Science and Management at Edmonson Point Wood Bay, Victoria Land, Ross Sea: Report on the Workshop held in Siena, Italy, 15 April 2003

Prepared for

Programma Nazionale di Ricerche in Antartide

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by

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with Science Reviews by

R. Bargagli, N. Cannone & M Guglielmin, S. Focardi

8 June 2003

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Cover Photo: Edmonson Point in foreground and Mount Melbourne, from the air, looking west.

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Prof Roberto Bargagli (Università di Siena), Prof Riccardo Cattaneo-Vietti (Università di Genova) and Prof David Walton (British Antarctic Survey) were responsible for initial inception of the proposal, with additional support from members of BIOTEX-1 and the Adélie Penguin Monitoring Programme; ICAIR and more recently Gateway Antarctica (University of Canterbury, Christchurch; Bryan Storey, Michelle Rogan-Finnemore and Paul Bealing) assisted PNRA in moving the initial proposal to the next stage;

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C. Harris
S. Grant

1.0 Introduction

Edmonson Point (74°20' S, 165°08' W) is located in Wood Bay, Victoria Land, Ross Sea, at the foot of the eastern slopes of Mount Melbourne, about 50 km NE of Terra Nova Bay Station (Italy) (Figure 1). At almost two km^2, Edmonson Point is one of the largest of the few low-lying coastal ice-free areas in Northern Victoria Land.

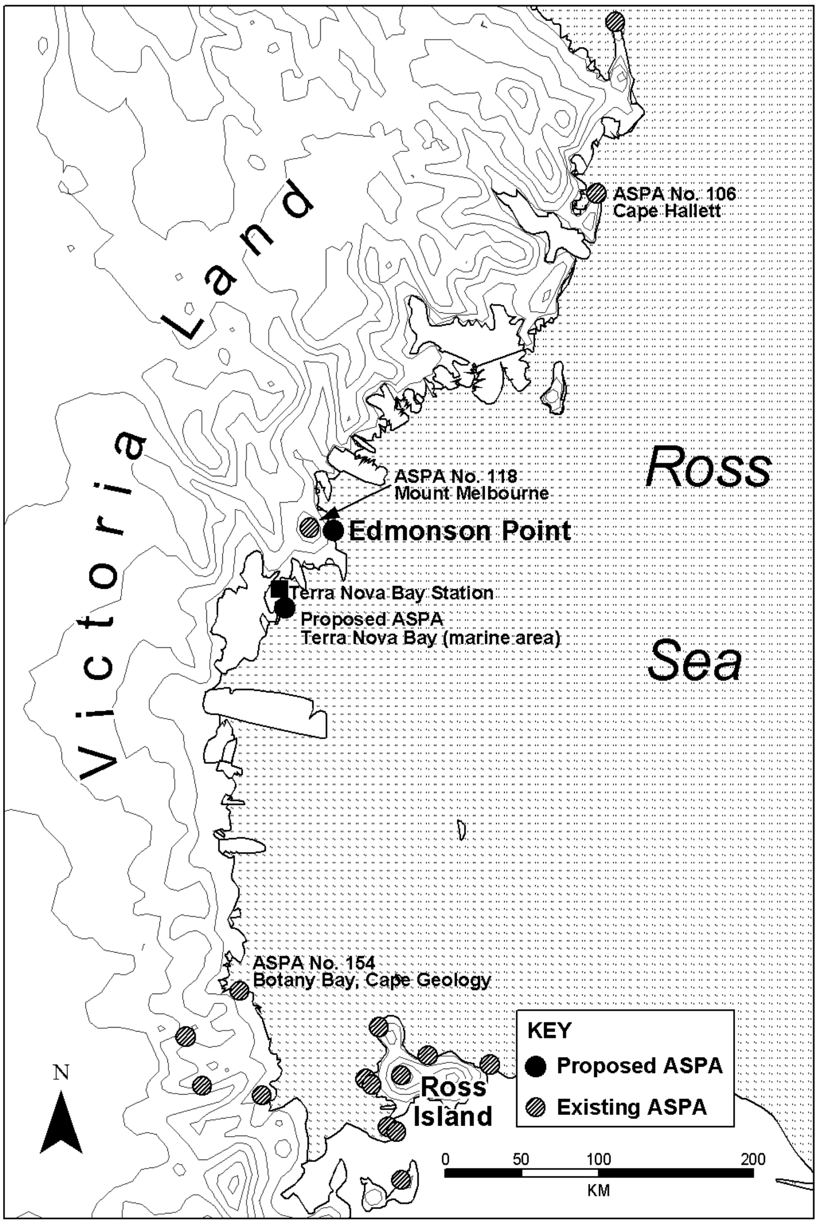

Figure 1. Location map of Edmonson Point, Victoria Land, and protected areas in the region (only the closest sites to Edmonson Point are shown by name).

Edmonson Point was first identified in the 1980s as a site that could merit special protection, principally because of its rich vegetation (Keys *et al.* 1988). Italy established a station in close proximity at Terra Nova Bay in 1986-87 and increased research interest in the site followed. A variety of scientific projects have been initiated, many of which are long-term with international involvement. For example, Edmonson Point was an important site for the SCAR Biological Investigations of Terrestrial Antarctic Systems (BIOTAS) programme in 1995-96, which involved collaborative research among a variety of countries on the BIOTEX-1 Expedition. There is important long-term research being conducted on bird colonies at Edmonson Point by Italian and Australian scientists. In addition, studies are being conducted on the geology, glacial geomorphology, freshwater ecosystems and on background contamination.

Given the variety of multi-disciplinary studies being conducted, and the sensitivity of certain features to disturbance, without more specific management guidance there is a risk that significant scientific and ecological values found at the site could be compromised. Edmonson Point is also potentially of interest to tourist parties because of the variety of interesting features present. A management plan would help to avoid unregulated visits and to provide more specific guidance to visitors so that risks can be minimised and the values of the site can be maintained long-term.

The process to draw up a management plan began in 1993-94, initially through the efforts of Prof. Roberto Bargagli, Università di Siena, Prof Riccardo Cattaneo-Vietti, Università di Genova, and Prof David Walton of the British Antarctic Survey (then Convenor of the SCAR Group of Specialist on Environmental Affairs and Conservation). The effort was supported by PNRA through a contract to prepare a detailed digital orthophoto for the site, which was also needed to support the scientific studies, particularly those on the terrestrial ecosystem. Subsequently, a draft management plan was prepared by the International Centre for Antarctic Information and Research and Gateway Antarctica (Christchurch) as a basis for discussion of management options. A wide range of scientists participated in these early stages of plan development. A hiatus in moving the process forward followed, until the initiative was restarted by PNRA in 2002-03 with a view to drawing plan development to a conclusion.

An important new step in 2002 was the decision to convene a small workshop in Italy to bring together scientists working at Edmonson Point from a variety of disciplines to discuss the proposal for the protected area. Given the multi-disciplinary context, it was considered important to provide scientists with the opportunity to discuss the reasons for special protection and to exchange views on regulations that might be proposed, which have the potential to influence how science and support is carried out at the site. More active engagement of the science community in the plan development process was considered an important objective of the workshop, and will provide a stronger basis for development of future plan drafts.

The workshop, hosted by the Dipartimento di Scienze Ambientali, Università di Siena, on 15 April 2003, had three principal objectives:

1. Review the latest scientific results from research at Edmonson Point;
2. Appraise the values in need of special protection;
3. Develop policies to regulate activities and to ensure the protection of values.

The first objective was accomplished through presentations made by Prof Roberto Bargagli (Terrestrial and freshwater ecology), Dr Nicoletta Cannone (Vegetation and permafrost), Prof Silvano Focardi (Seabirds and mammals), and Prof. Carlo Baroni (Geology and glacial geomorphology). Summaries of these presentations (with the exception of the last) in Section 2 of this report offer an overview of the science being conducted at Edmonson Point.

The second objective was met by dividing the workshop into two groups, roughly along disciplinary lines, to make a systematic evaluation using a 'Values Appraisal Matrix' (see Table 1) which had been developed and circulated to participants prior to the workshop. The method and results of this appraisal are presented in Section 3 of this report.

The third objective was achieved through workshop discussion of key management issues, including the aims and objectives of the plan, options for boundaries, mapping needs, helicopter access issues, campsites and structures. Time allowed for discussion of the most important issues and policies, but it was not possible in the workshop to finalise a precise text for the plan. For this reason, there is a need to draft text on policies based on comments made, and to circulate the result to participants for further comment / feedback. Key outcomes from the Workshop discussions and possible management policy options for further discussion are presented in Section 4 of this report.

This report summarises the important points arising from Workshop discussions, including the science reviews, the appraisal of values, and the discussion of management options. In addition, the remaining steps necessary to bring the plan to completion and the process by which this may be achieved are identified in the conclusion.

2.0 Science reviews

2.1 The value of terrestrial and freshwater ecosystems at Edmonson Point for long-term studies on climatic and environmental changes. R. Bargagli (Dipartimento di Scienze Ambientali, Università di Siena)

Edmonson Point comprises hills, knolls and moraines of volcanic materials (scoria, pumice, tuff and lavas), separated by small valleys with ephemeral streams and ponds, and a few larger lakes. A colony of Adélie penguins, nesting skuas and some abandoned penguin rookeries determine a patchy distribution of nutrients in terrestrial and freshwater ecosystems. The ground is generally dark in colour, which encourages rapid snow-melt in spring. Thus, in summer, most of the area is extremely dry and the ground is covered by salt encrustations, except below late snow beds, near stream and pool margins and in flood flats. Most streams and pools are transient. However, some long-lying snow deposits and the inland glacier margins can supply water to the larger streams and lakes for about two months (usually from the beginning of December to the end of January). Some shallow lakes are free of ice cover for two or three months in summer, but deeper lakes are permanently frozen and are supplied by groundwater or by the inflow of surface waters, which often create moats along shorelines.

Communities of algae (Cyanophyta, Crysophyta and Chlorophyta – about 120 species of algae have been identified at the site (Cavacini, pers comm. 2003 [eds])) develop on wet ground, in streams and in lakes. Mosses (5 species) may form large stands in depressions, flood flats and along the margins of melt-water streams. On the other hand, communities of saxicolous lichens (about 30 species) are not as well-developed, and differ from, those occurring in other ice-free areas of Wood Bay owing to the cleavage of volcanic rocks (e.g. as compared with Harrow Peaks and Kay Island). In spite of the low biomass and diversity of lichens, as well as the occurrence of highly 'common' species of Antarctic terrestrial and freshwater organisms, Edmonson Point constitutes an important 'natural laboratory' in Northern Victoria Land for long-term studies on ecosystem responses to climate change.

There are several main reasons for investigating this area:

- The wide range of terrestrial and freshwater ecosystems is variably affected during spring and summer by water and nutrient availability. This allows investigation of: a) differences in the species richness and/or functional diversity along moisture and nutrient gradients; b) relationships between richness/diversity and environmental factors; c) phenotypic plasticity or ecotypic variations within key species, and along gradients.
- Unequivocal evidence for climate warming is not provided by the relatively short period over which data have been gathered. However, gradients on water and nutrient availability provide useful analogues for potential future environmental changes (e.g. enhanced atmospheric precipitation, melting of ice and permafrost, leaching and drainage processes in dry and saline soils, changes in magnitude and timing of stream discharge, biogeochemical processes, survival and colonization of cryptogams).
- Scientists from Italy, New Zealand, Australia, the United Kingdom and the United States have undertaken a wide range of geological, glaciological, hydrological, botanical, zoological, and ecological studies at Edmonson Point over the past 20 years. The Adélie Penguin Monitoring Program and additional ornithological research has been carried out since 1994/95. In 1995/96, Edmonson Point was

the selected for BIOTEX 1, the first SCAR biological expedition for the investigation of Antarctic terrestrial ecosystems. Several experimental sites for long-term research on birds, permafrost, and terrestrial and freshwater ecosystems have been established. Based on data collected in the past, some environmental changes due to local or regional warming are now evident at Edmonson Point. For example, there has been a considerable drop in the water levels and rises in SO_4^{2-} concentrations in some lakes, probably as a result of enhanced evaporation, changes in permafrost depth, and alterations to drainage processes within catchment areas. Because lacustrine ecosystems behave as short- and long-term integrators of biogeochemical processes in the watershed, lakes (with/without perennial ice cover) at Edmonson Point are probably among the most reliable early warning indicators of climate and environmental changes in Northern Victoria Land.

2.2 Edmonson Point: a key area for monitoring climate change through the sensitive permafrost soil and vegetation system. N. Cannone (Milano Bicocca University) and M. Guglielmin (Varese Insubria University)

The environmental system comprising permafrost soils and associated vegetation is a useful and sensitive indicator for monitoring climate change effects, as has been demonstrated in Maritime Antarctica (Cannone *et al*., 2001; Cannone & Guglielmin, 2003; Cannone *et al*., in prep). Both vegetation and permafrost are subject to the same climatic inputs; in addition, the type and extent of vegetation cover has an important influence on the ground thermal regime (GTR) and, hence, on the aggradation or degradation of permafrost.

The influence of vegetation on the ground thermal regime has now been demonstrated also in Continental Antarctica. During the XVII and the XVIII Italian Antarctic Expeditions, ground temperature at different depths has been measured at different sites in Victoria Land exhibiting a gradient of environmental conditions. At each site, sensors to measure the magnitude of buffering effect on the GTR have been installed. A range of different environments / vegetation communities have been included: bare ground, bare ground with crustose lichens (*Buellia frigida*), communities dominated by macrolichens (*Usnea antarctica*, *Usnea sphacelata, Umbilicaria decussata*), and moss communities (*Bryum argenteum*, *Ceratodon purpureus*, *Syntrichia princeps*).

Moss communities, especially those dominated by *Bryum argenteum* and *Ceratodon purpureus*, exert a major buffering effect on the GTR compared to other vegetation types and to bare ground. The ranges of temperature values and the amplitude of changes with respect to the input of air temperature are reduced. This effect has also been clearly observed at Edmonson Point. This site provides unusual and very important environmental conditions, being characterised by the occurrence of moss stands on broad surfaces and by a thick the moss layer 5 cm, with accumulation of organic matter. The moss vegetation is composed by the following main communities dominated, respectively, by *Bryum argenteum*, *Bryum pseudotriquetrum*, and *Ceratodon purpureus*, associated to Cyanobacteria. These hydric communities are sensitive to changes in the hydrology of the ground and therefore are highly susceptible of rapid and significant degradation. In many sites through Continental Antarctica significant trends of regression have affected moss communities in the last decade (Melick & Seppelt, 1997).

In addition, climatic warming could increase thickness of the active layer and lead to changes of ground hydrology. These processes may affect the moss communities, in particular the hydric species, such as *Bryum argenteum*, *Bryum pseudotriquetrum*, *Ceratodon purpureus*.

Edmonson Point represents a core site, both for its actual characteristics and for the potential modifications which could be observed there. For these reasons, Edmonson Point has been included in the monitoring network of the sensitive vegetation-permafrost system for the assessment of climate change effects. This system, comprising nine sites and 20 permanent plots, spread across 5° of latitude from Apostrophe Island to Granite Harbour, has been included in the spatial framework of the SCAR RiSCC (Regional Sensitivity of Antarctic Terrestrial and Lymnetic Ecosystems in response to Climate Change) Project.

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2.3 Marine birds and mammals at Edmonson Point. S. Focardi (Dipartimento di Scienze Ambientali, Università di Siena)

The availability of accessible ice-free ground and the local microclimate at Edmonson Point make it suitable for marine bird and mammal reproduction, in particular for Adélie penguins (*Pygoscelis adeliae*), south polar skuas (*Catharacta maccormicki*) and Weddell seals (*Leptonychotes weddellii*). The Edmonson Point coastline consists of relatively gently-sloping beach gravels and cobbles, beyond which lie a series of raised beaches and elevated hills. Fast ice at Edmonson Point is usually present up until late January, extending in Wood Bay from the Aviator Glacier tongue to the eastern side of Cape Washington.

Each year in late October, an estimated 50 female Weddell seals give birth and rear pups close to the shore (Olmastroni 2003, pers. comm.). Females use the fast ice as a nursery and a rearing area where they rest and leave pups unattended while feeding at sea. Long tide cracks adjacent to the shore are kept open by the seals and used as breathing holes and for access to the sea. After a few weeks, pups are taught to dive until they are able to feed for themselves. Large males are occasionally seen resting on the shore.

Adélie penguins nesting at Edmonson Point have been monitored since the 1994-95 austral summer (Franchi *et al.*, 1996). Studies on the ecology of the Adélie penguin breeding population started as a joint programme between the Italian National Antarctic Program (PNRA) and the Australian Antarctic Division. Monitoring studies were undertaken mainly to obtain data for the CCAMLR Ecosystem Monitoring Program (CEMP) on the behalf of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Research on the feeding ecology of the Adélie penguin was carried out to investigate how natural or man-made variations in the Antarctic ecosystem may influence the breeding success of this species. The Adélie penguin colony at Edmonson Point is located near the middle of the ice-free area and consists of approximately 2000 breeding pairs.

A range of methods have been used to provide detailed information on the movement of birds at sea in relation to the presence of sea ice, on the time adults spend at sea, and on the food brought to chicks (Olmastroni, 2002). The methods used have included analysis of satellite data on sea ice distribution, satellite tracking of foraging penguins, time-depth recording of dive patterns, visualisation of data using Geographical Information Systems (GIS), automated weighing systems, and individual identification and recording systems at the breeding colony (Clarke *et al.*, 1998; Olmastroni *et al.*, 1998; Olmastroni *et al.*, 2001a; Olmastroni *et al.*, 2001b). Studies on behavioural ecology related to sex strategies and sex allocation has also been carried out in recent years (Pilastro *et al.*, 2001).

A parallel study on the south polar skua (*Catharacta maccormicki*) has been carried out alongside the Adélie penguin monitoring programme. Particular attention has been focused on the effect of the presence of penguins on skua breeding performance (Pezzo *et al.*, 2001). The high ratio between skua breeding pairs to penguin breeding pairs, currently 1:20, has provided insights into the relationship between the two species. A positive effect on nesting skuas that hold territories which include access to penguin subcolonies was observed as compared to those that breed within territories without such access.

Long term research underway includes capture-recapture studies focused on describing population parameters and possible environmental influences on skua and penguin populations. Ecotoxicological studies have also been carried out in marine birds through non-destructive sampling methods. Levels of trace elements (Ancora *et al.*, 2002) and toxic and persistent contaminants (Corsolini *et al.*, 1999; Corsolini *et al.*, 2002; Corsolini *et al.*, 2003) measured so far do not seem to have significantly affected the ecosystem.

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2.4 Geology and glacial geomorphology at Edmonson Point. C. Baroni (Dipartimento Scienze della Terra, Università di Pisa)

A presentation on the geology and glacial geomorphology of Edmonson Point was made at the Workshop by by Prof Carlo Baroni. A written version of this presentation was not available at the time of completion of this report.

3.0 Values and reasons for special protection

Early in the Siena Workshop, Prof Carlo Baroni raised an important question. He asked, why should Edmonson Point be considered any more, or any less, deserving of special protection than a wide range of other sites in Victoria Land? There are already measures under the Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol) designed to protect the environment, and the question was further asked why these were not sufficient to ensure protection for Edmonson Point?

These questions are very pertinent, since they go to the heart of whether there is a justification for a protected area at Edmonson Point. If it cannot be clearly demonstrated that the values found at Edmonson Point are any different to other parts of Victoria Land, or any more outstanding, or are useful because they are representative, or are under greater human pressures, then perhaps the case for special protection would be weak. For a protected area to be justified, the values of importance at the site and the reasons why they need special protection need to be clearly articulated. It was towards answering these fundamental questions that the appraisal of Edmonson Point values was directed in the second session of the Workshop.

3.1 Brief background to the Antarctic protected area system

Before examining these points in more detail in the context of Edmonson Point, it is worth recalling the underlying rationale for protected areas in Antarctica, and the requirements that the Madrid Protocol places on Treaty Parties to develop the Antarctic protected area system. Very early in the history of the Antarctic Treaty System, it was recognised that certain sites within the Treaty region may possess attributes that are of exceptional scientific or ecological importance. These sites were considered of such value that their compromise would represent a significant loss to the Antarctic community, and indeed possibly to humanity. The Treaty Parties recognised that they had a special responsibility to ensure long-term protection of these particular features, and thus created the means to do so under the Agreed Measures for the Conservation of Antarctic Flora and Fauna (1964) through the designation of Specially Protected Areas (SPAs). This was the first recognition that some parts of Antarctica might require more explicit and more stringent management than is needed more generally throughout the region.

Over the next 25 years, additional categories of special protection were agreed by the Treaty Parties to cover values that lay outside of the terms of the SPA category. For example, the Site of Special Scientific Interest (SSSI) was introduced in 1975 to offer the means specifically to protect scientific sites or experiments from interference, even if the phenomena at the site were not in themselves considered ‘outstanding’. In 1989, recognising that SPAs were focused on biological values, the Specially Reserved Area was introduced to provide a means for specially protecting sites of outstanding geological, geomorphological or glaciological importance. By 1990 six categories of special protection and management had been agreed under the Antarctic Treaty System, and the Madrid Protocol was seen as a useful opportunity to rationalise and simplify the system.

The Madrid Protocol, agreed in 1991 and entering into force in 1998, designated Antarctica as a 'natural reserve devoted to peace and science', and provided the means for comprehensive protection of the Antarctic environment. However, it was never intended that the Protocol on its own would be sufficient to provide the level of site-specific guidance that might be needed at sites of exceptional value, or where the pressures of human activity were high. The tools to manage these more specific circumstances were provided in Annex V to the Madrid Protocol, which deals with the protection and management of special areas. Under Annex V, which entered into force on 24 May 2002, the old categories of protection and management were replaced by two new types of area:

- Antarctic Specially Protected Areas (ASPAs)
- Antarctic Specially Managed Areas (ASMAs)

A key difference between them is that ASPAs are intended primarily to protect outstanding values, while the ASMA is intended to manage activities where there are risks of mutual interference. Both types of area require management plans. Entry into an ASPA is prohibited except by a permit, while entry into an ASMA does not require a permit. When Annex V entered into force all SPAs and SSSIs previously designated were incorporated as ASPAs, and were renamed according to a 3-digit schema (ASPA 101, 102, 103, etc.).

Provisions for the designation of protected areas in Antarctica are also found under other instruments of the Antarctic Treaty System. For example, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) provides for Conservation Measures that allow for:

> *"the designation of the opening and closing of areas, regions or sub-regions for purposes of scientific study or conservation, including special areas for protection and scientific study"*
>
> [CCAMLR Article IX(2)(g)]

Several CCAMLR Ecosystem Monitoring Programme (CEMP) Sites receive special protection under CCAMLR. It should be mentioned that there are a number of other sites that contribute data to the CEMP, and which are considered part of the CEMP network but are not currently formally protected. Edmonson Point is one such site that presently falls into this category. In addition, there is also provision for designation of Seal Reserves under the Convention for the Conservation of Antarctic Seals. For more information on the Antarctic Protected Area system, please refer to http://www.era.gs/resources.

3.2 Criteria for the designation of Antarctic protected areas

Annex V sets out the criteria for designation of ASPAs, and gives examples of the types of values that should be considered. Specifically, Article 3.1 states that:

> *"Any area, including any marine area, may be designated as an Antarctic Specially Protected Area to protect* ***outstanding*** *environmental, scientific, historic, aesthetic or wilderness* ***values****, any combination of those values, or ongoing or planned scientific research."* [emphasis added]

The criteria require that, for a site to be considered, the values must in some way be 'outstanding', or it must be shown that there is ongoing or planned scientific research that is in need of special protection. In the following Article, Annex V is more explicit about the obligations on Parties to the Antarctic Treaty with respect to developing a system of protected areas in Antarctica:

> "*Parties shall seek to identify, within a systematic environmental-geographical framework and to include in the series of Antarctic Specially Protected Areas*:"…
>
> (a) areas kept inviolate from human interference...
> (b) representative examples of major ecosystems...
> (c) important or unusual assemblages of species...
> (d) type localities or only known habitat of any species...
> (e) areas of particular scientific interest
> (f) examples geological, glaciological or geomorphological features
> (g) areas of outstanding aesthetic and wilderness value
> (h) sites or monuments of recognized historic value
> (i) such other areas as may be appropriate to protect the values set out in paragraph 1 above.
>
> [summarised from Annex V, Article 3.2]

It is of note that Article 3.2 contains the mandatory language "Parties shall seek to identify…": the elaboration of a system of protected areas in Antarctica is not an optional activity, but a requirement of the Madrid Protocol that places an obligation on Parties. It is also signalled that a systematic approach is required in order that the full range of values set out in the former Article can be represented within the protected area network.

The examples given in Article 3.2 illustrate the types of areas that should receive primary consideration. However, it is acknowledged in 3.2(i) that the list is not exhaustive where it states that 'such other areas as may be appropriate' can be included.

3.3 Protected areas designated under Annex V and Edmonson Point in context

It is important to put in context the scale of the areas under formal special protection in Antarctica. At the time of writing, there were 59 ASPAs (SPAs + SSSIs) and two CEMP sites formally designated within the Antarctic Treaty Area (south of 60°S). The total area of all of these sites combined represents approximately 0.0002 percent of the area of the continent: only a tiny fraction of Antarctica is designated as specially protected under these instruments to date. The majority of these areas (approximately 50%) are located along the Antarctic Peninsula, while a further 25% are located in the region close to Ross Island and the McMurdo Dry Valleys in the southern Ross Sea (Figure 1). The remaining 25% are scattered widely around the margins of the continent, and the vast majority of the ASPAs are coastal terrestrial sites.

Edmonson Point lies in an interesting position in relation to this network. The nearest coastal protected areas to the site are ASPA No. 154 at Botany Bay, Cape Geology, approximately 300 km to the south, and ASPA No. 106 at Cape Hallett, approximately 300 km to the north (Figure 1). Both of these areas are specially protected because of their exceptional values related to terrestrial ecology. The nearest 'inland' site is ASPA No. 118 at the summit of Mount Melbourne, at an elevation of 2732 m above Edmonson Point, which is designated for its highly unusual biological communities associated with warm ground and fumaroles. Edmonson Point is thus located at approximately the latitudinal mid-point along 600 km of the Victoria Land coastline between the two nearest comparable protected areas, and at the base of an altitudinal gradient extending to the summit of Mount Melbourne approximately 14 km inland. A marine area close to Terra Nova Bay Station is a fourth site in the vicinity, which is currently being proposed by Italy and is expected to be designated in the near future.

Taken together, and in terms of their contributions to the Antarctic protected area network, these four sites offer a representation of environments through a wide latitudinal and altitudinal range in the Ross Sea region. In terms of position, Edmonson Point is complementary to other sites. However, in itself, position is a thin basis on which to propose special protection. There is a need for an identification and elaboration of more specific values that may be present if a robust case for special protection at Edmonson Point is to be made. Returning to the question asked at the outset, why is Edmonson Point any more deserving of special protection than any other site in Victoria Land?

3.4 A systematic approach to the appraisal of values at Antarctic protected areas

The Values Appraisal Matrix (Table 1) was designed specifically to help answer this question when evaluating potential protected areas. The matrix is based first on the broad values identified in Article 3.1 of Annex V (see above), which is evident in the categories in the left column. These categories are broken down further according to the examples provided in Article 3.2 of Annex V. The matrix is also based on the 'Guidelines for Protected Areas under Annex V', which were developed by a working group established by the Committee for Environmental Protection (New Zealand, 2000), with some minor changes and additions.

The Value Quality Attributes along the top of the matrix are also based on the text of Annex V, and are similar to the categories used in the matrix presented in the 'Guidelines for Protected Areas under Annex V' (New Zealand, 2000). By appraising and describing any values present according to their essential quality attributes, it should be possible to define clearly those things about the area that are special or outstanding. For example, is a particular ecosystem present at the site the best example of its kind, and if so in what context – regionally, Antarctic-wide, or globally? Or can it be considered particularly representative of an ecosystem in the region? Is the ecosystem especially diverse, unusual or unique? Is the ecosystem especially unspoiled or pristine, which may make it valuable for certain studies and important to maintain in this condition? Similar questions can asked for the range of values in the matrix, and some examples are included in Table 1 for illustrative purposes.

Table 1. Values Appraisal Matrix used to evaluate Edmonson Point values

Values	**Subcategory**	**Value quality attributes** Best example	Representative	Diverse	Unique / unusual	Unspoiled / pristine
Environmental	Ecosystems	**The ecosystem is the best known example**				
	Habitats		**The habitats are representative of those in region**			
	Species Assemblages			**Diverse assemblages of species are present**		
	Species				**Species at the site are unique, rare, or unusual**	
	Genetic					**Genetic resources are considered relatively isolated and pure**
	Geological					
	Geomorphological					
	Glaciological					
	Limnological					
	Landscapes					
	Conservation					
	Intrinsic					
Scientific	Existing/ On-going	**A type locality, or the site is the best available for science of a particular type**	**A representative range of phenomena are under study**	**A wide range of disciplines are active at the site**	**The only site where a study can be carried out**	**The pristine state is vital for the science being conducted**
	Planned					
Historic	Sites, Monuments		**Representative of an era**			
	Artefacts			**Diverse range of items**		
Aesthetic						
Wilderness						

A second part of the appraisal was to consider the certainty with which a particular value could be described. This was achieved by assigning a score according to the criteria listed in Table 2, the Values Certainty Score.

Table 2. Values Certainty Scoring method used to appraise Edmonson Point values

Values Certainty Scoring

Is the value outstanding?	**Degree of Certainty**	**Score**
Yes	There is good evidence that the value is outstanding in terms of the quality attribute, with a high level of certainty.	1
Possibly	There is some evidence that the value may be outstanding in terms of the quality attribute, although there remains uncertainty.	0.5
No	There is good evidence that the value is **not** outstanding in terms of the quality attribute, with a high level of certainty.	0
Unknown	It is unknown whether the value is either outstanding or not outstanding in terms of the quality attribute.	?

3.5 Values appraisal methodology

In the Siena Workshop, participants were asked to consider the values listed in the matrix and to identify those that were considered most evident or important at Edmonson Point. They were then asked to define those values in succinct terms by reference to their quality attributes. Time was limited, so it was not possible to work through the matrix comprehensively: thus, participants were asked to focus on those values considered of greatest importance. Moreover, some of the values, such as 'Conservation', 'Aesthetic', 'Wilderness', and 'Intrinsic' were considered difficult to define and evaluate within the time available for this practical exercise, so attention was focused primarily on environmental and scientific values. 'Historic' values are not known to exist at Edmonson Point, and therefore do not feature in the matrix presenting the results of the appraisal. However, participants were able to identify freely any type of value that they felt to be of importance if they so wished.

The appraisal was conducted in two groups, one comprising primarily seabird and mammal biologists, the second composed mainly of terrestrial and freshwater ecologists and soil / geological scientists. The purpose of this division was to allow groups the opportunity to elaborate values in as much detail as possible in their particular specialist fields. The results of each group's evaluation were recorded in the session, and then when the groups joined back together the key points were reported to the workshop as a whole.

3.6 Values Appraisal results

A summary of the results of the Values Appraisal is presented in Table 3.

3.7 Certainty of Values

The Workshop considered the degree of certainty with which each value could be described using the Values Certainty Scoring method presented in Table 2. Both groups considered that most of the values identified apply with a high degree of certainty. Both groups made the point that there was less certainty about the degree to which the site could be considered pristine: the nature and duration of research activities undertaken at the site means that to some extent the site is already influenced by human activities. However, the magnitude of this influence is not precisely known, since few specific studies on human impacts have yet been undertaken.

The group focusing on seabirds and mammals considered the existing and ongoing scientific values applied with a high degree of certainty because Edmonson Point is an excellent site for the type of work being conducted. This is both for practical reasons and because substantial value also resides in the long-term data sets that have been established, which enhance the potential for future work. This group felt there was a high degree of certainty that the Edmonson Point seabird ecosystem could in most respects be considered representative of those with similar species assemblages elsewhere in the Ross Sea region, and that it can be considered a good example. However, in the sense that the ratio of skuas to penguins is high, the group was certain that in this respect the bird species assemblage is unusual. Participants strongly agreed that the site does not necessarily contain the *best* examples of seabird ecosystems, habitats or species assemblages, as it was felt that equally good examples may be found elsewhere. However, the group was certain that the wide variety of scientific studies both possible and being undertaken at Edmonson Point added to its special value for research.

Some value quality attributes were unknown, where inadequate information was available. This was particularly the case for genetic values, since only a small number of genetic studies have been carried out at this site, and these only on Adélie penguins. Geological, geomorphological and glaciological values were not appraised in the group sessions because of a lack of the necessary expertise, and thus there remains some uncertainty over the extent to which these types of values apply, or could be considered outstanding, at Edmonson Point.

Table 3. Values Appraisal Matrix, Edmonson Point

Values	**Subcategory**	**Value quality attributes** Best example	Representative	Diverse	Unique / unusual	Unspoiled / pristine
Environmental	Ecosystems	• The site is one of the best in Victoria Land for its diverse and extensive terrestrial and freshwater ecosystems.	• The combination of species, in particular of Adélie penguin and South Polar skua populations is a good example of this type of ecosystem. • The site is representative in particular of an Adélie penguin and South Polar skua breeding area, with significant interaction between the two species. • The site is one of the best in Victoria land for its diverse and extensive terrestrial and freshwater ecosystems. •	• The terrestrial and freshwater ecosystems at this site are diverse.	• One of very few low-lying non-mountainous ice-free sites in Northern Victoria Land. While larger than most, the site is of very limited extent. • The seabird and seal ecosystem at this site is not considered particularly unique. • The diversity and combination of terrestrial and freshwater ecosystems at this site is unusual, as well as their extensiveness (especially of hydric vegetation)	• The site is not considered especially pristine, having been worked at for more than 15 years. However, contaminants in the local marine ecosystem are very low and human impacts on the ecosystem as a whole are not considered high.
	Habitats	• The habitat for bryophyte development is the most extensive of its kind in Victoria Land. • The habitat for vegetation is one of the best examples known with this type of lithology and with the occurrence of a nutrient enriched substrate.	• The site is representative in the sense that a wide range of freshwater habitats is present, although such habitat diversity is highly unusual in Victoria Land (see 'Diverse' & 'Unique'). • The site is representative of hydric moss-dominated communities, with distribution patterns influenced by hydrologic conditions. • Habitats for Adélie penguins, south polar skuas and Weddell seals are good examples and representative of those found elsewhere.	• An exceptional diversity of freshwater habitats is present, with numerous streams, ponds and lakes, exhibiting eutrophic through to oligotrophic properties. • The range of vegetation communities is highly diverse: from epilithic nitrophytic vegetation, to chionophilous communities, to hydric moss dominated communities • There is a particularly diverse range of breeding territory habitats for south polar skuas. • The range of habitats for Adélie penguins and Weddell seals is not particularly diverse, although perhaps no less diverse than other sites throughout Victoria Land.	• The only site in N Victoria Land with such an extensive and substantial stream network. • The hydric environment present, influencing soil and vegetation development, is rare in Victoria Land. • The South Polar skua population is thought to be unusual in Victoria Land due to the diversity of available habitats.	• The habitats at this site are not considered to be pristine (see above), and there have been some impacts observed from human activity (e.g. footprints in moist soils, dispersal of materials from scientific equipment damaged by wind, construction of facilities, alteration of habitat by fence etc.). However, impacts are not all documented and some are not precisely known.

	Species Assemblages	• The bryophyte communities are the best example of their kind found in Victoria Land.	• This site is a good example of an Adélie penguin and south polar skua assemblage. • The site is representative of vegetation communities showing distinct boundaries between different community types, as a result of environmental gradients.	• Assemblages of seabirds and seals are not particularly diverse at this site, although perhaps no less diverse than other sites throughout Victoria Land.	• The site is unusual and rare because of the extensiveness of the terrestrial communities, in particular the bryophyte vegetation. • The unusually extensive and thick stands of moss are highly sensitive to changes in the hydrological regime, whether as a result of local or more global drivers. • There is an unusually high ratio of skuas to penguins (1:20) at this site.	?
	Species		• The site is particularly representative for algae species in Victoria Land, with over 120 species described. • The site is representative for both Adélie penguins and South Polar skuas.	• An exceptional diversity of algal species exist as a consequence of the variety of freshwater habitats. • Invertebrates species present are not particularly diverse. • The range of seabird and seal species found is not particularly diverse.	• The diversity of algal species found at one small site is rare in Victoria Land. • Invertebrates are unusually abundant and extensively distributed. • Seabird and seal species are not particularly unusual or unique at this site.	• Regular monitoring programme has involved routine handling of individual birds (e.g. lavage, weighing, sampling, tracking), although numbers small cf size of colony. Regular presence of people / constructions / access probably mean the colonies cannot be considered pristine, although the extent to which impacts have occurred is not well-known.
	Genetic	? (only a few genetic studies on Adélie penguins have been carried out at this site)	?	?	?	?
	Geological	?	?	?	?	?
	Geomorphological	• The cuspate foreland in the north is one of the best examples of its kind in Victoria Land.	?	• A diversity of geomorphic features is present, including a series of ice-cored moraines incorporating marine deposits, raised beaches, patterned ground, the cuspate foreland, fossil penguin colonies, etc. • There remains uncertainty over the degree to which these diverse features might be considered 'outstanding'.	• The cuspate foreland in the north is an unusual feature in Victoria Land and one of only a few such features on this coast. • The foreland is unusual in that it is not occupied by a breeding colony of penguins, as is the case at C. Hallett and C. Adare.	?
	Glaciological	?	?	?	• The glaciology in the general region is unusual because it is separate and distinct from that of the interior polar plateau.	?
	Limnological	The site was considered to possess outstanding limnological values: specific aspects of limnological importance were appraised under other categories in the matrix.				

Scientific	Existing/ On-going	• The site is considered one of the best in Antarctica for studies of algal ecology because of the wide range of habitats present. • The site is considered one of the best in Antarctica for studies of the impact of climate change on terrestrial ecosystems because of its geographical position in a continental research network (eg. the RiSCC programme) (see also "Unique"). • The combination of moisture and nutrient gradients present at the site are particularly useful as analogues for possible future environmental change as a result of shifts in climate. • The lakes are among the best in N. Victoria Land for studies of biogeochemical processes which show short- and long-term variation: these features are considered particularly useful as a sensitive indicator of ecological change and climate-related effects. • This site is a very good location for the research presently being undertaken on Adélie penguins and South Polar skuas, due to the practicality with which these methodologies can be carried out. • The size of the colonies present, the terrain and habitat features of the site, and its proximity to Terra Nova Bay Station allow good access to the penguin and skua breeding areas. • The site is a CCAMLR Ecosystem Monitoring Program (CEMP) site, and research here is important to on-going investigations of how natural and human induced variations in the Antarctic ecosystem may affect the breeding success of Adélie penguins.	• A wide representation of phenomena are under study, and the site is considered exceptionally good for multi-disciplinary studies. • The wide representation of terrestrial and freshwater habitats makes the site ideal for investigations of biological variation and processes along moisture and nutrient gradients. • There is a wide range of phenomena under study for Adélie penguins and South Polar skuas (e.g. breeding success, foraging strategies, dive depth, migration, demography and behavioural studies). • Glacial moraines incorporating marine deposits, including seal bones and shells of the bivalves *Laternula elliptica* and *Adamussium colbecki*, are particularly useful for dating regional glacier fluctuations and when local glaciers advanced over littoral deposits. • Sedimentary sequences containing fossils from former penguin colonies in the north-west are useful for dating the persistence of bird breeding at the site and thus for reconstruction of past glacial phases and as a Holocene paleoclimatic indicator.	• An exceptional diversity of science is being carried out at the site, which reflects the diversity of habitats and features present, as well as relative accessibility from Terra Nova Bay Station. • There is a high diversity of scientific projects being carried out on seabirds at this site, which also adds value to science being undertaken in other disciplines (e.g. on nutrient gradients and on fossil penguin colonies).	• Site is considered unusually sensitive as an indicator of terrestrial ecological change because of the unique properties of the active layer in the permafrost, which is particularly thick in this location. • The diversity of features / habitats support a diverse range of scientific projects in a variety of disciplines, which makes this site unusual for the region. • An abandoned penguin colony site is useful, providing information such as varying occupational phases, the growth and reduction of penguin populations and movement of colonies to different locations.	• The science being conducted generally is not critically dependent on the environment being maintained in a pristine state, although human impact should be minimised to the greatest extent practicable. • Some ecotoxicological studies examining global background levels of contaminants in marine birds have been carried out, which depend to some extent on the local area being relatively pristine. • There is some evidence of damage to soils and of moss communities by trampling. • There would seem no strong evidence for human impact on the bird colonies, although longer time-series data are required to discover possible reasons for penguin and skua population changes. • The precise effects of scientific research and human presence at this site are uncertain because detailed studies on human impact have not yet been undertaken.

	Planned	• Extensive scientific databases have been built up at the site, which adds to its value for the conduct of future research. • Many long-term data sets are being established, which increases the value of the site for future scientific research. •		• Planned scientific research at this site is likely to reflect the diversity of current projects and the increasing interest in multi-disciplinary studies.		• It may be important for future ecotoxicological studies, if they are planned, that local sources of contamination are minimised (e.g. for looking at trends in the global background).

4. Management policies

What is the purpose of management? In general terms, management policies within Antarctic protected areas have typically had a number of broad aims and objectives:

- Allow scientific research, but under a framework of guidance provided by the management plan;
- Prohibit other uses which may compromise the scientific values, such as tourism;
- Minimise pressures on and risks to the values present;
- Minimise environmental impacts, and avoid damage to, or loss of, the values.

Discussion of management policies followed the general structure of the draft management plan, using the draft as a starting point. Because of limited time, it was only possible for discussion to cover the most important policies: the aims and objectives of the plan, the proposed boundaries, mapping issues, aircraft access and overflight, and the location of field camps and structures. In this part of the report, the attempt has been made to summarise the main issues and points made in the discussion. Further feedback is sought on the key issues, in particular comment on whether the policies drafted below could be expected to be effective in avoiding problems, and also whether they reflect the views of the scientific community using the site.

4.1 Aims and Objectives

Under the Agreed Measures, entry to SPAs had to be for a "compelling scientific purpose which cannot be served elsewhere". Entry to SSSIs, on the other hand, did not require that the scientific purpose be "compelling" or that it could not be served elsewhere. With the introduction of the ASPA under the Madrid Protocol, entry requirements at each site are considered on a case-by-case basis, and may be more or less restrictive depending on the objectives of the management plan. Entry conditions may follow the more stringent model of the SPA or the less restrictive approach of the SSSI, which may also depend on the nature of the values being protected and their vulnerability. In practice, the majority of ASPAs in Antarctica (including the former SSSIs) have included some wording to the effect that entry should only be allowed for purposes that cannot be served elsewhere. The general line of reasoning has been that if the purpose can be adequately served at another site, then there would seem no strong reason why the protected area (which has been identified because it has values worthy of special protection) should be subjected to greater use than is necessary.

The Siena Workshop discussed whether entry to the protected area at Edmonson Point, if adopted, should be for "compelling scientific purposes that cannot be served elsewhere". First, it was noted that the existing draft made a distinction between "scientific research on flora and fauna" and "other scientific research". The latter would be allowed only for "compelling scientific purposes that cannot be served elsewhere", while the former was not subject to this condition. The Workshop was in general agreement that the same conditions should apply to all types of science, rather than certain types of science enjoying 'preferential' access.

A number of participants expressed unease over the proposal to restrict entry to "compelling scientific purposes that cannot be served elsewhere". The Workshop seemed to share a concern that the policy could lead to unreasonable restrictions being placed on legitimate scientific projects. Balanced against this, the point was made that if a particular scientific project could be carried out effectively at another site, at a location where the type and range of values were not considered to be so outstanding, then a case can be made for the work to be conducted there, rather than placing Edmonson Point under unnecessary pressure.

It should be noted that the policy to restrict entry to "compelling scientific purposes that cannot be served elsewhere" is not intended to eliminate or make difficult the conduct of research *per se*. Rather, it is intended to ensure that the research allowed really does need to be conducted at this particular site, with the intent to minimise any unnecessary disturbance. This policy has been accepted in the majority of protected areas thus far adopted in Antarctica, and recognises the fact that particularly important values are present at these sites.

Possible approach:

- "allow scientific research within the Area provided it is for reasons that cannot reasonably be served elsewhere."

4.2 Boundaries

There was considerable discussion over boundary alternatives at the site. In particular, a number of participants expressed support for the inclusion of the ice-free areas several km to the north and south of the main Edmonson Point. An important reason put forward for inclusion of these areas was to bring within the protected area several 'control' sites which could be used for comparative studies, particularly in the field of terrestrial ecology.

Concern was expressed that if these areas were not included within the protected area (and thus permits required for access), they may be subjected to an increase in pressure from scientific programmes because permits would not be required for entry. Scientists could decide to use these sites in preference to the main Edmonson Point simply to avoid the need to obtain a permit. Should this occur, the potential value of these sites as 'controls' could be placed at risk.

Balanced against this, these areas are not presently mapped in detail, and information on the resources and values present is not so readily available as at Edmonson Point. It was suggested that a practical option may be to proceed with the proposal for the main site at Edmonson Point, as currently suggested, but to keep the option for inclusion of the northern and southern ice-free areas under review. It would be useful to monitor any increase in pressures at the northern and southern sites after the protected area is designated. A review of the management plans every five years is a requirement for all protected areas, and this would be a useful mechanism to ensure the issue is kept under review.

There was insufficient time in the Workshop to consider inclusion of a marine component, although little information exists on the local marine environment. It was pointed out in the science reviews (Section 2.3) that the nearshore marine (fast-ice) environment is important as a pupping area for Weddell seals: there could be merit to further consideration of the justification and needs for inclusion of this area. For example, it may be considered important to control helicopter overflight in this region, and appropriate policies could be included in the management plan. However, to be effective the boundaries would need to extend over the marine area (i.e. the near-shore fast ice environment) within which the policies would be expected to apply.

Possible approaches:

- Proceed with the boundary currently proposed, which includes all of the ice-free area at the main Edmonson Point site.
- Evaluate further the case for inclusion of a near-shore marine component.
- Monitor use of the northern and southern ice-free areas, and consider their inclusion in the future if the need is determined.

The Siena Workshop appeared to support this approach, although further comment / feedback is sought.

4.3 Mapping

Mapping issues in part relate to those of the selected boundaries. In the current proposal, the boundary extends to include all of the ice-free area of Edmonson Point as far as the glacier margin on the lower slopes of Mount Melbourne. A very detailed digital orthophoto and map is available for slightly more than half of this area, covering the part adjacent to the coast (Figure 2). The orthophoto was prepared at an original scale of 1:1000, with 2 m contours, and over the area covered it represents one of the most detailed topographic maps available for any part of Antarctica.

Beyond this limited area, the best available mapping is at a scale of 1:250,000 which is generally inadequate for site-specific management. To address partially the gap in detailed mapping for the inland ice-free area at Edmonson Point, a low-resolution scan of 1993 aerial photography was rectified to fit the ortho-image available for the part of the area mapped in detail. This allowed for the approximate position of the glacier margin and lakes to be described (Figure 2). It must be emphasised that this technique does <u>not</u> include any information on topography / height over these areas, and for this reason the features inherit errors from terrain-related distortions in the photograph. Height information is not available for these areas. The mapping for the inland part of the ice-free area at Edmonson Point is thus best described as a sketch, and in no way compares to the accuracy or information content of the detailed digital orthophoto prepared for the coastal zone.

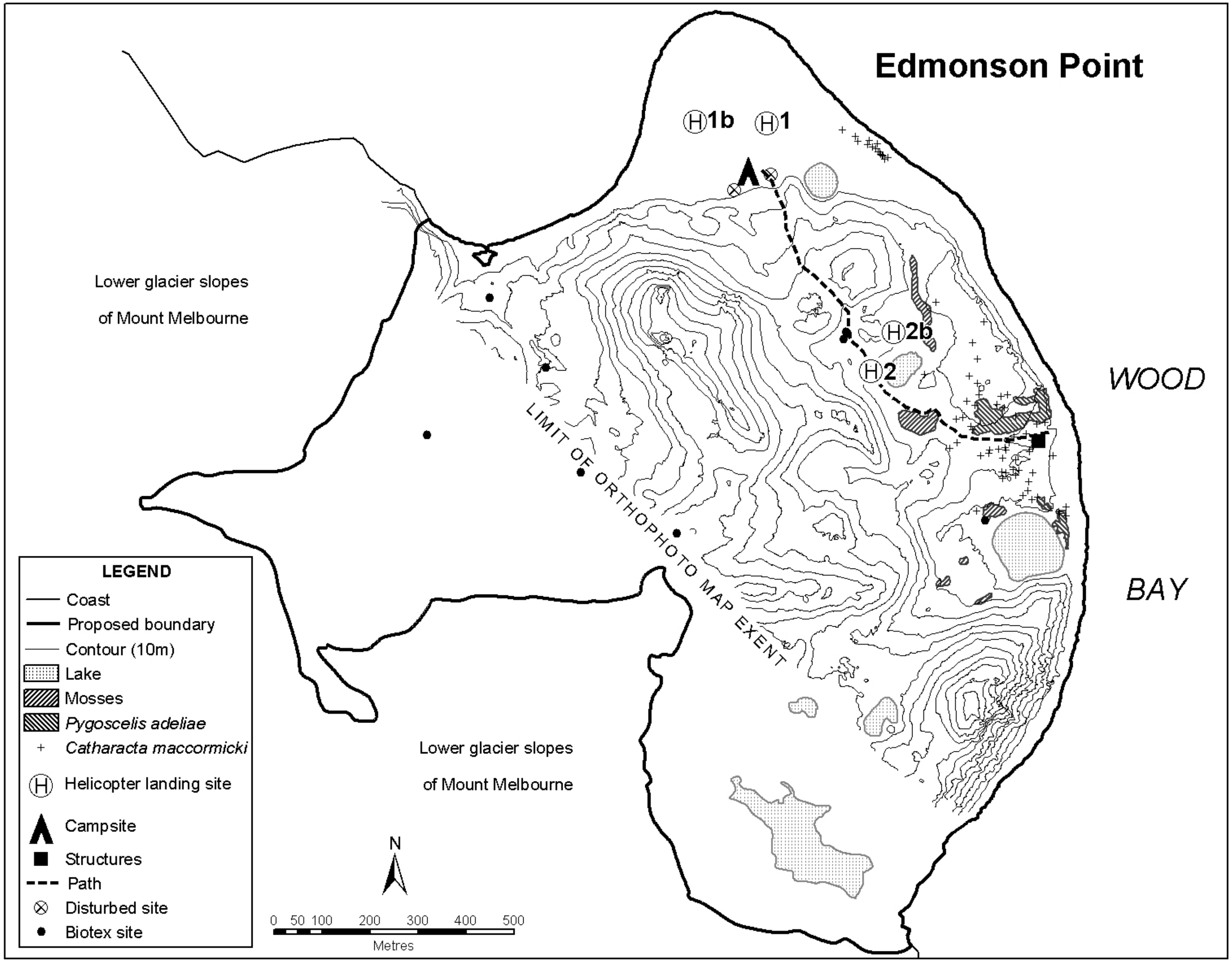
Best practice for mapping would be to prepare a map of consistent scale and accuracy for the protected area within the proposed boundaries. Detail would be to a level that shows the important features necessary to enable effective management and science at the site. Usually, topographic information is considered fundamental for effective understanding and practical use of the site map. Thus, science being conducted at these inland sites (e.g. several BIOTEX sites, geology, geomorphology) does not presently have the support of a precise topographic map. Detailed information on the geomorphological sketch map prepared by Baroni (Baroni and Orombelli, 1994) could be transferred to such an accurate map, which could be helpful in future geomorphological studies. Such a map might also be helpful for the proposed management plan. Moreover, any management measures, such as designated paths, or the location of particular monitoring sites, cannot be adequately shown without a proper map in these areas.

If the approach to boundaries suggested above is supported, at present more detailed mapping would not require inclusion of the northern and southern ice-free areas for the purposes of the management plan. However, the currently unmapped inland zone at the main Edmonson Point should be mapped to an accuracy, scale and detail that is consistent with the mapping for the remainder of the site (ie. the coastal zone) if at all possible.

Possible approach:

- Map properly all of the ice-free area at the main Edmonson Point site. This can be achieved by scanning and orthorectifying available higher-level photography using the existing orthophoto as control.
- Evaluate inclusion of the northern ice-free area in the extended map, and collection of the additional ground control needed.
- Consider transfer of geomorphological information onto an accurate topographic base map, and inclusion of this map in the proposed management plan.

Figure 2. Topographic map of Edmonson Point, Wood Bay.



4.4 Access and movement

Helicopter access is an important issue at Edmonson Point. Owing to the location of the site and the persistence of sea ice in the vicinity, the most practical means of access is by helicopter. A range of resources and values could potentially be impacted by such access, and it is therefore very important that flight guidelines are established and followed so that the risks and impacts are minimised. The evaluation and selection of appropriate landing site(s) and practical guidance on access routes are vital. At the same time, if science is to be facilitated at Edmonson Point, then guidelines need to be practical.

Guidelines for helicopter use in Antarctica received early attention within the Antarctic Treaty System in the Agreed Measures for Conservation of Fauna and Flora (1964). The Agreed Measures stipulated that flying or landing helicopters or other aircraft in a manner that would unnecessarily disturb bird and seal concentrations, or landing close to such concentrations (e.g. within 200 m), constitutes harmful interference. More recently, guidelines have been developed for aircraft operations in specific contexts through protected area management plans. In recognition of the fact that a wide range of inconsistent guidelines were developing *ad hoc*, the United Kingdom initiated a review of policies in use for aircraft operations in Antarctica, and also of the results of research into aircraft impacts on Antarctic birds. The aim of the paper was to work towards agreement of consistent guidelines for air operations close to concentrations of wildlife in Antarctica. The review paper was first submitted to the SCAR Bird Biology Subgroup for consideration in Tokyo (2000) (Harris, 2000). The Bird Biology Subgroup recommended that new interim guidelines for aircraft operations close to concentrations of birds would be helpful. The United Kingdom then submitted Information Paper No. 39, which updated the original paper to include the recommendations of the Bird Biology Subgroup, to the Committee for Environmental Protection (CEP) in St Petersburg, Russia, June 2001 (United Kingdom, 2001). The CEP welcomed this review and stressed the importance of developing further consistent and effective guidelines for aircraft operations over Antarctic Specially Protected Areas, as well as more generally. The UK therefore submitted a Working Paper to the next meeting of the CEP in Warsaw, Poland (2002), with a draft of proposed interim guidelines for the operation of aircraft close to concentrations of birds in Antarctica. The draft is presently under review by the Council of Managers of National Antarctic Programs, which is due to report back on the issue to CEP VII in 2004.

In summary, the draft interim guidelines suggest some minimum horizontal and vertical distances that should be maintained from concentrations of birds in order to minimise disturbance (Table 4). The proposal distinguished between different types of aircraft, recognising that both the number of engines and whether the aircraft is rotor or fixed-wing have an important influence on the levels of disturbance likely to result. It must be emphasised that the suggested distances are intended as guidelines for adaptation to particular contexts, rather than as fixed rules to be slavishly implemented without taking local factors into account. In practice, there is a wide range of factors that influence the potential impact of aircraft operations on wildlife, including the variable interactions among the aircraft (the source), the birds (the receptor), the ambient environment (spatial context) and the timing, duration and frequency of exposure (temporal context) (Harris, 2000). For example, the presence of a prominent ridge may 'shield' a bird colony from the noise source, and birds can become habituated to frequent and repetitive noise, and in these contexts an aircraft may be able to operate closer to a colony without disturbance than would otherwise be possible.

Table 4. Suggested interim guidelines for minimum horizontal and vertical distances for aircraft operations close to concentrations of birds in Antarctica.

Aircraft type	Number of engines	Minimum distance (m)			
		Vertical (above ground)[1]		Horizontal	
		Feet	Metres	*Feet*	Metres
Helicopter	1	*2461*	750	*2461*	750
Helicopter	2	*3281*	1000	*3281*	1000
Fixed-wing	1 or 2	*1476*	450	*1476*	450
Fixed-wing	4	*3281*	1000	*3281*	1000

1. Heights are above the ground on which birds are present, not mean sea level.

In the context of Edmonson Point, available flat land is very limited; birds breed in several localities and seals are often found along the shoreline. There are a number of low, rocky hills, which to some extent constrain practical flight routes and potential helicopter landing sites. Lakes, streams and sites of vegetation are also vulnerable to disturbance from helicopter landings: direct impacts may result from strong downdrafts disturbing sediments and plant cover (particularly when dry), and indirect impacts may result from an associated increase in foot traffic and movement of equipment / materials close to the landing site. Moreover, landings are always subject to the vagaries of local conditions (e.g. sudden shifts in wind), and to aircraft capabilities / pilot decisions, so the selection of landing sites should take into account the risks and consequences of access under less-than-ideal circumstances.

It was agreed that the cuspate foreland in the north of Edmonson Point was the most suitable landing site for the majority of purposes (Figure 2). The foreland is the most practical option for landings for several reasons:

- it is the most suitable site for camp facilities, which are necessary to support the science;
- the landing site needs to be fairly close to the camp site for practical handling of heavy equipment, etc.;
- the majority of skuas and all of the penguins breed at sites approximately 750 m to the south;
- while non-breeding animals are regularly present on the foreland, priority for disturbance avoidance should be given to breeding animals;
- the site can be approached from northerly directions without obstructions / hills, making landings more straightforward.

The landing site currently used (H1, Figure 2) is approximately 150 m west from the site where a small group of 10-15 skuas regularly breed. There could be merit to considering moving this landing site westward by about 150 m to increase the separation distance to this skua breeding site (H1b, Figure 2; see also Appendix 3). If this proves feasible, at 300 m this would still be less than the recommended minimum distances in the general guidelines, although alternative sites further away do not seem viable. Moreover, past helicopter usage on the foreland does not appear to have compromised the breeding performance of this group of skuas to date, although this should be kept under review. A further advantage to moving the helicopter landing site by 150 m to the west on the foreland would be an increase in separation distance, from 725 m to 830 m, from the penguin colony to the south. There is a need for on-site assessment of the feasibility of this proposal to move the landing location to H1b.

The long-term Adélie Penguin Monitoring Program (APMP) has established experiments and facilities on-site at the colony. There is a need for a range of equipment, power supplies, shelter and food to support these research activities. Helicopter support for these purposes has been provided at four main locations:

1. Early in the season, prior to the arrival of breeding birds, supplies and heavy equipment have been transported directly to the facilities site at the colony by helicopter (Figure 2);
2. After arrival of birds, helicopter support for heavy supplies has been to a landing site adjacent to the lake approximately 250 m to the northwest of the colony (H2, Figure 2);
3. Recently (2002-03) the landing site close to the lake (H2) was re-located to a site approximately 100 m northeast of H2 (H2b, Figure 2);
4. Throughout the season, support not requiring delivery of heavy items has been made to the landing site on the foreland (H1).

APMP researchers noted that helicopter support to deliver supplies to the colony facility is a necessity throughout the season. Carriage of heavy supplies from the foreland landing site (H1) is considered too difficult to be practical, especially when deep, soft snow is present. Thus, landing site H2 (now H2b) is considered important to enable practical transfer of heavy supplies to colony facilities occasionally throughout the season. H2b allows helicopters to approach the landing site at a lower elevation, thus reducing noise and potential disturbance to penguins, and aircraft approach is from north, away from the colony. Relocation of the secondary landing site reduces potential impacts to freshwater / vegetation values in the lake area.

However, the new site (H2b) remains within 225 m of the Adélie colony, and there is a significant area of vegetation within 50-60 m. Wind direction may not always be ideal for access and egress to the north, and operation of aircraft south of this site could result in significant disturbance to the colony. Guidelines on helicopter access might therefore need to include a specific prohibition on aircraft movement south of the landing site. While guidelines would normally be followed, there is a risk that aircraft may fly further south either by necessity or accidentally (e.g. for safety reasons). There could be merit to some further evaluation of options available for the secondary landing site, and whether potential risks at H2b are considered significant.

It was noted that landings at H2 have been made for purposes other than delivery of heavy supplies to support the APMP at the colony. The reasons for this appear to have been for convenience, or because clear guidance has not always been available to pilots or others visiting the site. One benefit expected of an agreed management plan is that such guidance would then be provided in a clear and unambiguous form to all visitors and pilots.

Time at the workshop did not allow for discussion of designated routes for foot traffic, although concern in this regard has been raised in the past. With the shift in the secondary helicopter landing site from H2 to H2b, there is a need to reconsider the appropriate designated path for access. Significant vegetation is nearby, and care needs to be exercised to ensure this is not damaged. Elsewhere, three permanent plots are installed for long-term monitoring of vegetation and permafrost, and any possible damage and/or interference to these monitoring sites needs to be avoided. Moist soils and vegetated sites, as well as delicate lichens, are vulnerable to disturbance by foor traffic (see Appendix 3). There may be a need to consider further any other sensitive areas where designated routes could help to minimise disturbance.

Possible approaches:

- **OPTION A**: ALL helicopter access shall be to landing site H1b (or nearby if this proves unsuitable), EXCEPT helicopter access allowed to H2b in support of the Adélie Penguin Monitoring Programme (see Figure 2).
- **OPTION B**: As above, EXCEPT helicopter access allowed to H2b in support of the Adélie Penguin Monitoring Programme <u>only when specifically necessary for delivery of heavy equipment / supplies which cannot practically be carried from H1b</u>. That is, routine access by all visitors including APMP personnel would be to H1b, with H2b only used when it is absolutely necessary for science support.
- Evaluate further the practical options available for a secondary landing site, and whether the potential risks at H2b are considered significant to both wildlife and nearby vegetation.
- Revise designated foot path(s), taking into account the revised position of the secondary helicopter landing site.
- Consider further whether there is a need for designated routes in other parts of the site.

4.5 Field camps and structures

Management of field camps and structures at Edmonson Point would aim to:

- Limit the number of sites at which camps and facilities are established;
- Select the appropriate location(s) for such camps and facilities, including minimising the amount of foot traffic needed from selected camp locations to key research sites;
- Minimise the 'footprint' of camps and facilities where they are established;
- Limit scale, or size, and incremental growth of developments;

- Manage the important risks associated with the establishment and operation of camps and facilities.

Two primary sites have thus far been used at Edmonson Point for camping: one on the northern foreland and a second at the research facilities at the Adélie colony. The site on the foreland (see Appendix 3) was selected for use in the BIOTEX project in the 1995-96 season for a number of reasons:

- the site is relatively devoid of extensive vegetation and remote from the main breeding areas of birds;
- ease of access by air and suitable flat ground for camp establishment;
- presence of a nearby clean freshwater supply;
- ease of access to the rest of the ice-free area from this location.

The BIOTEX camp comprised temporary tent / rigid plastic shelters for eating, sleeping and scientific work. A propane-burning toilet was installed nearby while the camp was in operation (at the eastern site marked as ‘disturbed’ on Figure 2). A second site marked ‘disturbed’ on Figure 2 is a large rock designated as a site for urination, which minimised the need to burn off liquid human waste using the propane toilet. The approximate area within which this camp was established was 70 x 50 m.

Overnight camping at the Adélie colony has been in one of the three semi-permanent structures erected on site in 1994-95 (see Appendix 3). These structures are used to house scientific instruments, power supplies and batteries, food and other supplies and for cooking etc. A small weather station is also established nearby. Fuel is stored in drums, and a temporary tent is erected seasonally for use as a toilet (sites where these are located are marked as ‘disturbed’ in Figure 2). The approximate area within which this camp is established is about 70 x 40 m. Low fences and an automated weigh-bridge are installed on the seaward side of the northern part of the colony (see Appendix 3).

On-going use of the facilities to support the APMP is expected to continue. Researchers indicated a willingness to minimise overnight camping at this site. Primary camping could therefore be focused at the foreland site, with overnight camps at the penguin colony when required for specific research purposes. This approach could offer benefits by reducing the amount of equipment, supplies and fuel that would be needed to support activities at the colony site. Primary storage of fuels and other supplies could be at the foreland site, minimising the need for large quantities to be stored and handled close to the sites of highest biological value? If camping and storage requirements can be reduced at the colony site, it may be possible to reduce the size of this camp and reduce the ‘footprint’ of activities in this area?

Possible approach:

- ALL camping to be at foreland campsite (old BIOTEX-1 site), EXCEPT to support research at the Adélie colony which cannot be carried out using the foreland site as a base (see Figure 2).
- Consider options for reducing the ‘footprint’ of the facilities at the Adélie colony, if practical.

4.6 Disposal of wastes

There was insufficient time in the Workshop forum to cover this aspect specifically. However, informal discussions throughout the day indicated support for the policy of removal of all wastes from the site, including all human wastes. There may be merit in continuing to allow the disposal of human waste by incineration, and perhaps by disposal into the sea. If numbers of personnel present are small (< 10 people), the level of contamination arising from disposal of human wastes, or at least of urine, into the sea would seem negligible as it would be quickly diluted / dispersed. This may also be a more practical option than total removal. However, there may be a preference to follow the principle of complete removal of ALL wastes, and the policy needs further discussion before consensus is reached.

Possible approaches:

- Consult further on the issue of whether there is need for, or a benefit to, the removal of all wastes, including all human wastes, from the area. Consider the options of disposal of human wastes into the sea and the use of propane-burning toilet technologies.
- **OPTION A**: Remove all wastes, including all human wastes (liquid and solid).
- **OPTION B**: Remove all wastes, including solid human wastes, EXCEPT liquid human wastes which may be disposed of into the sea or onto sea ice, but not onto land or into freshwater systems.

4.7 Use of materials

There was insufficient time in the Workshop forum to cover this aspect, although there are a range of points to consider. For example, comments indicated that a large number of the plastic cloches installed during the BIOTEX project were damaged and dispersed by wind, which has presented on-going clean-up problems. There is perhaps a need to consider more stringent conditions being placed on the installation of scientific equipment / structures in this respect, and on requirements for their continued maintenance or removal. To some extent the management of this problem may be assisted through the permit process that would be introduced with a management plan. All approved projects would require permits, which would include conditions for the siting, securing, maintenance and eventual removal of such equipment.

There have been reported incidents of minor fuel spills, occurring primarily during refuelling operations for generators, stoves, etc. There could be merit in considering some form of simple secondary containment for fuel drums, and for using drip trays and spill pads where necessary. Use of renewable forms of energy (solar and wind) should also be encouraged where practical.

Possible approaches:

- Care to be exercised in the installation of scientific equipment – problems of destruction / dispersal, maintenance and conditions for removal (e.g. cloches).
- Secondary containment for fuel drums, drip trays and spill pads on-site.

- Encourage the use of renewable forms of energy to meet power needs.

4.8 Zoning

The issue of zoning came up in relation to the question of boundaries, specifically on the question of setting aside one part of the area as a 'control' for biological studies. The suggestion was made that perhaps the ice-free areas to the north and south of Edmonson Point might be suitable as such controls, although at present there would appear to be insufficient information available to define clearly these areas. Zoning might be the best type of management tool for application to these types of control area, and this type of approach has been applied at other protected areas (e.g. Tramway Ridge, Mount Erebus; New Colege Valley, Cape Bird; and is presently proposed at the summit of Mount Melbourne). However, to be implemented practically, the proposal needs further study and more detailed descriptions / mapping of the proposed control areas.

Possible approach:

- Zoning not presently proposed, although keep issue under review with a view to possible control sites in the future.

4.9 Introduction of alien species

Again, there was insufficient time in the Workshop to consider this important aspect specifically. However, further consideration should be given to the procedures that might be desirable to minimise the risks of introduction of exotic plants and microbes into the area. One participant noted it should be obligatory to clean all boots, tents and scientific field equipment before departing from New Zealand (or any other departure point) to Antarctica to avoid biological contamination and the introduction of alien species / propagules / seeds. One might also give consideration to procedures that would be appropriate when moving from another Antarctic site to Edmonson Point (e.g. from Terra Nova Bay Station, or from other sites where scientists may be working (e.g. Inexpressible Island, etc.)).

Possible approach:

- Consult further on the issue of introduction of alien species. Consider management options to minimise the risks of foreign introductions, such as cleaning of boots, equipment etc.

5. Conclusions

Edmonson Point is one of the largest non-mountainous, coastal ice-free sites in northern Victoria Land. It has a diverse range of habitats and features, many of which may be considered outstanding both on a regional (Victoria Land) scale and in the context of Antarctica as a whole. Particularly noteworthy are the values associated with terrestrial and freshwater ecosystems. The site possesses the most extensive contiguous moss carpets known in Victoria Land. The main communities are representative of the distribution patterns found in response to the environmental gradients. The limnological values are exceptionally high, for the extensive stream networks and diversity of lake types. The site is considered unusual for its high skua to penguin ratio, although in other senses the colonies represent good examples of those found elsewhere. The site is considered to possess permafrost soils and vegetation communities in a locality that is likely to be especially sensitive as an indicator of climate change. The range of habitats and features present, including the terrestrial ecology, geological and geomorphic features, excellent examples of Adélie penguin and south polar skua colonies, together with its relative accessibility to Terra Nova Bay Station, make it particularly attractive and valuable for research programmes from a variety of disciplines. It is therefore particularly important that the range of values is maintained for long-term research programmes, and that potential mutual interference which could arise from the operation of multiple disciplines working in this very confined area is avoided.

A number of the features and values present are particularly vulnerable to disturbance and destruction should activities be inappropriately managed. For example, bird colonies are especially susceptible to impacts from the operations of aircraft. Vegetation and sediments are vulnerable to disturbance by helicopter landings, and to the effects of trampling on foot. Moist soils and surface hydrology are sensitive to the effects of uncontrolled foot access, and could be irreversibly damaged if surface drainage patterns are altered. Given the investment in long-term research programmes at the site, and that considerable time-series data sets have now been gathered, it is particularly important that the high scientific values of the site are maintained.

From a number of perspectives, it is evident that Edmonson Point is particularly outstanding for its representativeness. For example, the diversity of algal species represented at the site is one of the highest in Victoria Land, reflecting the wide range of freshwater habitats present. The site provides a good representation for terrestrial invertebrate communities, which although not particularly diverse are especially abundant. In terms of its position in the broader network of Antarctic protected areas, the site is located near the middle of 600 km of coastline between the two nearest existing coastal protected areas that are protected for outstanding biological values. As such, the site is complementary to others in the network, and may therefore be particularly suitable to contribute towards achieving the goal in the Madrid Protocol of developing a representative system of protected areas in Antarctica within a systematic environmental-geographical framework. More study is required to determine if this is the case, but nevertheless, Edmonson Point does seem to offer particular promise in this regard.

A range of management policy options were considered in the Siena Workshop, and there appeared to be a high degree of consensus among those present for those policies that have the greatest bearing on the conduct of science and operations within the area. In some cases, there is a need for further consultation to reach consensus on the preferred options, but the workshop made good progress in defining the issues. In summary, support appeared to emerge in the workshop for the following key policies:

- All scientific access to be allowed on the basis of the same criteria, and no preferential access for science of any particular discipline(s).
- Proceed at present with a boundary focused on the main ice-free area at Edmonson Point, for the time-being excluding the northern and southern ice-free areas, although keep their potential inclusion in the future under review.
- ALL helicopter access directed to landing site H1b, EXCEPT helicopter access allowed to a secondary site (potentially H2b) when necessary in support of the Adélie Penguin Monitoring Programme (see Figure 2).
- ALL camping to be at foreland campsite (old BIOTEX-1 site), EXCEPT when necessary at the Adélie colony to support research of the Adélie Penguin Monitoring Programme (see Figure 2).

There is a need for further consultation to reach consensus on the following issues:

- Whether scientific research that can reasonably be carried out elsewhere should be allowed within the Area.
- Evaluate further the practical options available for a secondary landing site, and whether potential risks at H2b are considered significant.
- Revise designated foot path(s), taking into account the revised position of the secondary helicopter landing site, and whether there is need for more designated paths, and if so, where.
- Whether it would be possible / practical to reduce the footprint of facilities at the Adélie colony.
- Whether there is a need to remove all wastes, including ALL human wastes, from the area.
- What management options would be best to minimise the risks of foreign introductions.

A broad range of outstanding environmental and scientific values were identified as present at the site, and its importance as a site representative of a variety of features and ecosystems was emphasised by many participants. Moreover, certain risks were identified that, in the absence of the more specific guidance that would be provided by a management plan, have the potential to threaten the long-term sustainability of the important values evident at Edmonson Point. In conclusion, it is believed that majority support for proceeding with the proposal for designation of an Antarctic Specially Protected Area was apparent at the Siena Workshop.

In view of this support, PNRA decided to proceed toward conclusion of the plan under the following procedure and timeline:

Task	Target date for achievement
Submit Information Paper to CEP VI (Madrid) on the outcomes of the Siena Workshop and invite interested parties to participate in further elaboration of a draft plan.	9 May 2003 (achieved)
Complete final draft of Siena Workshop Report	20 May 2003 (achieved)
Information Paper on Management at Edmonson Point at CEP VI	9 June 2003 (achieved)
Consultations among interested parties in developing draft plan and reaching consensus on outstanding issues	July 2003 – February 2004
Consider additional mapping to include all of main ice-free area	July 2003 – September 2003
Submit draft plan to CCAMLR for consideration by WG-EMM[1]	July 2003
WG-EMM consideration and comment on draft plan	August 2003
Resolve / clarify any remaining issues in field, if necessary	October 2003 – February 2004
Finalise draft plan for submission as a Working Paper to CEP VII	March 2004
Establish Intersessional Contact Group in CEP to consider draft submitted internationally and submit to SCAR / CCAMLR	June 2004 – February 2005
Finalise plan from result of ICG deliberations and comments received for submission to CEP VIII	March 2005
Adoption of plan at CEP VIII	June 2005

[1] WG-EMM – Working Group on Ecosystem Monitoring and Management, CCAMLR.

Appendix One - Consolidated Bibliography

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Appendix Two: List of Siena Workshop participants

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Appendix Three – Photographs of Edmonson Point

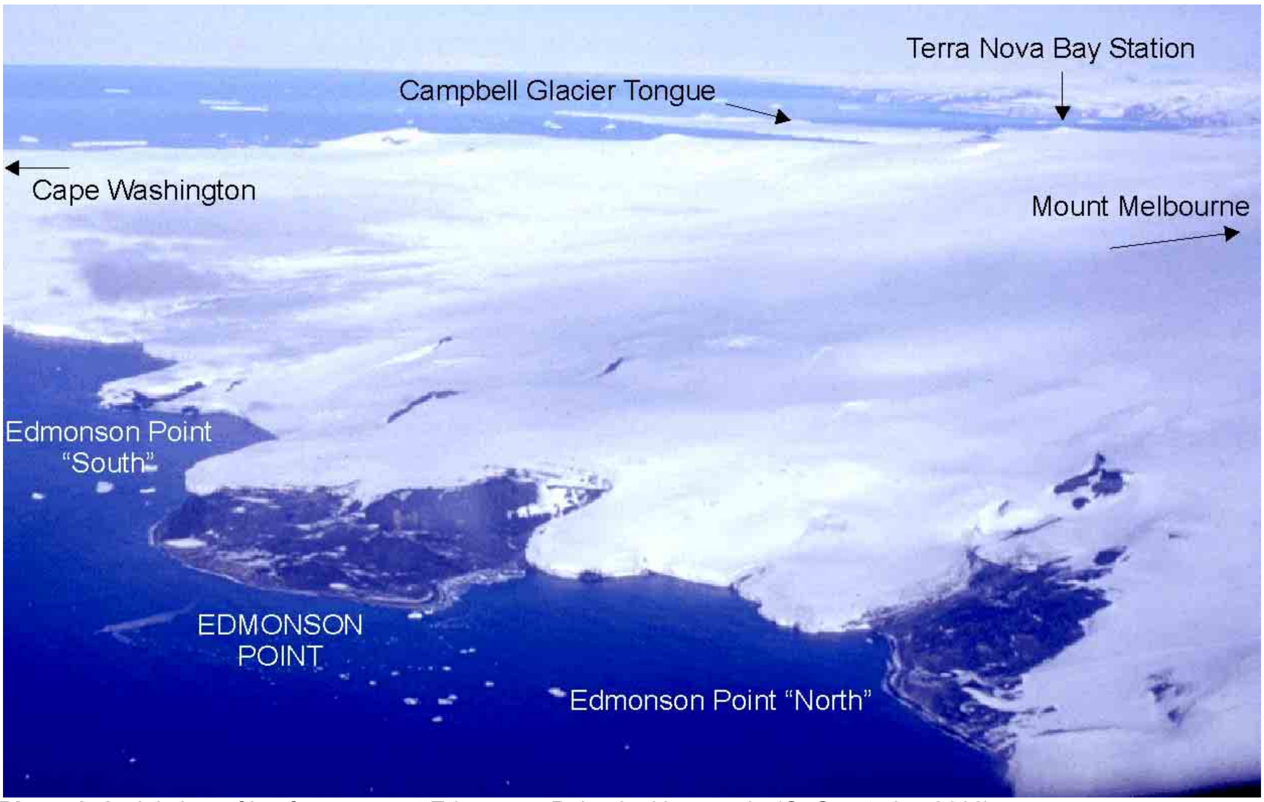

Photo 1. Aerial view of ice-free areas at Edmonson Point, looking south. (*S. Grant, Jan 2002*).

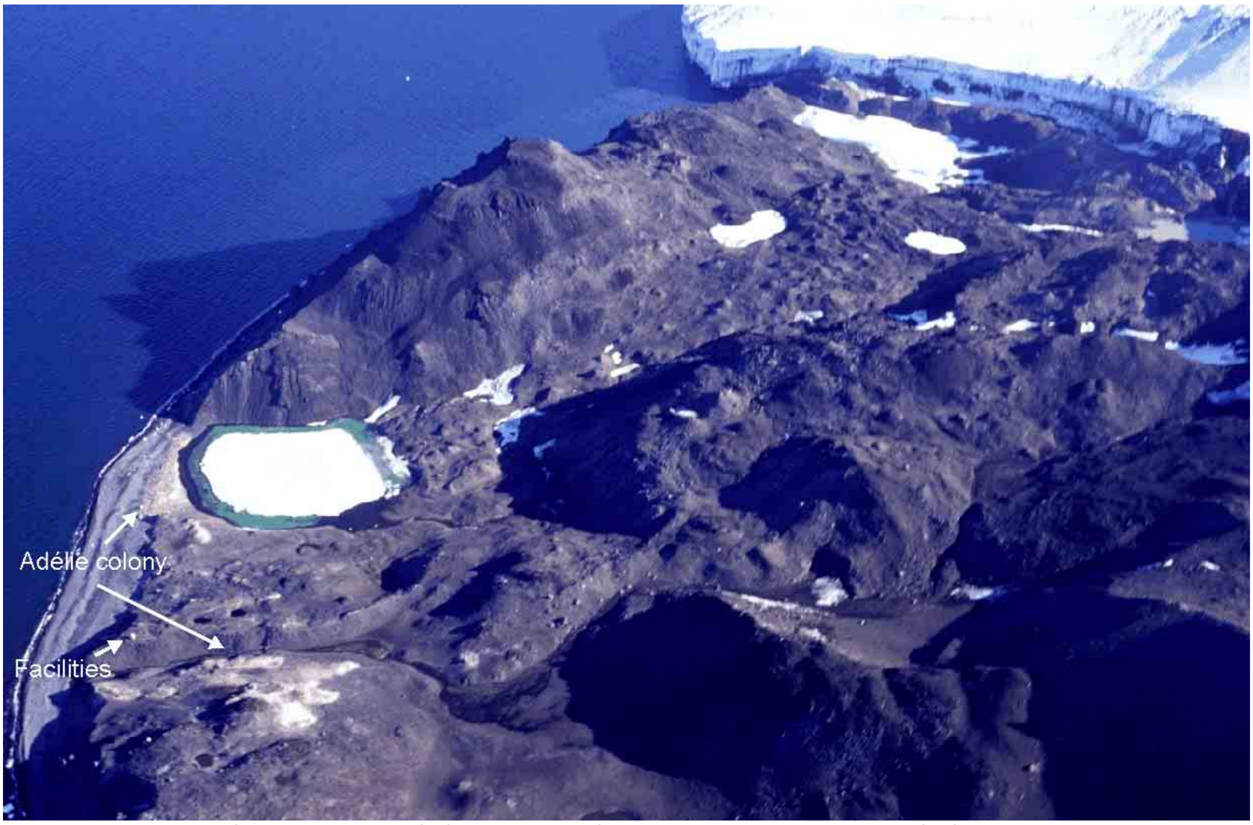

Photo 2. Aerial view of the southern half of the main ice-free area at Edmonson Point (*S. Grant, Jan 2002*).

Photo 3. Facilities at the Adélie penguin colony (*C. Harris, Jan 1996*).

Photo 4. BIOTEX-1 camp on the northern cuspate foreland, looking north-east (*C. Harris, Jan 1996*). The suggested helicopter landing site (H1b) is in the middle distance.

Photo 5. Damage to moist soils by foot traffic (*C. Harris, Jan 1996*). Care is needed when walking near sensitive soils, and vegetation (just visible in the foregound) is often inconspicuous.

Photo 6. Site of biological experiments – cloches established in BIOTEX-1 (*C. Harris, Jan 1996*). Scientific installations need to be secured, maintained, and removed when no longer necessary.

Photo 7. Southern part of the Adélie colony at Edmonson Point (*S. Grant, Jan 2002*). The size, accessibility and configuration of the colony in relation to landforms make it especially suitable for the type of biological research being conducted at the site (*S. Grant, Jan 2002*).

Photo 8. Adélie penguins pass over the automatic weigh bridge as they make their way to their nesting sites after foraging at sea. The fence 'channels' penguins over the bridge, and is installed in the northern part of the colony. It is important that equipment in this area is not disturbed (*S. Grant, Jan 2002*).

Photo 9. Scientists take samples at one of the lakes at Edmonson Point. The site is one of the best in Victoria Land for its diversity of freshwater habitats, which makes it particularly useful for limnological research (*S. Grant, Jan 2002*).

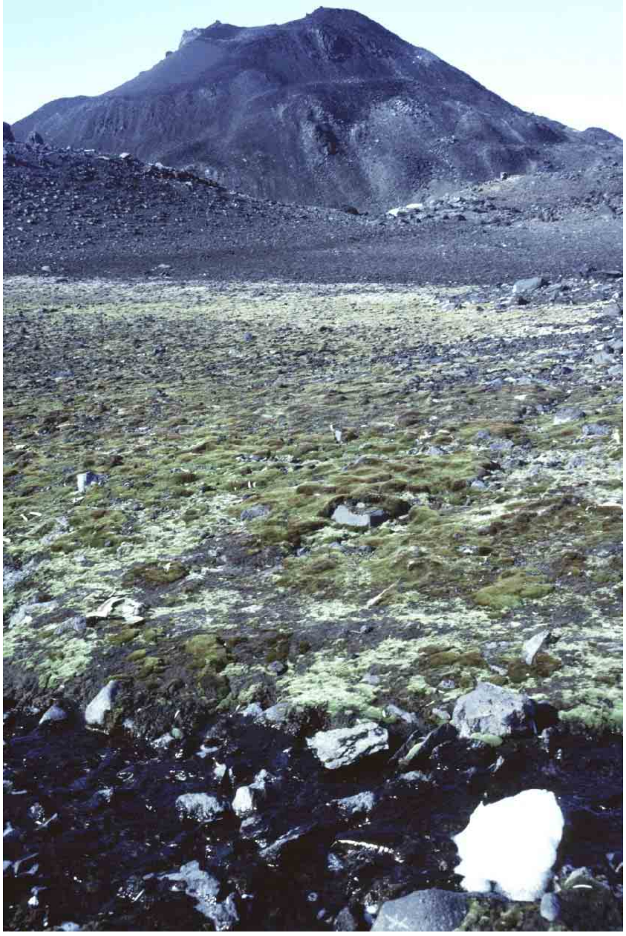

Photo 10. Bryophyte vegetation is exceptionally extensive for Victoria Land, although not particularly diverse. The plant cover can be easily disturbed by trampling or transportation (*C. Harris, Jan 1996*).

Photo 11. The foliose lichen *Umbilicaria aprina* is very delicate. It is scarce at Edmonson Point and blends in well with the substrate, so is difficult to see. These factors make it susceptible to damage by trampling (*C. Harris, Jan 1996*).

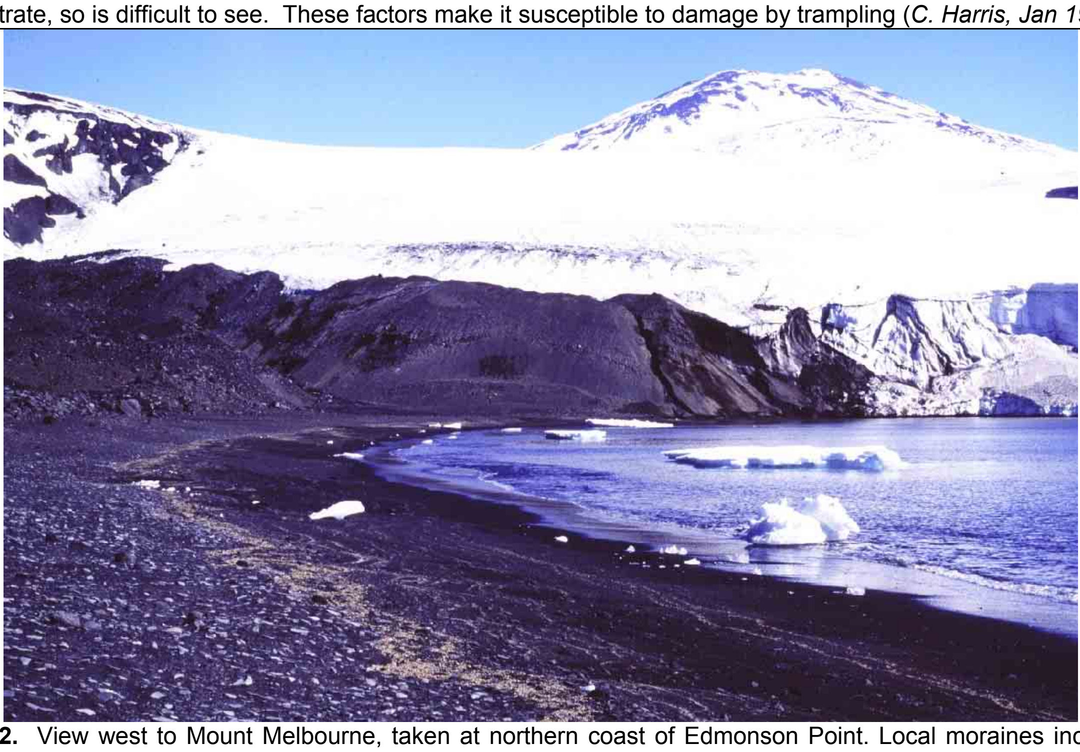

Photo 12. View west to Mount Melbourne, taken at northern coast of Edmonson Point. Local moraines incorporate marine shells that are useful for dating glacial advances in the region. Seals often haul out on the beaches, and the nearshore sea ice is a nursery area for breeding Weddell seals early in the season (*S. Grant, Jan 2002*).