DEPARTMENT OF NATURAL RESOURCES & MINES

Planning Guidelines for Water Supply and Sewerage

Chapter 9

ANALYSIS OF OPTIONS

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Analysis of Options

1.0 Purpose

The purpose of analysing options is to determine the preferred option which provides the optimal mix of financial, social and environmental outcomes for stakeholders.

This chapter provides an overview of options analysis methodologies. Reference to more detailed information sources is provided.

2.0 Key Principles

Informed investment decisions can only be made through thorough analysis that considers financial, social and environmental impacts (positive and negative) and implementation risks throughout the lifecycle of the infrastructure.

Analysis of planning options must identify the long term financial impact (e.g. recurrent costs, including depreciation and customer charges) of all planning outcomes before proceeding with capital investment decisions.

All feasible potential options to meet service levels, including non-asset solutions should be considered in the options analysis.

The assumptions underlying the analysis of options must be justified and clearly documented in a planning report.

3.0 Why is the Analysis of Options Important?

Options analysis is a critical component of any planning study because:

- it objectively evaluates options based on a range of financial and non-financial criteria
- it provides a clear rationale for selecting a preferred option.

A project must meet service level criteria, financial, social and environmental objectives as well as legal obligations within an acceptable risk to the service provider.

4.0 When Should the Analysis be Undertaken?

The options analysis should be undertaken once:

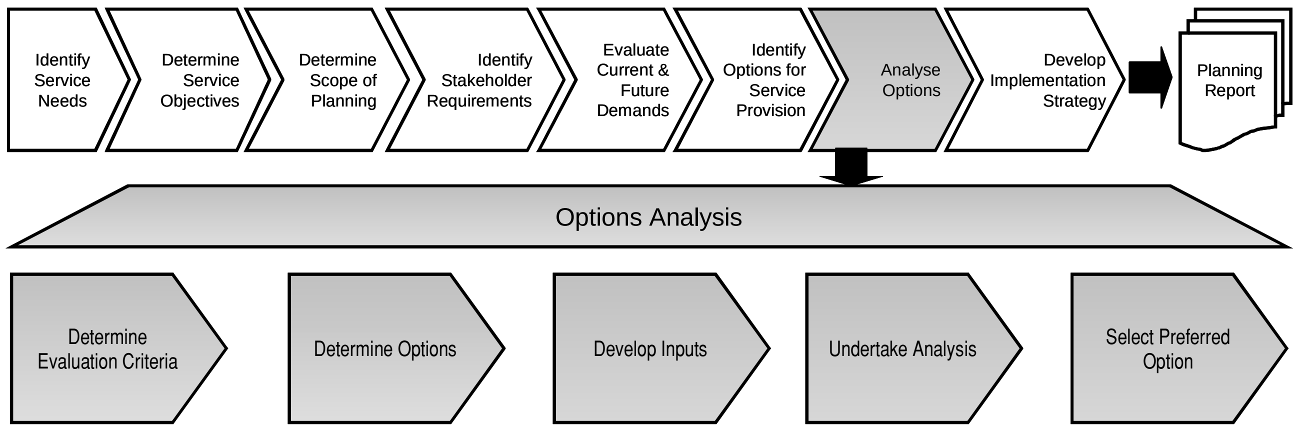
- A need has been identified (e.g. maintenance or improvement in service standards, change in community expectations or change to current planning/operating assumptions).
- The service objectives have been determined.
- Stakeholder requirements have been identified (refer to Chapter 4 - Stakeholders).
- Potential options for service provision have been identified (refer to Chapter 7 - Options for Service Provision).
- Reliable information has been compiled to quantify financial, social and environmental benefits, costs and risks.

The options analysis will be an iterative process commencing with a short-listing of potential options for more detailed evaluation, and subsequently the selection of a preferred option.

5.0 Key Elements

Key elements of the options analysis are illustrated in Figure 5.1.

FIGURE 5.1: Key Elements



5.1 Determine the Evaluation Criteria

The evaluation criteria should be clearly linked to quantified service objectives for the project. These objectives could relate to:

- service standards
- regulatory compliance
- operational performance/efficiency
- social objectives
- environmental objectives
- financial objectives.

5.2 Determine Options

These options may be categorised as:

- base case (do nothing)
- minimal approach
- existing asset options – this may involve asset rehabilitation, renewal or replacement options
- non-asset options (e.g. demand management, alternative means of service delivery, I/I reduction, optimising existing operation or improved utilisation of existing infrastructure)
- new asset options (a range of options may exist).

The optimal strategy could well be a combination of these categories. Details of potential asset and non-asset options are included in Chapter 7 - Options for Service Provision.

The identification and analysis of options can be facilitated through having value management or similar workshops. Options can be creatively and economically addressed through challenging assumptions, generating alternative ideas, improving communication and establishing priorities.

Depending on the scope of the planning study, workshops could involve internal planning and operational staff, or a range of key stakeholders or a combination of each.

The identification and management of risks should be embedded into the planning process and in particular the options analysis. Managing risk provides a basis for a more rigorous planning study as it will allow strategies to be developed to:

- reduce the likelihood and consequences of risks
- avoid the risk by not proceeding with the option
- accept the risks (and highlighting this in the planning report).

5.3 Develop Inputs

The range of inputs a planner would typically determine for each option may include:

- Whether the option is technically feasible.

- The level of compliance with service standards. This will be a quantitative assessment.

- Financial data including projected costs (capital, operational and renewal) and revenues.

- Compliance with regulatory requirements. This may be quantitative in relation to matters such as effluent standards. Other assessment may be qualitative. It would be mandatory for a preferred option to be fully compliant with regulatory requirements.

- Level of achievement of operational targets (e.g. energy consumption performance indicators). Some operational objectives may be more qualitative (e.g. operational skills requirements).

- Achievement of social objectives. Many of these would be qualitative (e.g. improved public health, equitable provision of services).

- Achievement of environmental objectives (e.g. reduced greenhouse gas emissions, improvement in the management of a scarce water resource). These could be a combination of quantitative (eg ecological footprint) or qualitative.

- Potential risks associated with the project. The assessment is likely to be qualitative. Risks to be considered would vary with the type of project and could include some of the following categories:

- Commercial/Financial
- Legal
- Social
- Environmental
- Political
- Cultural
- Site
- Contractual
- Design, construction & commissioning
- Operational
- Industrial relations
- Asset Ownership
- Organisational
- Technological
- Infrastructure
- Public health
- Workplace Health and Safety
- Regulatory
- Demand
- Security

A key input to the options analysis will be cost estimates. In developing cost estimates, the following should be considered:

- Estimates should include explanatory notes that clearly indicate the basis of the estimate. For instance.
  - Capital cost estimates should include all project costs (e.g. planning, survey, geotechnical, heritage, design, contract management, administration and service provider project management costs).

- Operational estimates should make allowance for administration and other overheads.
- The contingency percentage should be specified. The contingency percentage will be higher for preliminary or feasibility studies than more detailed planning studies, to reflect the confidence level in the estimate.
- Confidence in the estimates should be highlighted by specifying a range. The range would narrow as the definition of the scope of the project becomes more defined as planning develops. Specifying a number rather than a range may give decision makers an impression of greater estimating accuracy than actually exists.

- In developing estimates of benefits the following should be considered:
    - Avoided costs – costs which are unavoidable if nothing is done, but may be avoided if action is taken (for example, costs if a township experiences regular droughts requiring water carting).
    - Cost savings – verifiable reductions in existing levels of expenditure if a project proceeds (for example, reduced user costs if septics were replaced with a reticulated sewerage system or through more efficient operation).

Planners should be conscious of “optimism bias” – a tendency for under-estimation of costs and project duration and over-estimation of benefits. Higher risk of cost underestimation would occur with non-standard projects. This risk could be compensated through applying a higher risk-based contingency percentage in the cost estimates.

5.4 Undertake the Options Analysis

The options analysis should include:

- Technical evaluation of feasible options (refer Chapter 7 – Options for Service Provision) including project staging. If the project is technically feasible then further analysis can be undertaken.
- A financial analysis to determine the financial viability of each option.
- Analysis of social impacts (positive and negative).
- Analysis of environmental impacts (positive and negative).
- Risk assessment.
- A multi-criteria analysis for qualitative evaluation of impact and risk.
- Sensitivity analysis to evaluate the changes to key variables and how these changes would affect the overall cost/benefit of a project.

A **financial analysis** evaluates the financial viability of a project from the perspective of the service provider. An **economic analysis** assesses the overall impact of the project on the local, regional or state economy. The planning study should clearly identify what type of analysis has been undertaken.

A financial analysis includes:

- Projections of revenue (upfront and annual) from various sources. This would also include any community service obligations (CSO’s) and residual infrastructure value.
- Projections of costs including capital (new and renewal works), operation, maintenance, depreciation, administration, taxation and dividend payments.
- Calculation of financial viability. The project is usually considered financially viable if the net present value (NPV) is greater than zero, ie the total discounted value of revenues are greater than the total discounted costs. The option with the highest NPV is often selected if the sole criteria is financial. An alternative approach is the use of Internal Rate of Return (IRR) which determines the interest rate that a capital investment will return. In some instances a project may have a positive NPV but may not be considered financially viable as an internal rate of return greater than the “hurdle rate” may be required by the service provider. The “hurdle rate”

may have been set to meet commercial objectives based on some rate that is higher than the current weighted average cost of capital (WACC).

An economic analysis would evaluate quantifiable benefits in addition to revenue. The following may also be considered:

- Benefits which result directly or indirectly from the project.
- Benefits to consumers, and the broader community as a whole (externalities).

In an economic analysis, costs would also include such items as quantifiable environmental costs. **Least cost planning (LCP) analysis** is an evaluation technique that can be used to include consumer as well as service provider costs and benefits. For example, the principles of Least Cost Planning applied to water resource management involve considering demand management initiatives along with source substitution and supply augmentation options to identify methods of meeting the water related needs of a region at least cost to the community.

Demand management initiatives are identified by disaggregating water use into customer sectors and then into various end uses. Having identified demand management measures for each end use, the potential water savings from each initiative are systematically evaluated. This is followed by an estimation of water demand if the demand management initiatives are implemented and revised projections where appropriate.

The analysis of the costs and benefits of demand management options is undertaken by estimating the present value cost of implementing the option and the present value benefits that are accrued by avoiding and/or deferring any existing capital or operating costs associated with current supplies or any planned supply augmentation. The net present value (present value costs minus the present value benefits) is then used to estimate the unit cost of options and enable comparisons.

A **multi-criteria analysis** is a means of ranking options based on financial and non-financial criteria. The non financial criteria may be a combination of qualitative and quantitative criteria.

Quantitative criteria for Ecological Sustainable Development (ESD) are gaining greater acceptance within the water industry. Typical tools include:

- Ecological footprint (EF)
- Lifecycle assessment (LCA).

The EF concept can be used to convey the environmental impacts associated with a development. EF is a tool that calculates the area of land required to provide all energy and material resources consumed and includes all wastes discharged for each option. The EF concept is reported to have limitations (eg exclusion of downstream impacts such as impacts on receiving waters) and may not currently be appropriate for an options analysis. However, it could become a useful decision support tool as the technique is further refined.

LCA is an environmental assessment of the overall mass balance of an option, from the production of the raw materials to the ultimate disposal of all wastes. It can be a useful technique for comparing options on the basis for ecological sustainability.

A range of methodologies exist for multi-criteria analysis. Tables 5.1 and 5.2 provide an example. Weightings should be agreed prior to undertaking the multi-criteria analysis.

TABLE 5.1 Benefits – Compliance with Service Objectives

Criteria	Weighting	Option 1		Option 2		Further Options	
		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Service standards							
Social objectives							
Environmental objectives							
Operational objectives							
Etc							
Total							

TABLE 5.2 Risks

Risk Criteria	Weighting	Option 1		Option 2		Further Options	
		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Financial							
Social							
Political							
Environmental							
Etc							
Total							

Options can then be ranked based on the relationship between NPV, benefits and risks. The multi-criteria analysis could be undertaken through a workshop of key stakeholders.

5.5 Sensitivity Analysis

There will always be some degree of risk and uncertainty surrounding the outcome of a financial or economic evaluation.

An assessment should be made of a realistic range for all key variables. The assessment should be performed using different combinations of worst and best case scenarios. Techniques for assessing risk and uncertainty include:

- **Sensitivity analysis**. This illustrates what would happen if a small number of the key variables changed and how these changes would affect the overall cost and benefits/revenues of the project.
- **Risk analysis**. This assigns probabilities to the key variables, weights the key values by their probabilities of occurrence and uses these data to calculate the net present value of the project.
- **Scenario planning**. This approach is used if there are many assumptions in the project evaluation, each of which could vary. It is a process of looking at various possible situations or future scenarios.

A clear statement of the assumptions used in the analyses and the reasons for choosing them must be given in a planning report so that the decision maker is aware of the underlying assumptions.

6.0 Checklist

- How confident are you of the reliability of information provided for the options analysis? Can you confirm the validity of this information?
- Has a sufficiently wide range of staff and other stakeholders been involved in the multi-criteria analysis, including the development of criteria and weightings?
- Has a sufficiently wide range of options for service provision been considered? How were the options identified and then refined to focus the detailed analysis?
- Has there been adequate analysis of lifecycle revenues and costs, social and environmental impacts?
- Have non-asset solutions been adequately identified and assessed?
- Have the risks been rigorously evaluated?
- Does the analysis include an appropriate level of sensitivity analysis?
- To what extent has the analysis taken into account the tendency for “optimism bias”?
- Has the planning proceeded to the appropriate level to justify the recommended option?
- Has a ‘reality check’ been undertaken to assess whether the outcomes of the analyses are reasonable?
- Are you confident that you can demonstrate that the proposed option is the optimal strategy in terms of social, environmental and financial outcomes?
- Would you invest in the preferred option if you were personally responsible for its implementation?

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