Shoalwater Bay
MILITARY TRAINING AREA
RESOURCE ASSESSMENT
VOLUME 2
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ABARE, AGSO and the BRS are research organisations attached to the Commonwealth Department of Primary Industries and Energy.
The Shoalwater Bay Military Training Area is a valuable national asset. Its value derives from a variety of current and potential uses, including military training, conservation of natural and cultural assets (including Aboriginal sites), water supply, mineral deposits, fishing, scientific research, recreation and tourism. In August 1993 ABARE, AGSO and BRS jointly released 'Shoalwater Bay Military Training Area: Resource Assessment'. In that report information was presented to assist decision makers to determine the relative value of these alternative uses and to assess the additional information required for ongoing management decisions.

On 31 May 1994 the Commonwealth Commission of Inquiry into the Shoalwater Bay Military Training Area presented its final report to the Commonwealth government. The stated purpose of that Commission was to identify the environmental acceptability of alternative land uses. Interpreted that way, the Commission's role was to provide one set of information to a broader government decision making process. That is, the Commission's aim was not to assess the full range of costs and benefits of land use options and the final report does not present such an assessment. Notwithstanding this, the Commission does make detailed recommendations on land uses and land management in the Training Area.

The Bureaus believe that a full and objective assessment of the value from all potential uses is imperative to assist decisions about the use of Australia's assets. Therefore, the intention in publishing this report is to present an assessment of the robustness of the Commission's conclusions and recommendations from a broad economic perspective, that is from the viewpoint of multiple objective resource use.

In this context it should be noted that some of the uses are not totally compatible. However, there are management strategies which can improve the compatibility of these conflicting land uses, such that some can be concurrently undertaken on adjoining sites or sequentially on the same site.

This report is presented to assist decision makers to determine the set of uses and strategies with the highest net benefit (including market and non-market values) to all Australians from the Shoalwater Bay Military Training Area.

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# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary</td>
<td>1</td>
</tr>
<tr>
<td><strong>1 Introduction</strong></td>
<td>6</td>
</tr>
<tr>
<td>1.1 Purpose and content of report</td>
<td>6</td>
</tr>
<tr>
<td><strong>2 Decision framework</strong></td>
<td>8</td>
</tr>
<tr>
<td>2.1 Multiple use</td>
<td>8</td>
</tr>
<tr>
<td>2.2 Values</td>
<td>9</td>
</tr>
<tr>
<td>2.3 Evidence</td>
<td>10</td>
</tr>
<tr>
<td>2.4 Other aspects of the decision framework</td>
<td>11</td>
</tr>
<tr>
<td><strong>3 Conservation</strong></td>
<td>13</td>
</tr>
<tr>
<td>3.1 Conservation values</td>
<td>13</td>
</tr>
<tr>
<td>3.2 Opportunities for concurrent uses</td>
<td>16</td>
</tr>
<tr>
<td><strong>4 Military training</strong></td>
<td>17</td>
</tr>
<tr>
<td>4.1 Value</td>
<td>17</td>
</tr>
<tr>
<td>4.2 Impact on other uses</td>
<td>18</td>
</tr>
<tr>
<td>4.3 Opportunities for concurrent uses</td>
<td>18</td>
</tr>
<tr>
<td><strong>5 Water catchment</strong></td>
<td>19</td>
</tr>
<tr>
<td>5.1 Value</td>
<td>19</td>
</tr>
<tr>
<td>5.2 Opportunities for concurrent uses</td>
<td>19</td>
</tr>
<tr>
<td><strong>6 Mining</strong></td>
<td>22</td>
</tr>
<tr>
<td>6.1 Value of mineral deposits in the Training Area</td>
<td>22</td>
</tr>
<tr>
<td>6.2 Impact on other uses</td>
<td>23</td>
</tr>
<tr>
<td>6.3 Evaluation of impacts of mining and exploration</td>
<td>24</td>
</tr>
<tr>
<td>6.4 Opportunities for concurrent uses</td>
<td>26</td>
</tr>
</tbody>
</table>
7 Other potential uses

7.1 Aboriginal use
7.2 Recreation and tourism
7.3 Scientific research and education
7.4 Fishing

References

Map
Summary

The Shoalwater Bay Military Training Area (referred to as the Training Area in this report) has been managed by the Army as a Joint Defence Force training facility since 1965. Some commercial fishing, recreation and tourism activities are conducted in the waters of the Training Area. Part of the Training Area forms the catchment for water supply for residents of Livingstone Shire. It is also an important conservation area and, along with areas to the northwest and southeast, the Training Area is listed on the Register of the National Estate as the Capricorn Coast Area.

In December 1992 the Commonwealth Commission of Inquiry into Shoalwater Bay (hereafter referred to as the Commission) was announced. Based on its inquiry the Commission has recommended that the Training Area be used concurrently and equally for military training and conservation. In an attempt to improve the compatibility between these uses it is recommended that management strategies be introduced and a Management Advisory Committee advise the Army (as manager of the Training Area).

The Commission has recommended that no activities be embarked on which could adversely affect the water supply to Livingstone Shire. In addition, the Commission has recommended that access be granted to local Aborigines due to the location of archaeological sites within the Training Area. Further recommendations propose continued use of the Training Area for fishing, tourism and recreation and scientific research. Finally, the Commission has recommended that no exploration or mining of any type be allowed in any part of the Training Area.

In its inquiry the Commission focused primarily on the environmental aspects of alternative uses of the Training Area and this focus is reflected in its recommendations. Only a limited attempt was made to analyse the broader issues concerning social costs and benefits of alternative land uses. The aim in this report is to address these broader issues with a view to assessing the robustness of the Commission's findings and recommendations from an economic perspective.

Decision framework

In deciding how to use a resource to maximise the national net benefit, all feasible uses for that resource need to be considered. In valuing the net benefits associated with each form of use, account needs to be taken of market costs and benefits as well as any environmental and social consequences, with these being quantified in dollar terms wherever it is feasible to produce reliable estimates. In other words, within this decision framework both market and non-market values need to be assessed, including assessing the costs of the effect of one use on other uses. As part of this process the opportunities for multiple use, sequential use and improving the compatibility of uses should be investigated.

Such a decision making framework was applied to the Training Area in a recent report by ABARE, BRS and AGSO (1993). In that report an attempt was made to account explicitly for all costs and benefits of alternative land use combinations in the Training Area. These costs and benefits were considered from a national perspective.
perspective. Policy choices were suggested which are flexible enough to allow adaptation to changes in knowledge, community preferences and market conditions. In that report the most critical information gaps identified were those relating to the mineral prospectivity of most of the Training Area and the variable nature of information on biological resources.

The Commission's stated aim was to identify the environmental acceptability of alternative land uses. However, the Commission made strong and detailed recommendations on land uses and land management in the Training Area but did not present an analysis of the full range of costs and benefits of land use options. For example, the Commission made no attempt to fill a critical information gap identified by ABARE, BRS and AGSO (1993), which was the need for further data on mineral resources of the Training Area, and indeed recommended that no exploration be allowed to collect such information.

The Commission did not take a national view of the costs and benefits. Also, rather than determine values, it considered opinions of what some costs and benefits may be. In some instances costs and benefits to the residents of Livingstone Shire and others who live in the vicinity of the Training Area were valued more highly than costs or benefits to other Australians. Consideration of the impact of uses of the Training Area on the local community is necessary but this should not exclude the wider costs and benefits to the whole Australian community. In the Commission's report, costs of environmental disturbance seem to have been given greater weighting if they were caused by mining than if they were caused by fishing or military training activities.

As the potential uses of the Training Area are not totally compatible, with the possible exception of conservation and water supply, the decision process needs to include examination of strategies to improve the compatibility of uses and assessment of the costs of such strategies. In the Commission's report there was little examination of possibilities for promoting compatibility of mining and other uses, such as management options for minimising, and in some cases overcoming, potential adverse impacts of mining on other uses. The question of sequential use of sites in the Training Area for various purposes was not considered explicitly in the Commission's report. Given that the sand mining industry is an acknowledged leader in mine site rehabilitation, the use of a sand mining site for another purpose after rehabilitation is quite feasible.

On the other hand the Commission discussed at length options to improve compatibility between other uses and conservation in particular. For example, the Commission noted that levels of defence use impact have varied across the Training Area but these effects '...are not irreversible and they can be remediated'. This seems at odds with the recommendation that 'no go' areas be enlarged and more stringently enforced. The Commission noted that recreational fishing and fish trawling could have significant adverse impacts on marine fauna and ecosystems but it viewed these uses as compatible with conservation provided that a management plan was adopted. Such findings could be applied to mining also. The Commission did not consider the cost of the recommended management plans or the cost to military training of complying with recommended conservation strategies.

Conservation

The Training Area has significant value for conservation for several reasons. The marine zones contain seagrass beds which are important nursery beds; also some 'at risk' species (turtles and dugong) inhabit this zone. The land zones are diverse in landform, flora and fauna. The wetlands are important for migratory birds.
Several endangered or 'at risk' species inhabit parts of the Training Area, and it represents the geographical limit of the distributional range of some species. Partly because of this there are several unusual associations of landform and flora. Geological records of the Training Area hold interesting information about the formation of Australia’s land mass particularly in relation to sea-level changes and coastal features.

The Commission concluded that parts of the Training Area have significant wilderness value but these are by no means contiguous. On the other hand, conservation and wilderness values of the Training Area have been lowered by grazing, mining and forestry activities in the past and by the existence of a substantial feral animal population. Military infrastructure and use, including cleared areas and impact zones, and managed burning also have negative impacts on some conservation values. Indeed the wilderness value and ecological integrity of the Training Area are likely to be lower than that implied by the Commission. Unfortunately there are no reliable estimates of the value of conservation of the Training Area.

Military training

The benefits to Australia of military training arise from its contribution to the existence of a credible and efficient defence force. The existence of such a force reduces the risk of threats to Australia’s sovereignty and enables Australia to fulfil international peace keeping obligations. The Training Area contributes to national security to the extent that it provides a more effective or a less costly facility than alternative areas. Restricting other activities which is necessary for safety during Defence exercises helps to protect some aspects of the natural environment of the Training Area. However, military use also has some detrimental effect on conservation values, such as managed burning.

The Training Area does have substantial value as a military training facility, as indicated by an estimated range of between $60 million and $148 million in the net present cost of relocation. However, given increasing emphasis to military training in the far north of Australia the Training Area is likely to experience a decline in use for this purpose in the future. As military training is not totally incompatible with the other uses being considered for the Training Area there is no need to relocate the training facility. To enable concurrent use with conservation there will be additional, but unquantified, management costs imposed on the Army as managers of the Training Area if the Commission’s recommendations are followed.

Water catchment

About half of the water catchment for Livingstone Shire lies within the Training Area. In recommending that no adverse activity be permitted in the water catchment zone the Commission has assigned infinite value to the water supply for Livingstone Shire residents. However, this is not the case and the provision of water supply can coexist with most other uses provided that planning and management of other uses take consideration of their impact on both the quantity and quality of the water supply.

Any human activity in a water catchment area poses some risk to water supply. Conservation is compatible with water catchment, with mining often seen to represent the other extreme. However, there are precedents of mining being conducted in water catchment areas without major problems of pollution or diminution of the water supply; for example, mineral sand mining at Tomago, New South Wales, coal mining in the water catchment area for Sydney and mining of bauxite in Perth’s catchment. Also, studies conducted for the Commission indicate that there is a very low chance that sand
mining within the water catchment area would adversely affect the water supply. In the event that sand mining did affect the water supply the cost, in present value terms, may not be high. For example, if baseflow was reduced by 10 per cent it would incur a present value cost of only about $400,000.

If, in the very unlikely event it became necessary to replace the present water supply due to incompatibility with other uses, the Livingstone Shire Council estimated that the cost would be $20.9 million. Mining in other regions of the Training Area could be undertaken with no threat to the water supply.

Mining

Although subject to much uncertainty, estimates from various models indicate that sand mining in the Training Area would most likely provide net benefits to Australia. For example, ABARE, AGSO and BRS (1993) estimated that sand mining in the main dune area has a 64 per cent chance of being undertaken by a risk neutral company, with an expected net present value of $233 million.

Consultants to the Commission reviewed the submissions and research on sand mining in the Training Area and concluded that sand mining in both the main dune fields and Clinton Lowland would be likely to offer positive net economic benefits to the Australian community.

The Commission appeared to discount all this evidence and assumed that conservation, military training and water supply have a much larger value, which is also assumed not to be subject to uncertainty.

The Commission's report implied that mining is always incompatible with other land uses, that mined areas cannot be successfully rehabilitated and that mining is not in society's interests. However, with the available information it is not possible to determine the level of impact mining would have on conservation values, particularly ecological integrity. Also, it is feasible that after mining, rehabilitation could reestablish ecological integrity of some previously degraded sites.

Concurrent military training and mining within the Training Area will impose extra costs on both as each would be required to modify operations to some extent, such as vacating the minesite to allow military exercises involving live firing. Assuming that moving military training to another location is not necessary, sand mining would impose a cost on the Army of around $3 million to $40 million in present value terms.

With concurrent use, the expected net benefit of sand mining in the main dune fields after allowing for the costs to military training operations could be between $190 million and $230 million. Any benefits from mining in Clinton Lowland or other regions of the Training Area would be additional to this amount.

The question of mining in other parts of the Training Area was not addressed in the Commission's final report. It is possible that substantial deposits of other minerals, particularly gold, exist in the Training Area. Given the diversity of the Area, the effects of mining a deposit on other uses would vary greatly between sites and with mining techniques, and may be quite low on the cleared areas.

If the Commission's recommendations are adopted and no further exploration and resource assessment is allowed it is possible that Australia will forgo a substantially large, but unknown, net benefit from the Training Area. Conversely, further exploration may indicate that mining these resources would not be commercially viable given market conditions at that time and mining would not proceed at that stage. However, future changes in market conditions or mining technology could change the viability of a mineral resource and a reassessment may be justified.
Other potential uses

Commercial fishing in the Shoalwater Bay Area is small and constitutes less than 1 per cent of Queensland fisheries production. Output from the fisheries has been constrained by the necessary restrictions to access due to military training. Fishing activities, particularly trawling, can cause damage to seagrass beds and the sea floor and is a threat to some ‘at risk’ species (dugong and turtles).

The benefits flowing from other uses do not pertain to markets and are difficult to measure other than in broad qualitative terms. The Training Area does have value for Aboriginal use, scientific research, recreation and tourism. The former two uses could be accommodated with other uses relatively easily as they do not significantly impact on other uses. The current low levels of recreation and tourism also could be continued alongside most other uses with the continuation of closure of the Training Area during military exercises. However, strategies would be needed to minimise damage to the environment should these uses increase in the future.

Critical aspects

Given the geological variation and biodiversity of the Training Area the optimal use and management strategy will vary across it. Any approach to decisions and management which considers the Training Area as one unit, which appears to have been the approach adopted by the Commission, is inappropriate in respect to all land uses.

A decision on resource use is necessarily constrained by the available information. As new information becomes available or as market conditions or community preferences change, the optimal use of the resource may also alter. In view of this, maintaining a reasonable degree of flexibility with respect to future use of the Training Area is appropriate.

At this stage it may be appropriate to continue military use of the Training Area together with changes in management to reduce damage to sites with high conservation values. Similarly, management strategies need to be considered to curb adverse impacts of other uses such as fishing, tourism and recreation on sites with high conservation values.

Given the current level of knowledge there is a significant probability that exploration could reveal a mineral sands resource of both commercial and national importance. The value of other mineral resources in the Training Area is largely unknown but given the geological structure of, and past mining in, the Training Area it is feasible that there are other mineral deposits that would yield net benefit to Australia.

Even after allowing for the extra costs imposed on military training, mining in the Training Area is likely to yield net benefits. The total exclusion of mining and exploration as recommended by the Commission would result in the Australian community forgoing an uncertain but possibly substantial net benefit. Further resource assessment, particularly of the mineral resources, and additional research on ecosystems, with a view to ascertaining the impact of various uses, would substantially assist the decision process and subsequent management strategies to be applied in the Training Area.

Taking all values into account, including likely but uncertain environmental values, there is currently insufficient information to exclude mining from the Training Area. Rather, there is a significant chance that exploration could reveal mineral resources of national significance which could be developed in ways consistent with all or most of the Training Area’s current military use and conservation values.
Introduction

The Shoalwater Bay Military Training Area (hereafter referred to as the Training Area) covers an area of about 4545 square kilometres on the central Queensland coast. The Training Area is currently managed primarily for military training. Some commercial and recreational fishing is conducted in the waters of the Training Area, and part of the Area forms the catchment for water supply for residents of Livingstone Shire. It also has conservation value and, along with areas to the northwest and southeast, the Training Area is listed on the Register of the National Estate as the Capricorn Coast Area. In December 1992 the Commonwealth Commission of Inquiry into Shoalwater Bay (hereafter referred to as the Commission) was announced.

ABARE, AGSO and BRS (1993) published an economic and scientific assessment of the resources of the Training Area, including a detailed analysis of the likely tradeoffs between values of alternative uses, given the state of knowledge at the time of writing. An assessment of the gaps in knowledge and the relevance of those gaps to decision making was also provided.

The most critical information gaps identified in that study relate to the geology and mineral resources of most of the Training Area and some aspects of its biological resources. Less was known of flora than of fauna resources. In that report it was stressed that the time horizon of any resource use decision would be limited by changes in information, community preferences and income, technology and markets. The major conclusion was that management of the Training Area needed to be flexible enough to allow adaptation to changes in the relative values of alternative uses, and access to the Training Area '... should not be such that potentially beneficial activities are discouraged without a full economic assessment' (ABARE, AGSO and BRS 1993, p. 5).

The Commissioners to the Inquiry presented the final report (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, b) to the Federal government on 31 May 1994. The Commission was wide ranging and considered use of the Training Area for conservation, military training, Aboriginal use, tourism and recreation, scientific research and education, fishing and mining.

The main recommendations were that conservation and military training be concurrent and equal uses of the Training Area; that water supply have precedence over other uses in the catchment region; other current uses and Aboriginal use be allowed subject to military access restrictions; and that no mining or exploration of any type be permitted in the Training Area.

1.1 Purpose and content of report

In publishing this report the intention is to assist decision makers to determine the set of uses and strategies with the highest net benefit from the Training Area (including market and non-market values) to all Australians. To this end the broad economic issues in multiple objective resource use are addressed in this report, with a view to assessing the robustness of the Commission's conclusions and
recommendations from an economic perspective.

In section 2 the issues relating to the overall decision framework are discussed along with an assessment of the Commission's framework used in reaching its recommendations. This is followed by an assessment of the issues relating to each land use identified by the Commission as potentially valuable. These are conservation, military training, water supply, mining, fishing, Aboriginal use, recreation, tourism and scientific research and education. An examination of other land uses such as grazing, aquaculture, horticulture and forestry is contained in ABARE, AGSO and BRS (1993) and is not included in this report.
Decision framework

The decision making framework applied in ABARE, BRS and AGSO (1993) has three essential features. First, it involves explicit (although not always quantitative) accounting for all costs and benefits associated with alternative land use combinations in the Training Area. While quantification may not be possible in all cases, the full range of land use options and the full extent of costs and benefits, market and non-market, needs to be considered. This involved assessing the costs of the effect of one use on other uses and exploring the opportunities for multiple use and sequential use.

Second, costs and benefits are considered from a national, rather than a local or regional, perspective. Third, policy choices are suggested which are flexible enough to allow adaptation to future changes in information, community preferences and in market conditions.

The approach taken by ABARE, BRS and AGSO is based on explicit recognition of the diversity of terrain and of biological and geological resources in the Training Area.

In the Commission’s summary report (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a), it was stated that the Commission’s purpose was to identify the environmental acceptability of alternative land uses. Interpreted that way, the Commission’s role would have been to provide one set of information to a broader government decision making process. Such a role would appear to have been consistent with the Commission’s terms of reference. However, the Commission made strong and detailed recommendations on land uses and land management in the Training Area even though it did not assess the full range of costs and benefits of land use options and the final report did not present such an assessment.

Furthermore, it appears the Commission has been selective in regard to information. For example, while the Commission employed a consultant to rectify the information gap on flora resources of the Training Area (see Research Report 8 in Commonwealth Commission of Inquiry into Shoalwater Bay 1994d), it made no attempt to fill the other information gap identified by ABARE, BRS and AGSO (1993), which was the need for further data on mineral resources of the Training Area. Indeed the Commission recommended that no exploration be allowed to collect such information.

The Commission did not take a national view of the costs and benefits. Also, rather than determine values, it considered opinions of what some costs and benefits could be. The Commission’s weighting of a cost or a benefit appeared to depend on who bore the cost or who received the benefit. Costs or benefits to residents of Livingstone Shire and others who live in the vicinity of the Training Area seemed to be valued more highly than costs or benefits to other Australians. Costs of environmental disturbance appear to have been given greater weighting if they were caused by mining than if they were caused by fishing or military training activities.

2.1 Multiple use

As some potential uses of the Training Area are not totally compatible, with the possible exception of conservation and water supply, the decision process needs to
include examination of strategies to improve the compatibility of uses. In the Commission's report there was little discussion of possibilities for promoting compatibility of mining and other uses, such as management strategies to minimise, and in some cases overcome, potential adverse impacts of mining on other uses. For example, the Commission implied that it would be commercially infeasible for miners to vacate minesites for periods to allow military training exercises to proceed unhindered. This was despite the fact that the companies interested in mining within the Training Area indicated they would be prepared to do so (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 18).

On the other hand the Commission stressed the compatibility between other uses and conservation in particular. The Commission noted that levels of defence use impact varied across the Training Area but these effects '... are not irreversible and they can be remediated' (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 27). The Commission noted that recreational fishing and fish trawling could have adverse impacts on marine fauna and ecosystems but viewed these uses as compatible with conservation provided a management plan was adopted. It is unclear why such findings would not also apply to mining in the Training Area, particularly given the high standard of sand mining rehabilitation techniques (see section 5). The Commission itself noted that the Australian sand mining industry is a world leader in rehabilitation of minesites (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b).

2.2 Values

Market values

In general it is relatively easy to determine the value of resource uses, such as mining and fishing, which produce goods traded in the market place. For some uses, such as military training, it is possible to estimate a value by determining the opportunity cost of relocating the use to another site. In these cases there is no need to resort to non-market valuation measures.

It is noteworthy that the Commission took the view that any potential income from mining in the Training Area could be substituted by the development of a mine somewhere else, even another country (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 61). There may be another site which could be profitably developed for sand mining. However, profit from this other mine would result in additional income to Australia and not necessarily substitute for the loss of income from mining in the Training Area.

There is a loss of income to Australia if a potentially profitable mining operation is not developed. A mine in one part of Australia is no more a substitute for another Australian mine than is the income of one family a substitute for the income of another family. In addition, it is not clear what income, if any, Australians would obtain from overseas mines.

By suggesting that one mine may substitute for another, the Commission managed to imply that the expected loss from not allowing exploration would not be large. If the potential loss from choosing to ban exploration and consequent consideration of mining were only small, then the additional conservation benefits from doing so would only need to be small. However, the available evidence indicates a high likelihood of discovery of substantial commercial mineral resources. The additional conservation benefits from an exploration and mining ban must, therefore, be equally high or greater if that ban is to be optimal from the viewpoint of national welfare. Little evidence was provided by the Commission to demonstrate that the additional conservation benefits are potentially very large.
Non-market values

No reliable estimates exist of non-market values for the Training Area. There are various techniques to estimate non-market values, such as contingent valuation, but great care needs to be exercised in conducting such studies otherwise the validity of the results is questionable. For instance, a major problem is to describe the scenario in sufficient detail to clearly delineate the risk and consequences so that respondents can make informed decisions.

The purpose in such studies is to assign monetary figures to values held by the community. In this context it is vital to draw a distinction between values and attitudes. Values indicate what people are willing to pay to maintain a particular use of the resource. Attitudes merely indicate people’s opinion of a resource. Attitudes have no element of payment or tradeoff and thereby do not necessarily indicate values.

2.3 Evidence

In considering what information is potentially useful to rational decision making it is important to draw distinctions between values, evidence and opinions. In the case of values of market goods, clear evidence of values is available from existing markets, such as those for mineral sands. Similarly, there is much scientific knowledge about the nature of the overall geology and biology of the Training Area, although there are substantial gaps. However, purely subjective views which conflict with existing evidence will only mislead, as may unresearched or unsubstantiated interpretation of the evidence.

In the case of non-market values, objective evidence is often lacking. When there is no resort to market tests of value, each individual’s view is potentially equally valid. However, opinions or individual statements of value are not necessarily values, as is evident from the literature on contingent valuation (see for example Ajzen and Peterson 1988; Imber, Stevenson and Wilks 1991). In addition, care is required in interpreting attitudes and evidence. The approach taken by ABARE, BRS and AGSO, as shown in their report and subsequent evidence, was to present an objective assessment of the values of alternative uses of the Training Area within a consistent framework. However, the Commission has erroneously interpreted this as support for mining (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 98).

During the course of the inquiry a great deal of information was provided in submissions and evidence by interested parties, plus studies undertaken for the Commission (Commonwealth Commission of Inquiry into Shoalwater Bay 1994c, d and e). It is difficult to gauge what information has been taken as relevant by the Commission or the weighting given to information in the Commission’s consideration. However, there are many instances in which emotive appeals by individuals or groups appear to have been given the same or greater weight than evidence provided by expert witnesses. In this sense it is important to draw a distinction between opinions which are subjective and evidence which is objective.

For instance, the Commission’s own consultants’ study by Townley and Flemming (1993) concluded that sand mining would pose a slight risk to the water supply although it did recommend further research. The local community considered that any risk at all was unacceptable. It appears that more weight was given to local community opinion than scientific evidence in reaching recommendation 19 ‘... that all activities ... likely to have an impact on the quality and quantity of fresh water available to the Capricorn Coast ... be prohibited’ (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 41). This recommendation implies an infinite value to the water...
supply, but there is no implication that the residents should pay according to this value.

A further danger of relying on community attitudes as an indicator of values is that the community may not have sufficient information on which to form rational opinions. Due to the access restrictions, the community did lack information on the Training Area as noted by the Commission (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 98, para. 4.25). Given this lack of knowledge, it would be imperative that in surveying attitudes to alternative uses of the Training Area, respondents be given sufficient detail or specifics to clearly describe the risk and consequences of alternative uses to enable them to make an informed decision. This was not the case with the survey of attitudes by AGB McNair (1994) used by the Commission. Indeed respondents may have formed the impression that mining would affect the whole Training Area. However, mining would only affect a very small part of the Training Area; for example, Pivot Mining’s leases cover only 1.7 per cent of the Training Area.

2.4 Other aspects of the decision framework

In deciding the best use (or combination of uses) for the Training Area the Commonwealth government will necessarily consider benefits in relation to the whole of Australia, not just the local community. Much weight was given to local community views by the Commission. In several instances, the benefits to local residents of some management choices were considered without mention of the possible costs of those choices to other Australians. An example was the recommendation that no action should be allowed that has a potential impact on the Livingstone Shire water supply. The relevant consideration is the potential national benefit of the action being considered, compared with any change in the value of water supply which may result from the action. It is appropriate for policy formulation to identify the nature and extent of the impacts on local residents. However, the consideration of the welfare of local residents should accompany, not exclude, that of other Australian residents.

The best use and management strategy will probably vary across the Training Area and the Commission’s treatment of it as one unit is inappropriate. The boundaries of the Training Area have been defined according to the history of human land use patterns and bear little relationship to ecological systems. The diversity within the Training Area is useful for military training for which the Training Area was defined and acquired in 1965.

This diversity means that the impact of different land uses varies across the Training Area. For example, sand mining can affect the flow of water and the level of the water table. In the water catchment for Livingstone Shire the main issue is the extent to which sand mining is likely to affect the water supply, whereas on Clinton Lowland the major concern is whether sand mining will affect the native vegetation across a wider area than the immediate vicinity of the mine. The geological variation and biodiversity of the Training Area underlines the desirability of setting decisions in the context of each environmental region.

In rejecting mining the Commission noted that ‘...it is generally incompatible with the social objectives because it involves resource-use decisions which fail to ensure intergenerational equity.’ (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 27). This statement seems to imply that mining in all areas of Australia, not just the Training Area, is incompatible with social objectives. Such a statement ignores the fact that, to exist and grow, ‘societies must extract, process and consume natural resources’
The problem is to ensure intergenerational equity while allowing consumption of natural resources, particularly those that are irreversible.

Intergenerational equity is usually defined as increasing the welfare of the current generation without decreasing the welfare of future generations. This can be facilitated by passing on to the next generation a stock of capital no lower than the current level which can then be used to yield the same level of welfare for the next generation. This does not mean that the stock of capital needs to be preserved in its current state. In relation to non-renewable resources, the question is what is the most efficient way to pass on productive capacity or capital stock, whether it is human, natural or man-made capital (Fisher and Thorpe 1992). Mining a non-renewable natural resource is not inconsistent with social goals or intergenerational equity so long as any economic surplus from the use of that resource is invested in future productive assets (including human capital).

Uncertainty surrounding future events is an unavoidable aspect of land use decisions. It is possible to incorporate some consideration of uncertainty into analyses of the net benefits of resource use. Such an approach was used by ABARE et al. (1993) in estimating the value of sand mining in the Training Area. However, the Commission considered that the uncertainty surrounding the sand mining proposals was so great that it discounted all the results from several analyses (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 55).

In contrast, the Commission made no mention of the uncertainty which also applies to the values associated with other uses of the Training Area, such as water catchment, military training and conservation. Although some of these uses may not produce marketable output, they are nevertheless subject to uncertainty regarding future values. For example, the value of the Training Area for military training in the future is uncertain given the increasing emphasis on training in the far north of Australia (Bergin 1994) and the uncertain nature of any future threat to Australia.

A decision on resource use is necessarily constrained by the available information. Accordingly any opportunity to obtain further information should not be precluded, such as not allowing exploration, unless there was no expected net benefit in acquiring and using that information. When new information becomes available or as market conditions change or the nature of the resource is altered the optimal use of the resource may also change. Therefore, it is economically desirable to maintain flexibility about future use of the Training Area.
3 Conservation

3.1 Conservation values

The Training Area has significant value for conservation for several reasons but the value varies across the Training Area's regions. The marine zones contain seagrass beds which are important nursery beds for recruitment to the eastern seaboard fisheries, and some 'at risk' species (such as turtle and dugong) also inhabit this zone. The land zones are diverse in landform, flora and fauna, while the wetlands are important for migratory birds.

Several endangered or at risk species inhabit parts of the Training Area and it represents the geographical limit of the distributional range of some species. Partly because of this there are several unusual associations of landforms and flora. Geological records of the Training Area hold interesting information about the formation of Australia's land mass, particularly processes such as sea-level changes affecting coastal features. The Commission concluded that parts of the Training Area appear to have high wilderness value. Finally, the Commission discussed Aboriginal values and noted the presence of several sites of cultural heritage value, such as graves and homesteads but did not include the abandoned Jubilee Gold Mine (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 94 and figure 4.1).

Several factors also detract from the conservation values of the Training Area. First, there is an unquantified but significant feral animal population and weed invasion. Second, any wilderness value of the Training Area needs to be modified by the existence of bomb sites, permanent military infrastructure and roads which cross the Training Area. The Commission's report noted the high wilderness value of the Training Area and asserted that it is 'the largest coastal area with high wilderness values south of Cooktown on the east coast' (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 50).

However, there are deficiencies in the Australian Heritage Commission's analysis of the wilderness value of the Training Area which formed the basis of the Commission's considerations.

A recognised strength of the methodology used by the Australian Heritage Commission is that it is pragmatic and transparent through the use of four indicators of remoteness and naturalness; 'remoteness from settlement', 'remoteness from access', 'apparent naturalness' and 'biophysical naturalness'. Further, the methodology '... is designed to measure variation in wilderness quality in the landscape using consistent and objectively measurable criteria' (Lesslie, Taylor and Maslen 1993, p. 1).

In applying this methodology to the Training Area, the Australian Heritage Commission did not use all available information (some of which may not have been accessible to it) and failed to provide or justify the weighting factors applied to each criterion.

These deficiencies are particularly apparent for the biophysical naturalness criterion that is used to determine the freedom of the natural environment from changes caused by modern technological society, including clearing, grazing and feral animals. The Australian Heritage Commission's analysis did not adequately...
account for the environmental impact on biophysical naturalness caused by past logging and grazing, military training activities and the presence of feral animals. For example, one region classified as having moderate to high wilderness qualities incorporates the two mainland impact areas. These areas are subject to shelling, bombing and other live fire which are likely to detract considerably from the wilderness values of the area.

Townshend Island was omitted from the Commission’s wilderness classification but in its submission the Australian Heritage Commission noted that the island is likely to have moderate wilderness value (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 75 and figure 3.8). In fact this island has a substantial population of feral goats and is used as a target area by both the RAAF and the RAN. Further, access routes appear not to have been captured adequately in the measurements for the two criteria of remoteness from access and apparent naturalness.

The classification of wilderness values across the Training Area requires a more complete accounting of all available information, the use of higher resolution data and more complete measures of disturbance than those which underlay the classification used by the Commission.

The Commission argued that the whole of the Training Area should be conserved for reasons of ecological integrity. This view seems to be at the heart of the Commission’s recommendation against mining in the Training Area. The Commission argued that mining and consequent rehabilitation would inevitably destroy that integrity. However, this is not clearly the case and the following points need to be considered in the context of mining’s impact on ecological integrity.

- The Commission found that the Training Area displayed a high degree of ecological integrity (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 42, para. 3.79) although it correctly noted that there was disagreement on where the Training Area lies on the continuum of ecological integrity or whether the ecological integrity of the Training Area was of uniform value (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 38, para. 3.65).
- Ecological integrity is a complex concept and encompasses the capacity of an ecosystem to remain healthy, to maintain its organisation (in terms of species structure, population and ecosystem processes), and to maintain the evolutionary potential essential for its adaptation to changing environmental conditions (Amos, Kirkpatrick and Giese 1993). The ability of an ecosystem to maintain its organisation can be affected by the level of environmental change and there is a threshold beyond which this ability is lost and the ecosystem will reorganise into a different, often ecologically impoverished ecosystem (see RAC 1992, pp. 107-10). If a segment of the ecosystem becomes degraded or impoverished, the ecological integrity of the ecosystem can still be maintained as long as the disturbance does not reorganise or change the whole ecosystem to another threshold. The disturbance of segments of the ecosystem can be ecologically sustainable if appropriate and quick restoration takes place.
- In considering ecological sustainability a very long period of time is appropriate. It is important to define ecological integrity in relation to time and geographical zones. However, the studies that have been undertaken have not collectively yielded sufficient knowledge of the ecosystems to determine the ecological integrity of the Training Area.
- The level and uniformity of ecological integrity of the Training Area has still to be ascertained. The Training Area was put together with military training (and presumably ease of management) in mind. It is unlikely that the value of ecological integrity would be uniform across the Training Area. Parts of the southern,
western and central sections of the Training Area have been degraded and severely modified by grazing and associated clearing activities.
- Similarly, the development of the Samuel Hill base and airstrip, roads and other airstrips have greatly modified parts of the Training Area. Prior to military use the Training Area had a history of logging, grazing and mining. The dune fields were periodically subjected to fire disturbance. Given these aspects the boundaries of the Training Area are unlikely to coincide with an area of uniform value of ecological integrity.
- It is unclear why mining would have a significant impact on ecological integrity whereas military training and commercial fishing activities would not. If pursued in an unrestricted manner all three activities have the potential to fragment habitat and thereby affect the biodiversity and hence ecological integrity of the Training Area.
- There is insufficient knowledge to allow a rigorous assessment of the impact of mining on the ecological integrity of the Training Area. Similarly, further research would be necessary to determine how mining can be designed so as to minimise impacts on conservation values and integrity of ecosystems. There is the possibility that rehabilitation of minesites could reestablish the integrity of ecosystems that have already been degraded by military activity, weeds and feral animals.
- There is no proof that sand mining in the Training Area would fragment habitat to such an extent as to affect the biodiversity of the Training Area. At any one time the area disturbed by sand mining would be small. Also, by using knowledge gained in an Environmental Impact Statement, it could be possible to implement appropriate mine planning to leave the more environmentally sensitive habitats undisturbed and interconnected to provide biodiversity refuges for sites that are being rehabilitated. Fragmentation, therefore, is not necessarily an issue.
- While the Commission noted the potential damage trawling could have on seagrass beds in Port Clinton the concept of ecological integrity was not applied. Any mine that was contemplated would disturb an area only a fraction of that disturbed by trawling, and minesites are rehabilitated while trawl sites are left in a degraded state. Yet the expected net value from mining exceeds the gross value of trawling by orders of magnitude. ABARE, BRS and AGSO (1993) estimated the expected net present value of mining the main dune fields at around $233 million, whereas the annual net value of fishing in the Training Area was likely to be far less than $1 million.
- Mine rehabilitation could not restore the ecological integrity to its present condition in the majority of situations within the first decade. However, rehabilitation if carefully and scientifically undertaken could replicate the species composition of mined sites and over time the organisation of species and the site’s ecological processes could approximate the current ecological integrity of particular sites.

The diversity of the Training Area and the consequent variation in conservation values would suggest that the net gains from restricting other uses would vary across the Training Area. In restricting other uses there will be some forgone values (or opportunity costs) or increases in operational costs to other users in complying with conservation requirements. The Commission appears to have ignored such costs. Also, the value of an extra unit of a good is often lower than that for the last unit; likewise the value of conserving an additional hectare of an area will usually be less than that of the first. The decision whether to conserve particular areas should be based on comparison of the net benefit of conserving that area compared with other uses. It should not be assumed that conserving all of the Training Area is necessary to generate net benefits to Australia.
3.2 Opportunities for concurrent uses

Devoting the whole of the Training Area purely to conservation would severely limit other uses as few of the alternative uses are totally compatible with conservation. However, there are strategies which can be adopted to lessen the impact of other uses on conservation values. For instance, the Commission has recommended that the Army delineate further ‘no go’ areas in environmentally sensitive areas. In this case concurrent uses are accommodated on adjoining areas principally by setting aside corridors of environmentally sensitive areas with high conservation value. The concept of ecological integrity is important in the successful integration of multiple uses in this manner. In other instances, both conservation and another use may be possible on the same site if the other use has low impact on the environment, such as some scientific research and exploration. A third strategy is for sequential use of the Training Area by conservation and other uses. For example, a site may be used for military training or mining for a period, then rehabilitated and conserved.
4 Military training

4.1 Value

The Training Area has been managed by the Army as a Joint Defence Force training facility since 1965. The benefit to Australia of military training is difficult to quantify directly as it derives from its contribution to the existence of a credible and efficient defence force which reduces the risk of threats to Australia's sovereignty and enables Australia to fulfil international obligations such as peace keeping. The role of training is to maintain readiness and improve efficiency of the military force. The importance of Shoalwater Bay to that training function depends on both the usefulness of the Training Area to training needs and its cost relative to training alternatives.

The Training Area is used frequently for military training, about 70 per cent of the year (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 161, para. 9.12). However, this training facility is not a permanent base for troops, unlike several other training facilities in Australia. In addition, military training use is concentrated in the central and western sectors with very little use of the dune systems (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 18). Despite this the Department of Defence emphasises the benefit for training of the variation in landforms across the Training Area. The location of the Training Area offers other advantages in that no permission from surrounding communities is required before military training exercises and is sufficiently large to allow live firing. Several other military training areas also have these advantages (Bergin 1994).

As there are alternative sites (albeit not perfect substitutes) it is possible to estimate the value of the Training Area for military training indirectly by estimating the cost of acquiring and relocating the training facility to another site (that is, the opportunity cost). This opportunity cost should include any forgone value of the Training Area where the alternative site does not offer the same desirable characteristics. For example, an alternative site may involve higher transport costs to the military in moving troops for training. It is important in this analysis not to overlook the value from any new use of the Training Area in the absence of the military, plus any change in value for existing uses such as fishing and conservation.

The Commission noted that based on estimates of the Department of Defence and a commissioned study by James (1994), relocating the military training facility and achieving similar training results elsewhere over a 26 year period may have a net present cost of between $180 million and $268 million (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 122, para. 7.25). However, the Department of Defence has overestimated the cost, as indicated by ABARE estimates provided to the Commission, mainly because the cost of purchasing land for a new training area is included but the sales revenue for selling the Training Area is not included. Given the estimated land value of $120 million (Auditor General 1992) the above cost range should be reduced to between $60 million and $148 million. Before these estimates were made available, ABARE, BRS and AGSO (1993) concluded that there was a strong case for retaining the Training...
Area while there is demand for its training facilities, because of the various aspects of dislocation, the costs and difficulties in acquiring another suitable site and the cost of establishing new training facilities. Bergin (1994) in reviewing the Department of Defence’s submission found that the Training Area is a substantial asset for military training, but not essential. He also concluded that in the future the use and importance of the Training Area for military training is likely to decline because of the shift in focus to training in the north end of Australia.

4.2 Impact on other uses

The overriding effect of military training on other uses is to restrict access to the Training Area. This has tended to maintain some conservation values in the Training Area. The direct effects of military use on conservation values varies greatly across the Training Area — from some almost untouched pockets in the mainland hills and mountains to the target ranges on Townshend Island. This island bombing range is in a World Heritage area. In addition, the location of infrastructure such as airstrips, roads, camps, target ranges and the maintenance of cleared zones would have reduced any conservation value those sites may have possessed.

Although the Commission found that most local residents believed the Army to be managing the Training Area effectively for conservation, it noted ‘...most parties have little or no information as to how the Area is managed’ (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 98, para. 4.25). Conversely, the Commission noted several concerns about the Army’s conservation management, principally the lack of effective feral animal and weed control measures, controlled burning which could reduce the biodiversity of the Training Area, and the need to redefine ‘no go’ areas (Hynes 1993; Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, paras. 9.39–55). The Commission recommended that the Army produce a strategic plan specifically to address these problems and to increase the size and policing of ‘no go’ areas containing environmentally sensitive sites.

4.3 Opportunities for concurrent uses

The Commission’s recommended land use option is equal use for military training and conservation. The recommended composition of the Management Advisory Committee with six conservationists and only one defence representative could result in a much heavier emphasis on conservation practices in the Training Area. The Commission did find that the Army could greatly improve some of its resource management practices as outlined above. With the recommended changes in management practices the Commission found military training and conservation could be concurrent uses of the Training Area.

Similarly, as discussed in the following section, some changes in management are necessary to enable concurrent use for military training and water supply of the catchment area in the southern sector of the Training Area. Such requirements are likely to impose additional costs to the military in managing the Training Area and in conducting training exercises.

As mentioned above the major impact of military use of the Training Area on other uses is to restrict access. There appear to have been no major problems with this practice in the past with fishing, recreation and tourism. Similar practices could be entered into with other potential users such as miners and Aborigines.
5 Water catchment

5.1 Value

About half of the water catchment for Livingstone Shire lies within the Training Area. This is the only water supply for the Capricorn Coast region and as such represents a significant regional asset. Any use of the Training Area which reduced the quantity or quality of this water supply would impose costs on local residents. Not surprisingly, the community attitude survey by the Commission’s consultants (AGB McNair 1994) indicated that the residents valued the water and would tolerate no activities which would pose any risk whatsoever to their water supply. This was the main reason underlying the community’s strong opposition to mining.

In this context it is important not to confuse attitudes with values, as mentioned above. It is evident that the local residents place some value on their water supply but the community attitude survey cannot indicate the magnitude of the value of that supply. It is also worth noting that only two of the five mining leases in the Training Area could possibly affect the water supply. The other three leases and potential sand mining sites on Clinton Lowland are totally unconnected with the Livingstone Shire water catchment area.

In deciding on the optimal use of the existing water catchment zone in the Training Area any alternative supply needs to be considered — its nature in terms of quality, quantity and overall cost (that is the opportunity cost). One indicator of the value of this water supply is provided by the cost of replacing the present water supply, which was estimated to be $20.9 million by the Livingstone Shire Council. In recommending that no adverse activity be permitted in the water catchment zone the Commission assigned infinite value to the water supply for Livingstone Shire residents. Water supply for Livingstone Shire is important. However, it is not of infinite importance. It is no more important than water supply to similar populations elsewhere in Australia. Reasonable estimates of the values which Australians place on domestic water supplies can be deduced by the behaviour of people in the increasing number of urban and rural areas where water is paid for on the basis of individual usage. That behaviour indicates not that people value water supplies so highly that they will brook ‘no risk’ to supplies, but that they are quite sensitive to the price of water.

The Commission did not recommend that Livingstone Shire residents should pay increased water charges to reflect this value or to compensate the rest of Australia for income forgone from barring other uses of this Commonwealth land. Based on the value which other Australians place on water supplies, the amount that the Shire’s residents would be willing to pay may be small. Whether or not water supply is an issue depends on that value and on the likelihood of there being a significant mineral deposit in the relatively small area containing parts of Pivot Mining’s leases 1 and 2 which may impinge on the water supply (see map).

5.2 Opportunities for concurrent uses

Any human activity in a water catchment area poses some risk to water supply. Land
use decisions for such areas need to consider not only the net benefits from alternative uses as well as water supply but also the level of risk each use poses for the water supply.

At one extreme, conservation is totally compatible with water catchment. Mining is often seen to represent the other extreme. However, there are precedents of mining being conducted in water catchment areas without major problems of pollution or diminution of the water supply; for example, mineral sand mining at Tomago, New South Wales and coal mining in the water catchment area for Sydney. Perhaps the most striking example is the mining of bauxite by Alcoa in the water catchment for Perth, which because of its topography, climate and growth has placed considerable emphasis on water supply and quality issues. Alcoa has won awards for the excellence of its environmental work, including the prestigious Global 500 award from the United Nations. Although the issue in the Perth catchment area was different to the Training Area the example shows the very real possibility of successful concurrent use of an area for water catchment and mining.

An Army training camp base, including latrines, is located in the water catchment area. While such infrastructure remains in the water catchment area there is a risk of contaminating the water supply. Also, there is the risk of accidental spillages from military operations. In view of this, the Commission recommended that Defence facilities and activities ‘... should be assessed to ensure that they pose no risk to the quality or quantity of the water supply. No activity which places the water supply at risk should be permitted’ (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 41).

Given the concerns about the effect of sand mining on the water supply for the Livingstone Shire the Commission engaged Townley and Flemming of CSIRO to examine this issue in detail. The conclusion of that study (Townley and Flemming 1993) was that sand mining in the leases held by Pivot Mining was unlikely to have any more than minimal effects on the water supply. However, it was recommended that further research on hydrology and on the location of any acid sulphate soils surrounding any proposed mine should be conducted before the establishment of such a mine.

In ABARE, BRS and AGSO (1993) an estimate is provided of the additional cost to Livingstone Shire of a reduction in baseflow into Waterpark Creek. It is estimated that the cost of a 10 per cent reduction in baseflow would impose a cost with a present value of $400 000. As well as these costs there could be a reduction of water quality which would cause additional costs through increased treatment of water. The choice of 10 per cent appears pessimistic in the light of Townley and Flemming’s study. A reduction in baseflow would mean that the Shire would need to bring forward its capital works program or introduce a unit charge for water to discourage water use.
6 Mining

6.1 Value of mineral deposits in the Training Area

Prior to the Army acquiring the Training Area in 1965 there was some exploration and mining activity, such as shallow underground mining of gold. Available data indicate that heavy mineral sands are widespread in the extensive sand masses of the Area. While there is a reasonably high prospect of other mineral deposits (such as gold) in the Training Area there are insufficient data to assess the commercial viability of mining any such deposits. Further exploration would be required to ascertain the extent of mineral sands and heavy mineral deposits in the Training Area and the likelihood of mining being viable.

Sand mining is very likely to generate benefits to Australia. ABARE, AGSO and BRS (1993) estimated that there is a 64 per cent chance that a risk neutral producer would begin mining the main dune region and the operation would produce an expected net present value of $233 million. Insufficient information was available to ABARE, AGSO and BRS (1993) to enable a complete analysis of mining of Clinton Lowland, although, based on available information and assumed grades for a heavy mineral deposit, it appears highly likely that mining would yield a positive net present value.

On the basis of further confidential data James (1994), a consultant to the Commission, concluded that mining in Clinton Lowland was likely to be commercially attractive and offered positive net benefits. Other evidence, based on various modelling approaches, presented to the Commission tends to confirm the view that mineral sands mining is likely to offer benefit to Australia but these estimates vary widely (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 130).

The Commission ignored such evidence as ‘... the characteristics of the resource have not been verified’ (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 33). However, it recommended no further exploration. The presence of a commercially viable mineral sands resource in the Training Area has yet to be established and requires further exploration. The implementation of this recommendation would deny essential information to decision makers in assessing the net benefit of alternative uses of the Training Area.

The question of mining in other regions of the Training Area was not addressed in the Commission's report. It is possible that substantial deposits of other minerals exist in the Area. Given the diversity of the Training Area the effects of mining a deposit on other uses could vary greatly between sites and with mining techniques. For instance, little or no conservation value would be lost by locating a mine in the already cleared areas. This fact was ignored by the Commission which recommended that mining be banned because of ‘strong local opposition’ and the need to maintain the ecological integrity of the Area.

As discussed above, the validity of these reasons are questionable and do not provide sufficient evidence to ban mining across the whole Area. Such a ban would only be justified if the likely net benefit from all possible mining in any part of the Shoalwater Bay Military Training Area...
Training Area were to be less than any other use which was incompatible with mining.

6.2 Impact on other uses

The sand mining industry is an acknowledged international leader in minesite rehabilitation. It is possible to reconstruct the environment reasonably closely after mining is completed, although it may not be possible to replicate exactly the existing dunes in terms of gradient.

Aspects which may be lost are the microdiversity and internal stratigraphy of the mined area. However, if these features have particular value it may be possible to set aside certain areas for conservation. ABARE, BRS and AGSO (1993) estimate that 10–30 per cent of the dune area may contain commercially viable mineral sands deposits. Thus, much of the area would be undisturbed by mining.

In terms of wilderness or amenity values mining is incompatible, yet there is the possibility of sequential use after successful minesite rehabilitation. For instance, several areas previously mined for mineral sands are listed or intended for listing in the Register of the National Estate (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 199, para. 10.114).

The Department of Defence has noted that any mining activity would impose costs on the military, but appears to have somewhat overstated the cost (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 19). As military use of the eastern dune fields is low, sand mining in those areas would have little impact on the design and undertaking of exercises. With concurrent use, the expected net benefit of mining after allowing for the costs to military training operations, as estimated by the Department of Defence, could be between $190 million and $230 million (based on ABARE estimates).

The fishing industry was concerned at the possible effect of sand mining on the pattern of freshwater flow and its effect on fish nursery beds. However, Townley and Flemming (1993) concluded that sand mining in the eastern dune fields would not significantly affect groundwater flows to the coast. It is noteworthy that neither the local fishermen nor the Commission seem concerned that Livingstone Shire’s water extractions from Waterpark creek would disturb the balance of Corio Bay to the south of the Training Area.

Spillage from barges was held by some to be a major risk to seagrass beds. However, such spillage seems extremely unlikely given the record at other sand mining sites such as North Stradbroke Island (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 196, para. 10.96). In fact, natural damage from periodic cyclones is perhaps more likely than damage from spillage.

Mining could destroy archaeological sites, but the use of an Aboriginal adviser to locate and recognise archaeological sites of particular value could significantly reduce such risk and is a common practice in the mining industry.

The earth sciences value of the Training Area could be lowered by mining which destroys the geological structure of the minesite. However, it would be possible to set aside areas for scientific research. In addition, there is an opportunity for scientific research to gain from knowledge gleaned during mineral exploration and mining. Similarly, local knowledge of flora and fauna is often enhanced by surveys conducted for environmental impact studies (see, for example, material in GEOPEKO 1992).

The only effect of mining on recreational and tourist use is to restrict access to that site and to lower the visual amenity value for some people. Given that most recreational and tourist use is confined to the marine zone it is quite likely that the minesite would not be visible to many users and hence not affect visual amenity value.
6.3 Evaluation of impacts of mining and exploration

In evaluating alternative land uses of the Training Area the Commission made use of the following scenarios:
A Status Quo;
B Exploration and sand mining on Clinton Lowland;
C Exploration and mineral sand mining over Pivot Mining NL leases 1–5 and exploration in areas of interest to RZM Pty Ltd; and
D Reservation of the Area for nature conservation.

Aspects of the Commission’s evaluation of Scenario B (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, pp. 296–308) are inadequate and misleading. For example, the harmful effects of exploration on Clinton Lowland are overstated by the Commission as it states that ‘... Increased exploration activity will result in more widespread disturbance to vegetation and will cause increased erosion ... Exploration activities have a high potential to increase the risk of fire. The establishment of tracks associated with exploration provides a mechanism for increased uncontrolled access to the Area. Uncontrolled access has the potential to increase disturbance through introduction of pests, in particular weeds, and fire’ (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 302, para. A.128).

As pointed out in ABARE et al. (1993) adverse effects on vegetation can be kept to a low level of impact, provided appropriate care is taken during the exploration program. Past experience has shown that it takes only a few years for vegetation to regrow over disturbed areas. Apparently the Commission did not use this information. The risk of fire from exploration, given appropriate precautions, should not exceed the fire risk of other activities considered to be acceptable for the Training Area, such as military exercises. The impact of continuing use of tracks after the exploration program should be negated by the fact that Clinton Lowland is already isolated from the mainland by seawater, mangroves and swamps; and access to the area is restricted by the Army. Any tracks resulting from exploration activities would be overgrown in a few years. It is noted in the report itself (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 303, para. A.141) that continued restriction of public access to the Training Area and a relatively low level of tourism and recreation use are envisaged under this scenario, suggesting that uncontrolled access is not likely to eventuate in the Training Area.

The Commission noted that exploration and mining of Clinton Lowland was incompatible with the Lowland’s high wilderness values (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, paras. A.128 and A.134). The validity of the assessments of wilderness values used in the Commission’s report are discussed in section 2 above. Much of the land indicated as having high wilderness value has anthropogenic impacts and changes, including feral animals, aircraft presence and military training activities that diminish wilderness values.

The risk of fire and the introduction of species in a closely controlled mining operation should not exceed the risk of similar hazards associated with military exercises carried out in the Training Area. While the Commission noted that mining will create potential for increased fire and introduced species (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, para. A.129), it seemed to overstate the risks associated with mining compared with risks arising from some other uses of the Training Area.

The Commission believed that mining would result in the permanent loss of much of Clinton Lowland’s earth science values — potentially important records of past climate and dune building processes.
An exploration program is essential to establish whether a heavy mineral sands resource is present and whether mining is justified. Similarly, further scientific information may need to be collected to ascertain the earth science values. Only after such research would it be possible to weigh the value of such a mineral resource (if any) against the value of the Lowland’s earth science values. Furthermore, a mine plan could cater for heritage values so as to minimise impacts, such as avoiding any disturbance to sites of particular significance.

Clinton Lowland could be explored for minerals without compromising the National Estate values and ecological integrity of the Training Area. This was clearly pointed out in ABARE et al. (1993, pp. 89–90) in the discussion of exploration impacts on conservation values; however, there is no reference to this discussion in the Commission’s considerations (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 184, para. 10.28). Appropriate management and minesite planning could be implemented to minimise impact on recognised values of Clinton Lowland. Rehabilitation could be undertaken to restore the environment to almost the equivalent of unmined lands.

The Commission appeared not to have undertaken a geographical analysis of the national estate values of the Training Area to determine the likely extent of impact on national estate values, particularly in respect of Clinton Lowland. The Commission saw the Lowland as an integral part of the Training Area and the effects of activities on the Lowland were not considered in isolation from the Area as a whole. The Commission’s view was that the Lowland contributed to and was part of the Training Area’s values at all levels and therefore any effect on the values of the Lowland would also potentially seriously diminish the values and ecological integrity of the Training Area as a whole (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 256, para. 16.81). Such a conclusion was made without the Commission undertaking a justifiable or rigorous evaluation of the Lowland’s contribution to the Training Area’s heritage values and environmental quality and how exploration and mining would impact on such values.

Before the Commission’s inquiry, Clinton Lowland was not recognised for having the following heritage values: unusual richness or diversity of flora and fauna; wilderness attributes; understanding of the history of human occupation; importance to the community for aesthetic characteristics; demonstration of range of landscapes, environments or ecosystems, and complexity of vegetation pattern. Evidence in the report does not indicate that such values are now true for the Lowland. Indications are that such values would not be applicable to the Lowland although, apart from wilderness, they are recognisable values for other parts of the Training Area. National Estate values for Clinton Lowland that can be recognised (GEOPEKO 1992: Annexure A, Attachment B and Annexure E) are:

- that this is the only place within the Training Area where parallel beach ridges occur and thus it is an important component of the high landform diversity and geomorphological research significance of the national estate listing;
- the major occurrence of wet heath (sedgelands) including wallum and several species at or near their known distributional limits;
- the presence of Aboriginal archaeological sites; and
- the presence of the Eastern Curlew (Numenius madagascariensis) on mudflats that border the Lowland.

The Commission stated (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 302, para. A.133) that it was possible that the noise from
mining operations would have an adverse effect on waders and shorebirds. Military exercises involving low level bombing runs by aircraft also involve high noise levels, probably much higher than those in a mining operation, yet military training activity was considered to be an accepted land use in the Training Area.

As pointed out in the Commission's report the critical and yet unanswerable question is whether the mineral resources in parts of the Lowland are significant and the extent and value of those deposits if they were mined. However, '... only a detailed program of exploration, assessment and feasibility analysis can determine whether mining might actually be undertaken' (Commonwealth Commission of Inquiry into Shoalwater Bay 1994b, p. 304, para. A.142). The Commission acknowledged (in paras. A.143, A.146 and A.147) that exploration is essential to assess the various economic objectives associated with a mining operation on Clinton Lowland. Quantification of the economic values is a missing key element of a balanced assessment of the values of the Training Area. Proper comparative assessment of the Training Area's values is a requirement for a decision regarding the appropriate land use that reflects the national interest.

Exploration is necessary to establish the presence, location and characteristics of the mineral resource so that the value, extent and relative impact of mining can be based on firm data.

6.4 Opportunities for concurrent uses

The Commission's recommendations appear to be based on the premise that mining is incompatible with all other uses. This may be true if neither miners nor other potential users are willing to adopt practices consistent with multiple use. However, it is often feasible to alter the use and management of an area to accommodate more than one use. Mining is not undertaken in an unrestricted fashion in Australia, as there is usually a requirement by government and a commitment by the miner to instigate practices to minimise environmental damage and to rehabilitate the minesite.

In contrast to its consideration of other uses, the Commission did not fully explore possibilities for the compatibility of mining and other uses, and dismissed options for minimising, and in some cases overcoming, potential adverse impacts of mining on other uses. For instance, the Commission gave little consideration to the possibility of setting aside highly sensitive areas in order to retain sites with high conservation value while mining other sites. Recommendations of this nature are made in relation to military training through the recommended extension to 'no go' areas.

As discussed in section 5, sand mining is unlikely to affect the water supply although further research would be advisable before mining proceeds in parts of the catchment area. Pivot indicated its willingness to forgo mining at sites which could pose a threat to the water supply (Commonwealth Commission of Inquiry into Shoalwater Bay 1994a, p. 183, para. 10.20). Under such circumstances the two uses can be considered compatible concurrent uses.
7 Other potential uses

7.1 Aboriginal use

The eastern dune fields of the Training Area contain some archaeological sites of interest to a local Aboriginal group. The Commissioners found that access to such sites for Aborigines could be accommodated with concurrent use for military training and conservation, but that it would be necessary to bar access during actual military exercises. However, if such archaeological sites are to be preserved it would be necessary to restrict access to them.

The exact number, location and characteristics of Aboriginal archaeological sites in the Training Area is unknown, and therefore it is not possible at this stage to determine their value.

As with other uses of the Training Area the decision about whether to preserve a particular Aboriginal archaeological site should be based on the net benefit of preserving that site compared with that of other uses which are incompatible, such as military training, recreational use or mining.

The potential impact of other uses on Aboriginal values is uncertain. Some protective measures would be required if recreational and tourist use on the eastern dune fields was to grow substantially. It is also possible that military training and mining could have an adverse impact if sufficient care were not taken.

To guard against damage from such sources it would be necessary to instigate certain strategies, perhaps including the employment of a local Aborigine to advise on the location and recognition of archaeological sites.

7.2 Recreation and tourism

There is currently only minor use of the Training Area for recreation or tourism, mainly in the marine zone. Both these uses have probably been discouraged by the difficulty of access due to military training needs and lack of roads.

While current levels of recreation and tourism may not pose a serious threat to conservation values, Aboriginal sites or other uses of the Training Area, this may not be the case in the future. Substantial growth of tourist and recreational use of marine zones could have adverse impacts on fishing either directly or through their effect on the fish population. If either or both uses were to increase it would be beneficial to subject recreation and tourism to controls designed to minimise impacts on other valuable uses of the Training Area.

7.3 Scientific research and education

Given the diversity of flora, fauna and landforms, the Training Area holds value for scientific research. Further scientific value derives from the Area being the geographic extremity of some species and from its unusual associations of land and flora.

Scientific research would have little if any impact on other uses of the Training Area. However, other uses have the potential to affect the Area's value for scientific use. There is potential for scientific research to gain from knowledge gleaned during mineral exploration and mining. Conversely, mining could detract from earth science values by upsetting the...
geological structure of a site. Such a loss could be avoided by not allowing mining at sites of particular scientific value. Other commercial uses which alter the nature of the Training Area also have the potential to detract from scientific values.

7.4 Fishing

Commercial fishing in the Training Area is small. Even the larger area defined in ABARE, BRS and AGSO (1993, p. 113) constitutes less than one per cent of total Queensland fisheries production. There are insufficient data available to assess the sustainability of the fishery or the profitability of fishing in the Training Area. Although a fisheries resource exists in the Training Area, access is restricted by military training safety requirements. Given continuing use of the Training Area for defence purposes substantial growth of commercial fishing in the Training Area is unlikely while there are other more accessible fisheries. If fishing activity were to increase research would be needed to assess the sustainability of the fishery and assist in designing management plans.


Pearce, D.W. and Warford, J.J. 1993, World Without End, Economics, Environment and

Shoalwater Bay

The Shoalwater Bay Training Area is a military training facility. Research has indicated the Training Area also has value for conservation and water supply and is highly prospective for minerals. The Commission has recommended that mining and exploration be banned from the Training Area.

In this report the available information is drawn together in a multiple resource use framework to examine the validity of the Commission’s recommended use of the Training Area.