline of the principal risks and minimum measures is presented in the following table.

Risk Management

The selection of the preferred tenderer took into account how well the risk implications associated with the work were addressed and any additional measures that reduced potential liabilities, within the context of meeting time and cost constraints. Tender acceptance was made conditional on these procedures being observed or completed during execution of the works.

Risk Management table: Tender assessment

Risk	Consequences	Risk measures
Work not completed to deadline	Delays to adjoining services Additional costs Adverse publicity	Detail preparatory work Assured method of temporary span holding Establish reserve crane capacity for contingencies
Power lines damaged	Loss of service Additional costs	Adequate protection of wiring Method of work to minimise likelihood of line interference
Damage to rail or signalling	Loss of service Adverse publicity Additional costs	Protection for signalling Security of span lift Minimisation of debris from lift activities
Derailment due to debris on the track	Injury or loss of life Damage to equipment Loss of service	Plan to minimise debris Preventive measures to exclude debris from service easement
Collapse of roadway segment in easement	Injury or loss of life Loss of service Damage to equipment Adverse publicity	Lighten span to reduce likelihood of failure No loading of span after first section removed
Injury or fatality to contractor personnel	Injury / loss of life Delay to works Adverse publicity	Reduction of personnel in danger areas Precaution measures / training Barriers to access to live equipment Coordination with service agency

Appendix C1 Risk action schedule - Typical format

Risk action schedule

1 Recommended Risk Management actions

- 1A Summary
 - 1B Impact
-

2 Risk identification and assessment

- 2A Activity description
 - 2B Risk identification
-

3 **Responses** to risk

- 3A Alternative courses of action
 - 3B Consequences of alternatives
-

4 Implementation

- 4A Proposed actions
 - 4B Resource requirements
 - 4C Responsibilities
 - 4D Timing
 - 4E Reporting
-

Appendix C2 Risk action schedule

Case study

This appendix provides a simplified risk action schedule from a Government procurement project. The project is concerned with the provision of integrated communication facilities for a large fleet of vehicles that must operate in several regions.

Details are provided for two major risks and the associated responses.

Risk action schedule - Integration software

1 Recommended Risk Management actions

1A Summary

The Project Manager will contact her counterpart in Northern Region to establish a joint team to liaise on system specification and operations across the regional boundary.

The Engineering Manager will set system specifications and commence development of common modules. He will obtain advice and assistance for managing software development, and monitor requirements for additional rack space.

The Quality Manager will review and monitor the implementation of software development procedures by the contractor.

1B Impact

These measures will minimise the impact of delay in specifying integration protocols in the adjoining region and assist in maintaining project milestones.

2 Risk identification

2A Item description

The "Integration Software" item consists of the software necessary to integrate the new communications system with the operating protocols in the adjoining region.

2B Risk identification and assessment

<i>No.</i>	<i>Risk description</i>	<i>Priority assessment</i>
1	Requirements unknown at contract start date	Major problem, high likelihood due to specification delays and high impact risk.
2	Installation and integration problems.	Major risk.
3	Fleet compatibility problems during changeover.	Minor risk, acceptable.
4	Difficulties in measuring software performance. (impact).	Moderate risk (high likelihood but low impact).
5	Lack of in-house software management skills.	Moderate risk.
6	Time for extended reliability testing not available.	Moderate risk.
7	Requirement for hardware upgrades.	Moderate risk.

3 Responses to risk

3A *Alternative courses of action for major risks*

Risk 1 Requirements not specified fully

<i>Response no.</i>	<i>Description</i>
1.1	Liaise with adjoining region to obtain advance specifications from project team and contractor.
1.2	Create joint specification team with adjoining region.
1.3	Delay start of all software development.
1.4	Start development of common system modules, with provisions for delay until specific integration details are available.

Risk 2 Installation and integration problems

<i>Response no.</i>	<i>Description</i>
2.1	Fix specification for “our” side of system.
2.2	Create joint integration team with adjacent region.
2.3	Pre-test modules.
2.4	Specify integration modules with parameters.

3B *Consequences of alternatives*

Risk 1 Requirements not specified fully

<i>Response no.</i>	<i>Assessment of responses</i>
1.1	Low cost, high effectiveness.
1.2	May not be acceptable to other contractor.
1.3	Only feasible to delay for 4 weeks.
1.4	These should be started, to reduce potential project delay.

Risk 2 Installation and integration problems

<i>Response no.</i>	<i>Assessment of responses</i>
2.1	Should be done, Engineering Manager to action.
2.2	Pursue as part of 1.1.
2.3	This is contractual requirement.
2.4	Only feasible in part; discuss with contractor.

4 Implementation

4A *Proposed actions*

The Project Manager will contact her counterpart in the adjoining region to establish a joint liaison team. This team's responsibilities should be more extensive than software integration alone. They should cover communication system specifications and protocols.

The Engineering Manager will ensure system specifications are fixed as soon as possible (they are already firm for many of the contracted elements). Development of common modules will be started.

The Quality Manager will review and monitor the implementation of software development procedures by the contractor.

4B *Resources*

No additional resources required.

4C *Responsibilities*

Manager	Responsibilities
Project Manager	Contact project manager. Nominate members of joint team. Set terms of reference.
Engineering Manager	Fix system specifications. Specify common modules. Obtain advice and assistance. Monitor requirements for rack space.
Quality Manager	Monitor software development.

4D *Timing*

Liaison to start immediately.

4E *Reporting*

Managers are to report every two weeks to the Project Management Committee.

Appendix D Examples of sources of risk

Planning and feasibility stages

Commercial & strategic

- competition
- market demand levels
- growth rates
- technological change
- stakeholder perceptions
- market share
- private sector involvement
- new products and services
- site acquisition

Economic

- discount rate
- economic growth
- energy prices
- exchange rate variation
- inflation
- demand trends
- population growth
- commodity prices

Contractual

- client problems
- contractor problems
- delays
- force majeure events
- insurance and indemnities
- joint venture relations

Financial

- debt/equity ratios
- funding sources
- financing costs
- taxation impacts
- interest rates
- investment terms
- ownership
- residual risks for Government
- underwriting

Environmental

- amenity values
- approval processes
- community consultation
- site availability/zoning
- endangered species
- conservation/heritage
- degradation or contamination
- visual intrusion

Political

- parliamentary support
- community support
- government endorsement
- policy change
- sovereign risk
- taxation

Social

- community expectations
- pressure groups

Project initiation

- analysis and briefing
- functional specifications
- performance objectives
- innovation
- evaluation program
- stakeholder roles and responsibilities

Procurement planning

- industry capability
- technology and obsolescence
- private sector involvement
- regulations and standards
- utility and authority approvals
- completion deadlines
- cost estimation

Project delivery stages

Procurement and contractual

- contract selection
- client commitment
- consultant/contractor performance
- tendering
- negligence of parties
- delays - weather, industrial disputes
- damages and claims
- errors in documentation
- force majeure events
- insurance and indemnities

Construction and maintenance

- buildability
- contractor capability
- design and documentation
- geotechnical conditions
- latent conditions
- quality controls
- equipment availability and breakdowns
- obsolescence
- industrial action
- materials availability
- shut-down and start-up
- recurrent liabilities
- health and safety
- accident, injury
- OH&S procedures
- contamination
- noise dust and waste
- disease
- irradiation
- emissions

Human factors

- estimation error
- operator error
- sabotage
- vandalism

Natural events

- landslip/subsidence
- earthquake
- fire
- flood
- lightning
- wind
- weather

Organisational

- industrial relations
- resources shortage
- scheduling
- operational policies
- management capabilities
- management structures
- personnel skills
- work practices

Systems

- communications or network failure
- hardware failure
- linkages between sub-systems
- software failure
- policies and procedures

Appendix E Calculating risk factors

Two simple techniques are illustrated below for calculating risk factors. Both are essentially based on establishing quantitative criteria in reference to likelihoods and risk consequences.

The key objective is to create a means to nominally rank risks and identify the most significant.

Example 1

To estimate the likelihood of each risk arising and assess its impacts, initially use verbal scales that are readily understood. The tables show examples. Where necessary, adapt or adjust these to suit the circumstances, or use different scales for different criteria. Convert the verbal assessments to numerical measures.

Risk likelihood	L	Risk impact	I
Almost certain	0.9	Extreme	0.9
Highly likely	0.7	Very high	0.7
Likely	0.3	Medium	0.3
Unlikely	0.1	Low	0.1
Rare	0.01	Negligible	0.01

Calculate a 'risk factor' or combined risk measure for each major risk:

L = risk likelihood measure, on a scale 0 to 1

= average of likelihood factors;

I = impact measure, on a scale 0 to 1

= average of impact factors;

RF = risk factor

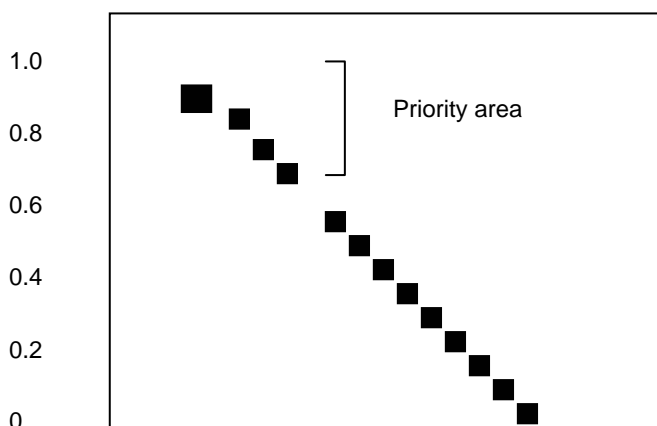
= $L + I - (L \times I)$

The risk factor (RF), varies from 0 (low) to 1 (high). It reflects the likelihood of a risk arising and the severity of its impact. The risk factor will be high if a risk is likely to occur, if its impacts are large, or both.

Rank components or work packages in decreasing order of their risk factors, to generate a risk profile. The ranking and the risk factors are used to decide which risks are acceptable and unacceptable, and to enable Risk Management priorities to be set.

Risk profile

Risk factor (RF)



Components ranked in order of decreasing RF

Example 2

This technique uses different quantitative values for likelihoods and consequences and derives risk factor values by simple addition. However, the objective, namely to develop a ranking of risks, remains the same.

Risk likelihood		Scale
Frequent	Likely to occur frequently (several times per year)	1
Reasonably probable	Likely to occur several times in life of operation (once per year)	0
Occasional	Likely to occur sometime in life of operation (once in 10 years)	-1
Remote	Unlikely but possible in life of operation (once per 100 years)	-2
Very unlikely	Very unlikely (might occur once per 1000 years)	-3

Risk impact	Damage	Scale
Catastrophic	> \$10 million	7
Critical	\$1 million < \$10 million	6
Major	\$100,000 < \$1 million	5
Minor	\$10,000 < \$100,000	4
Negligible	< \$10,000	3

In this example, risk factors are calculated by adding the likelihood and impact scores, and risk priorities are assigned on the following score groupings:

		Risk likelihood				
		Frequent	Probable	Occasional	Remote	Very unlikely
Risk impact		[1]	[0]	[-1]	[-2]	[-3]
Catastrophic	[7]	8	7	6	5	4
Critical	[6]	7	6	5	4	3
Major	[5]	6	5	4	3	2
Minor	[4]	5	4	3	2	1
Negligible	[3]	4	3	2	1	0

Risk profiles

Risk priorities are then allocated as follows:

Score	Ranking	Management Action
[5], 6, 7, 8	Major risk	Imperative to suppress risk to lower level
4, [5]	Medium risk	Corrective action required in a reasonable time frame
< 4	Low risk	Corrective action where practicable.