



# The Antarctic Treaty

Measures adopted at  
the Fortieth Consultative Meeting  
held at Beijing, China 22 May – 1 June 2017

*Presented to Parliament  
by the Secretary of State for Foreign and Commonwealth Affairs  
by Command of Her Majesty  
September 2018*



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## **MEASURES ADOPTED AT THE FORTIETH ANTARCTIC TREATY CONSULTATIVE MEETING**

Beijing, China 22 May – 1 June 2017

The Measures<sup>1</sup> adopted at the Fortieth Antarctic Treaty Consultative Meeting are reproduced below from the Final Report of the Meeting.

In accordance with Article IX, paragraph 4, of the Antarctic Treaty, the Measures adopted at Consultative Meetings become effective upon approval by all Contracting Parties whose representatives were entitled to participate in the meeting at which they were adopted (i.e. all the Consultative Parties). The full text of the Final Report of the Meeting, including the Decisions and Resolutions adopted at that Meeting and colour copies of the maps found in this command paper, is available on the website of the Antarctic Treaty Secretariat at [www.ats.aq/documents](http://www.ats.aq/documents).

The approval procedures set out in Article 6 (1) of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty<sup>2</sup> apply to Measures 1 to 8 (2017).

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1As defined in Decision 1 (1995), published in Miscellaneous No. 28 (1996) Cm 3483

2 Treaty Series No. 15 (2006) Cm 6855

The texts of the Antarctic Treaty together with the texts of the Recommendations of the first three Consultative Meetings (Canberra 1961, Buenos Aires 1962 and Brussels 1964) have been published in Treaty Series No. 97 (1961) Cmnd. 1535 and Miscellaneous No. 23 (1965) Cmnd. 2822. The text of the Environmental Protocol to the Antarctic Treaty has been published in Treaty Series No. 6 (1999) Cm 4256. The text of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty has been published in Treaty Series No. 15 (2006) Cm 6855.

The Recommendations of the Fourth to Eighteenth Consultative Meetings, the Reports of the First to Sixth Special Consultative Meetings and the Measures adopted at the Nineteenth and the Measures adopted at the Twenty-sixth, Twenty-seventh, Twenty-eighth, Twenty-ninth, Thirtieth, Thirty-first, Thirty-second, Thirty-third, Thirty-fourth, Thirty-fifth, Thirty-sixth, Thirty-seventh, Thirty-eighth and Thirty-ninth Consultative Meetings were also published as Command Papers. No Command Papers were published for the Twentieth to Twenty-fifth Consultative Meetings.

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## Measure 1 (2017)

### **Antarctic Specially Protected Area No. 109 (Moe Island, South Orkney Islands): Revised Management Plan**

#### **The Representatives,**

*Recalling* Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (“the Protocol”) providing for the designation of Antarctic Specially Protected Areas (“ASPA”) and approval of Management Plans for those Areas;

#### *Recalling*

- Recommendation IV-13 (1966), which designated Moe Island, South Orkney Islands as Specially Protected Area (“SPA”) No. 13 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a revised description of SPA 13 and a Management Plan for the Area;
- Measure 1 (1995), which annexed a revised description and a revised Management Plan for SPA 13;
- Decision 1 (2002), which renamed and renumbered SPA 13 as ASPA 109;
- Measures 1 (2007) and 1 (2012), which adopted revised Management Plans for ASPA 109;

*Recalling* that Recommendation IV-13 (1966) was designated as no longer current by Decision 1 (2011), that Resolution 9 (1995) was designated as no longer current by Resolution 1 (2008), that Recommendation XVI-6 (1991) did not become effective and was withdrawn by Decision (D) 2017 and Measure 1 (1995) did not become effective and was withdrawn by Measure 3 (2012);

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 109;

*Desiring* to replace the existing Management Plan for ASPA 109 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol:

That:

1. the revised Management Plan for Antarctic Specially Protected Area No. 109 (Moe Island, South Orkney Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No. 109 annexed to Measure 1 (2012) be revoked.

## Management Plan for Antarctic Specially Protected Area No. 109

### MOE ISLAND, SOUTH ORKNEY ISLANDS

#### Introduction

The primary reason for the designation of Moe Island, South Orkney Islands (Latitude 60°44'S, Longitude 045°41'W), as Antarctic Specially Protected Area (ASP) No. 109 is to protect environmental values, and primarily the terrestrial flora and fauna within the Area.

The Area was originally designated in Recommendation IV-13 (1966, SPA No. 13) after a proposal by the United Kingdom on the grounds that the Area provided a representative sample of the maritime Antarctic ecosystem, that intensive experimental research on the neighbouring Signy Island might alter its ecosystem and that Moe Island should be specially protected as a control area for future comparison.

These grounds are still relevant. Whilst there is no evidence that research activities at Signy Island have significantly altered the ecosystems there, a major change has occurred in the low altitude terrestrial system as a result of the rapidly expanding Antarctic fur seal (*Arctocephalus gazella*) population. Plant communities on nearby Signy Island have been physically disrupted by trampling by fur seals and nitrogen enrichment from the seals' excreta has resulted in replacement of bryophytes and lichens by the macro-alga *Prasiola crispa*. Low-lying lakes have been significantly affected by enriched run-off from the surrounding land. So far Moe Island has only been invaded by fur seals to a limited extent and its topography makes it less likely that seals will penetrate to the more sensitive areas inland. Moe Island has been visited on few occasions and has never been the site of occupation for periods of more than a few hours.

Resolution 3 (2008) recommended that the "Environmental Domains Analysis for the Antarctic Continent", be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, ASPA 109 is contained within Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment Domain G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 111, 112, 125, 126, 128, 145, 149, 150, and 152 and ASMAs 1 and 4.

Resolution 6 (2012) recommended that the Antarctic Conservation Biogeographic Regions (ACBRs) be used for the 'identification of areas that could be designated as Antarctic Specially Protected Areas within the systematic environmental-geographic framework referred to in Article 3(2) of Annex V to the Environmental Protocol.

ASPAs 109 sits within Antarctic Conservation Biogeographic Region (ACBR) 2 South Orkney Islands.

Through Resolution 5 (2015) Parties recognised the usefulness of the list of Antarctic Important Bird Areas (IBAs) in planning and conducting activities in Antarctica. Within the boundary of ASPA 109 is located IBA ANT020 Moe Island, which was identified due to its extensive colonies of chinstrap penguins, cape petrels and Antarctic prions.

The two other ASPAs present within the South Orkney Islands (ASPAs 110 Lynch Island and ASPA 111 Southern Powell Island and adjacent islands) were designated primarily to protect terrestrial vegetation and bird communities. Moe Island complements the local network of ASPAs by protecting a representative sample of the maritime Antarctic ecosystem including cryptogam-dominated terrestrial and coastal communities.

## **1. Description of values to be protected**

Following a visit to the ASPA in February 2016, the values specified in the earlier designation were reaffirmed. These values are set out as follows:

- The Area contains exceptional environmental values associated with the biological composition and diversity of a near-pristine example of the maritime Antarctic terrestrial and littoral marine ecosystems.
- Moe Island contains the greatest continuous expanses of *Chorisodontium-Polytrichum* moss turf found in the Antarctic.

## **2. Aims and objectives**

Management of Moe Island aims to:

- avoid major changes to the structure and composition of the terrestrial vegetation, in particular the moss turf banks;
- prevent unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microorganisms;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- allow visits for management purposes in support of the aims of the management plan;
- minimise the possibility of introduction of pathogens which may cause disease in bird populations within the Area;

### **3. Management activities**

The following management activities are to be undertaken to protect the values of the Area:

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- The Management Plan shall be reviewed at least every five years and updated as required.
- Markers, signs or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- A copy of this Management Plan shall be made available at Signy Research Station (UK; 60°42'30" S, 045°36'30" W) and Orcadas Station (Argentina; 60°44'15" S, 044°44'20" W).
- Where appropriate, National Antarctic Programmes are encouraged to liaise closely to ensure management activities are implemented. In particular, National Antarctic Programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area. Also, National Antarctic Programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.
- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I of the Protocol on Environmental Protection to the Antarctic Treaty.

### **4. Period of designation**

Designated for an indefinite period.

### **5. Maps**

Figure 1. Map of the location of Moe Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71 °S. Central meridian 45 °W.



Figure 2. Map of Moe Island in greater detail. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71 °S. Central meridian 45 °W.

## 6. Description of the Area

### 6(i) Geographical co-ordinates, boundary markers and natural features

#### - *Boundaries and Co-ordinates*

The boundary co-ordinates of the Area, starting with the most north-westerly position and moving clockwise, are shown in Table 1.

Number	Latitude	Longitude
1	60°43'40'' S	045°42'15'' W
2	60°43'40'' S	045°40'30'' W
3	60°43'55'' S	045°40'10'' W
4	60°44'40'' S	045°40'10'' W
5	60°44'40'' S	045°42'15'' W

The Area includes all of Moe Island and unnamed adjacent islands and islets. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within the boundaries, but excludes the marine environment extending greater than 10 m offshore from the low tide water line (Figure 2). Boundary markers have not been installed.

#### - *General Description of Area*

Moe Island, South Orkney Islands, is a small irregularly-shaped island lying 300 m off the south-western extremity of Signy Island, from which it is separated by Fyr Channel. It is about 1.3 km from the northeast to southwest and 1 km from northwest to southeast (1.22 km<sup>2</sup>). It should be noted that the position of Moe Island on Admiralty Chart No. 1775 (60°44'S, 45°45'W), does not agree closely with the more accurate coordinates in Figure 2 (60°44'S, 45°41'W).

The island rises precipitously on the north-eastern and south-eastern sides to Snipe Peak (226 m altitude). There is a subsidiary summit above South Point (102 m altitude) and lower hills on each of three promontories on the western side above Corral Point (92 m), Conroy Point (39 m) and Spaul Point (56 m). Small areas of permanent ice remain on the east- and south-facing slopes with late snow lying on the steeply dipping western slopes. There are no permanent streams or pools.

#### - *Geology*

The rocks are metamorphic quartz mica schists, with occasional biotite and quartz-rich beds. There is a thin bed of undifferentiated amphibolite on the northeastern coast. Much of the island is overlain with glacial drift and scree. Soils are

predominantly immature deposits of fine to coarse clays and sands intermixed with gravels, stones and boulders. They are frequently sorted by freeze-thaw action in high or exposed locations into small-scale circles, polygons, stripes and lobes. There are deep accumulations of peat (up to 2 m thick on western slopes), considerable expanses of the surface of which are bare and eroded.

- *Terrestrial Biological Communities*

The dominant plant communities are *Andreaea-Usnea* fellfield and banks of *Chorisodontium-Polytrichum* moss turf (the largest known example of this community type in the Antarctic). Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 0.58 km<sup>2</sup> (48% of the ASPA area; Figures 3 and 4). These moss banks constitute a major biological value and a reason for the designation of the Area. The cryptogamic flora is diverse. The majority of these moss banks have received little damage from fur seals, and show few visible signs of degradation. However, the exception to this observation is the northern-most banks located around Spull Point. Here, although still extensive, the moss turf was estimated to have suffered about 50% damage from Antarctic fur seal (*Arctocephalus gazella*) activity during a survey in January 2006 and still evident during observations in February 2016. One sub-adult male Antarctic fur seal was present on this area of moss turf during the survey in January 2006. Almost certainly fur seals gain access to this plant community via the gentle slope leading inland from the small shingle beach located at the north-eastern corner of Landing Cove.

The mites *Gamasellus racovitzai* and *Stereotydeus villosus* and the springtail *Cryptopygus antarcticus* are common under stones.

- *Vertebrate Fauna*

There were five colonies of chinstrap penguins (*Pygoscelis antarctica*) totalling about 11,000 pairs in 1978-79. A visit in February 1994 noted fewer than 100 pairs on the northern side of Landing Cove and more than a thousand on the southern side. A visit in February 2011 noted c. 75 pairs on the northern side of Landing Cove and c. 750 pairs on the southern side. Approximately 100 breeding pairs were observed on Spull Point during a visit in January 2006. Numerous other birds breed on the island, notably about 2,000 pairs of cape petrels (*Daption capensis*) in 14 colonies (1966) and large numbers of Antarctic prions (*Pachyptila desolata*). Snow Petrels (*Pagodroma nivea*) were recorded breeding on Moe Island in 1957/58 when the colony comprised 34 breeding pairs (Croxall *et al.* 1995), and were confirmed breeding during a survey in 2005/06 (R. Fijn pers. comm. 2015, quoted in Harris *et al.*, 2015).

Weddell seals (*Leptonychotes weddellii*), crabeater seals (*Lobodon carcinophaga*) and leopard seals (*Hydrurga leptonyx*) are found in the bays on the west side of the island. Increasing numbers of fur seals (*Arctocephalus gazella*), mostly juvenile males, come ashore on the north side of Landing Cove and have caused some damage to vegetation in that area (25 seals were counted in this area in February 2016).

However, it is possible that the nature of the terrain will restrict these animals to this small headland where damage may intensify.

*6(ii) Access to the Area*

- Where possible, access shall be by small boat. There are no restrictions on landing from the sea. Landings are usually most safely made at the northeast corner of Landing Cove (Lat. 60°43'55" S, Long. 045°41'06" W; Figure 2). If Landing Cove is inaccessible due to the ice conditions, an alternative landing site is at the western-most point of Spaul Point (Lat. 60°43'54" S, Long. 045°41'15" W), directly opposite an offshore rock of 26 m altitude.
- Under exceptional circumstances, necessary for purposes consistent with the objectives of the Management Plan, helicopters may be permitted to land within the Area.
- Helicopters may land only on the col between hill 89 m and the western slope of Snipe Peak (Lat. 60°44'09" S, Long. 045°41'23" W, Figure 2). Landing on vegetation in the col should be avoided to the maximum extent practicable. To avoid overflying bird colonies, approach should preferably be from the south, though an approach from the north is permissible.
- Within the Area the operation of aircraft should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit the Area.
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used, all smoke grenades should be retrieved.

*6(iii) Location of structures within and adjacent to the Area*

A marker board is located at the back of the small shingle beach in the northeast corner of Landing Cove, beyond the splash zone on top of a flat rock, to which it is bolted (Lat. 60°43'55" S, Long. 045°41'05" W). During periods of heavy snowfall, the marker board may be buried and difficult to locate.

There is a cairn and the remains of a survey mast, erected in 1965-66, on Spaul Point (Lat. 60°43'49" S, Long. 045°41'05" W). This mast is of interest for lichenometric studies and should not be removed. There are no other structures on Moe Island.

*6(iv) Location of other Protected Areas in the vicinity*

ASPAs No. 110, Lynch Island, lies about 10 km north-north-east of Moe Island. ASPA No. 111, Southern Powell Island and adjacent islands, is about 41 km to the east (Figure 1).

*6(v) Special zones within the Area*

None.

## **7. Permit conditions**

### *7(i) General permit conditions*

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

Conditions for issuing a Permit to enter the Area are that:

- it is issued for a compelling scientific purpose which cannot be served elsewhere; or
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- a report or reports are supplied to the authority or authorities named in the Permit;
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

### *7(ii) Access to and movement within or over the Area*

- Land vehicles are prohibited within the Area.
- Movement within the Area shall be on foot.
- Pilots, helicopter or boat crew, or other people on helicopters or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimise trampling effects, i.e. all movement should be undertaken carefully so as to minimise disturbance to the soil and vegetated surfaces, walking on rocky terrain if practical.
- Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority.

### *7(iii) Activities which may be conducted in the Area*

- Compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area.
- Essential management activities, including monitoring.

*7(iv) Installation, modification or removal of structures*

No new structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be clearly identified by country, name of the principal investigator and year of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

*7(v) Location of field camps*

Camp in the Area is not normally permitted. If camping is essential for reasons of safety, tents should be erected having regard to causing the least damage to vegetation or disturbance to fauna.

*7(vi) Restrictions on materials and organisms that may be brought into the Area*

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. Further guidance can be found in the CEP Non-native Species Manual (Edition 2011) and COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species. In view of the presence of breeding bird colonies within the Area, no poultry products, including wastes from such products and products containing uncooked dried eggs, shall be released into the Area or into the adjacent sea.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided. Fuel or other chemicals shall not be stored

in the Area unless specifically authorised by Permit condition. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material in situ. The appropriate authority should be notified of anything released and not removed that was not included in the authorised Permit.

*7(vii) Taking of, or harmful interference with, native flora and fauna*

Taking of or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of or harmful interference with animals is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

*7(viii) The collection or removal of materials not brought into the Area by the Permit holder*

Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs.

Other material of human origin likely to compromise the values of the Area which was not brought into the Area by the permit holder or otherwise authorised, may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ; if this is the case the appropriate Authority must be notified and approval obtained.

*7(ix) Disposal of waste*

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

*7(x) Measures that may be necessary to ensure that the aims and objectives of the Management Plan continue to be met*

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, or to carry out protective measures.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.

- Scientific activities shall be performed in accordance with *SCAR's environmental code of conduct for terrestrial scientific field research in Antarctica*.

#### 7(xi) Requirements for reports

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

### 8. Supporting documentation

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Figure 1. Map showing the location of Moe Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica.

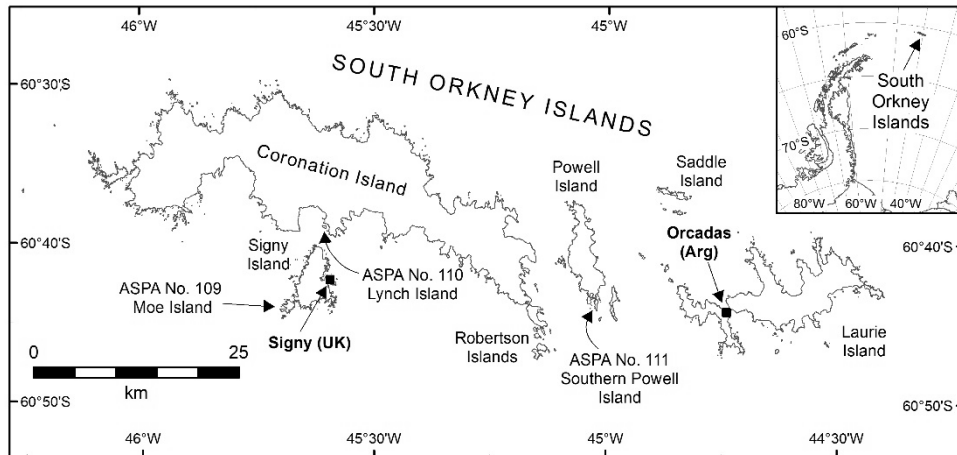


Figure 2. Map of Moe Island in greater detail.

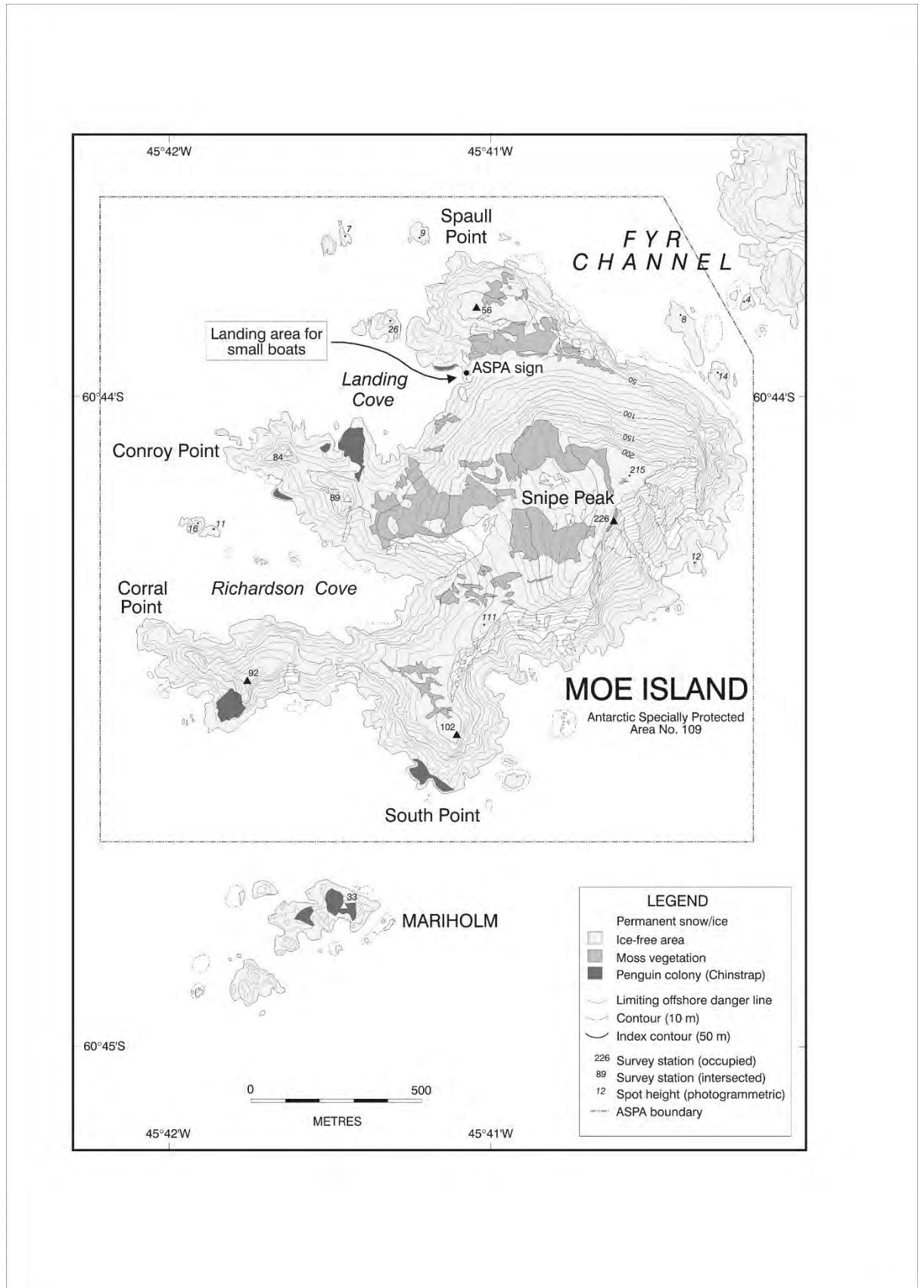
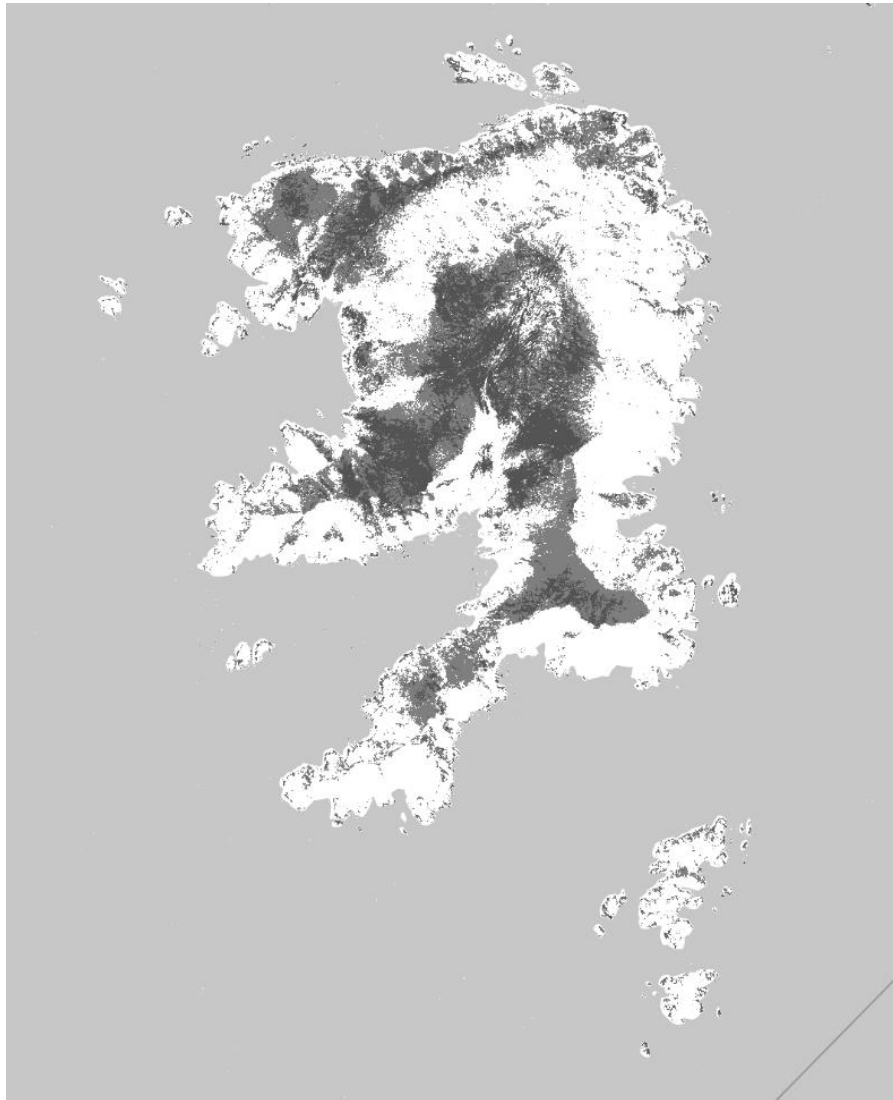


Figure 3. False colour satellite image of ASPA No. 109 Moe Island, South Orkney Islands, which highlights vegetation in red.



Figure 4. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 109 Moe Island, South Orkney Islands, showing vegetation cover using a colour scale of white → orange → red, with red indicating the highest NDVI values.



## Measure 2 (2017)

### **Antarctic Specially Protected Area No. 110 (Lynch Island, South Orkney Islands): Revised Management Plan**

#### **The Representatives,**

*Recalling* Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (“the Protocol”) providing for the designation of Antarctic Specially Protected Areas (“ASPAs”) and approval of Management Plans for those Areas;

#### *Recalling*

- Recommendation IV-14 (1966), which designated Lynch Island, South Orkney Islands as Specially Protected Area (“SPA”) No 14 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a Management Plan for the Area;
- Measure 1 (2000), which annexed a revised Management Plan for SPA 14;
- Decision 1 (2002), which renamed and renumbered SPA 14 as ASPA 110;
- Measure 2 (2012), which adopted a revised Management Plan for ASPA 110;

*Recalling* that Recommendation XVI-6 (1991) and Measure 1 (2000) did not become effective and were withdrawn by Decision (D) 2017;

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 110;

*Desiring* to replace the existing Management Plan for ASPA 110 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol:

That:

1. the revised Management Plan for Antarctic Specially Protected Area No. 110 (Lynch Island, South Orkney Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No. 110 annexed to Measure 2 (2012) be revoked.

## Management Plan for Antarctic Specially Protected Area No. 110

### LYNCH ISLAND, SOUTH ORKNEY ISLANDS

#### Introduction

The primary reason for the designation of Lynch Island, South Orkney Islands (Latitude 60°39'10'' S, Longitude 045°36'25'' W; 0.14 km<sup>2</sup>), as Antarctic Specially Protected Area (ASPA) 110 is to protect environmental values, and primarily the terrestrial flora within the Area.

Lynch Island, Marshal Bay, South Orkney Islands, was originally designated as a Specially Protected Area through Recommendation IV-14 (1966, SPA No. 14) after a proposal by the United Kingdom. It was designated on the grounds that the island "supports one of the most extensive and dense areas of grass (*Deschampsia antarctica*) known in the Treaty area and that it provides an outstanding example of a rare natural ecological system". These values were amplified and extended by Recommendation XVI-6 (1991) when a management plan for the site was adopted.

Lynch Island is 2.4 km from Signy Island, the location of Signy Research Station (UK), and about 200 m from Coronation Island, the largest of the South Orkney Islands. The Area has been afforded special protection for most of the modern era of scientific activity in the region, with entry permits having been issued only for compelling scientific reasons. Thus, the island has not been subjected to frequent visits, scientific research or sampling. Since 1983, the numbers of Antarctic fur seals in the South Orkney Islands has increased significantly, with consequent destruction of accessible areas of vegetation where the seals come ashore. Some vegetated areas on Lynch Island have been damaged, for example, accessible *Polytrichum* and *Chorisodontium* moss banks and *Deschampsia* on the north-eastern and eastern sides of the island have been extensively damaged in some locations. A visit in February 2011 reported fur seals were present over the eastern side of the island [roughly drawing a line between the boat landing site (Lat. 60°39'05'' S, Long. 045°36'12'' W; Figure 2) and the island's summit (Lat. 60°39'05'' S, Long. 045°36'12'' W)]. Seals were present to the highest point of the island with about 30 seals on the summit. Despite this, both the Antarctic hair grass; *Deschampsia Antarctica* and *Colobanthus quitensis* appeared to be thriving. The area covered by *Deschampsia*, as reported in February 2011, is more extensive than in the previous report (February 1999). The grass has now increased its abundance and distribution range in an area to the east of the island, extending west to the highest point on the island with good cover to the summit and all over the area around the summit cairn (Figure 3). During a visit in February 1999 it was observed that the most luxuriant areas of grass on the northern and north-western slopes had not yet been affected and this observation was confirmed during a visit in February 2011. Notwithstanding some localised destruction, to date the primary values of the island, as noted above, have not been significantly compromised by either human or seal access to the island.

Resolution 3 (2008) recommended that the “Environmental Domains Analysis for the Antarctic Continent”, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). ASPA 110 is not categorised within Morgan et al.; however, ASPA 110 is likely to be contained within Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment Domain G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 109, 111, 112, 125, 126, 128, 145, 149, 150, and 152 and ASMAs 1 and 4.

Resolution 6 (2012) recommended that the Antarctic Conservation Biogeographic Regions (ACBRs) be used for the ‘identification of areas that could be designated as Antarctic Specially Protected Areas within the systematic environmental-geographic framework referred to in Article 3(2) of Annex V to the Environmental Protocol. ASPA 110 sits within Antarctic Conservation Biogeographic Region (ACBR) 2 South Orkney Islands.

The two other ASPAs present within the South Orkney Islands (ASPAs No. 109 Moe Island, and ASPA No. 111 Southern Powell Island and adjacent islands) were designated primarily to protect terrestrial vegetation and bird communities. ASPA No. 110 Lynch Island complements the local network of ASPAs by protecting a representative sample of the maritime Antarctic ecosystem including phanerogam-dominated terrestrial communities.

## 1. Description of values to be protected

Following a visit to the ASPA in February 2016, the values specified in the earlier designation were reviewed. Values within the Area are set out as follows:

- The Area contains luxuriant swards of Antarctic hair grass *Deschampsia antarctica* and the only other Antarctic flowering plant, Antarctic pearlwort (*Colobanthus quitensis*), is also abundant. It is also one of few sites where the grass *Deschampsia* is known to grow directly on *Polytrichum-Chorisodontium* moss banks.
- The cryptogamic vegetation is typical of the region; however, several species of moss found on the island (*Polytrichastrum alpinum* (= *Polytrichum alpinum*) and *Muelleriella crassifolia*) are unusually fertile for their southerly location. It is also possibly the only known location in Antarctica where *Polytrichastrum alpinum* develops sporophytes in profusion annually. Furthermore, *Polytrichum strictum* (= *Polytrichum alpestre*) occasionally produces male inflorescences in local abundance, which is a rare occurrence in this species in Antarctica and the rare moss *Plagiothecium ovalifolium* occurs in moist shaded rock crevices near the shore.
- The shallow loam-like soil associated with the grass swards contains a

rich invertebrate fauna. The population density of the arthropod community associated with *Deschampsia* on Lynch Island appears unusually high, with some measurements suggesting it is one of the highest in the world. The site also shows unusual diversity for an Antarctic site. A rare enchytraeid worm was also found in moist moss in rock crevices on the northern side of the island. One arthropod species (*Globoppia loxolineata*) is near the northernmost limit of its known distribution, and specimens collected from Lynch Island exhibited unusual morphological characteristics compared to specimens collected elsewhere in the South Orkney-Antarctic Peninsula region.

- *Chromobacterium* bacteria, yeasts and fungi are found in higher densities than on Signy Island, thought to be a result of the lower acidity of the soils associated with *Deschampsia* and the more favourable microclimate at Lynch Island.
- The shallow gravelly loam-like soil beneath the dense swards of *Deschampsia* may represent one of the most advanced soil types in the Antarctic.

## **2. Aims and objectives**

Management at Lynch Island aims to:

- avoid major changes to the structure and composition of the terrestrial vegetation;
- prevent unnecessary human disturbance to the Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microorganisms;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- ensure that the flora and fauna are not adversely affected by excessive sampling within the Area;
- allow visits for management purposes in support of the aims of the management plan;
- minimise the possibility of introduction of pathogens which may cause disease in vertebrate populations within the Area.

## **3. Management activities**

The following management activities shall be undertaken to protect the values of the Area:

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.



- The Management Plan shall be reviewed at least every five years and updated as required.
- Markers, signs or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- A copy of this Management Plan shall be made available at Signy Research Station (UK; 60°42'30" S, 045°36'30" W) and Orcadas Station (Argentina; 60°44'15" S, 044°44'20" W).
- Where appropriate, National Antarctic Programmes are encouraged to liaise closely to ensure management activities are implemented. In particular, National Antarctic Programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area. Also, National Antarctic Programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.
- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I of the Protocol on Environmental Protection to the Antarctic Treaty.

#### 4. Period of designation

Designated for an indefinite period.

#### 5. Maps and images

Figure 1. Map of the location of Lynch Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71 °S. Central meridian 45 °W.

Figure 2. ASPA No. 110, Lynch Island, South Orkney Islands, topographic map. Projection: Lambert Conformal Conic. Standard parallels: 1<sup>st</sup> 60°40'00" W; 2<sup>nd</sup> 63°20'00" S. Central Meridian: 045°26'20" W. Latitude of Origin: 63°20'00" S. Spheroid: WGS84. Datum: Mean Sea Level. Horizontal accuracy of control points: ±1 m.

Figure 3. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 110 Lynch Island, South Orkney Islands, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values.

## 6. Description of the Area

### 6(i) Geographical co-ordinates, boundary markers and natural features

#### - *Boundaries and Co-ordinates*

The Area encompasses all of Lynch Island but excludes all unnamed adjacent islands and islets. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within Lynch Island, but excludes the marine environment extending greater than 10 m offshore from the low tide water line (Map 2). Boundary markers have not been installed because the coast itself is a clearly defined and visually obvious boundary.

#### - *General Description*

Lynch Island (Latitude 60°39'10" S, Longitude 045°36'25" W; area) is a small island situated at the eastern end of Marshall Bay in the South Orkney Islands, about 200 m south of Coronation Island and 2.4 km north of Signy Island (Map 1). The 500 m x 300 m island has low cliffs of up to 20 m in height on the south, east and west sides, dissected by boulder-filled gullies. The northern side has a low cliff below a rock terrace at about 5-8 m altitude, above which moderate slopes rise to a broad plateau at about 40-50 m, with a maximum altitude of 57 m. A beach at the eastern end of the northern coast affords easy access to relatively gentle slopes leading to the central plateau area. The coastal cliffs generally make access to the upper island by other routes difficult, although access is feasible via one or two of the gullies on the eastern and northern sides. Small temporary melt-streams occur on the slopes in summer, but there are no permanent streams or pools, and only a few small late-lying snow patches occur on the southern side of the island. No meteorological data are available for Lynch Island, but conditions are broadly expected to be similar to those experienced at Signy Research Station. However, anecdotal observations suggest that significant microclimatic differences exist on Lynch Island, as the more profuse growth of plant communities would seem to attest. The island is exposed to the south-west and to katabatic and föhn winds descending from Coronation Island to the north. However, in other respects the island is relatively sheltered from regional northerly, easterly and southerly winds by Coronation Island, Cape Hansen and Signy Island respectively. The föhn effect can briefly raise local air temperatures by as much as 10°C at Signy Island. Lynch Island has often been observed to receive sunshine when the surrounding region is shrouded in low cloud. The angle of solar incidence is also relatively high on the northern side of the island because of its general slope and aspect. The above factors may be important reasons for the abundance of the two flowering plants found on the island.

#### - *Geology*

The bedrock of Lynch Island consists of quartzo-feldspathic and micaceous schists of the Scotia metamorphic complex, but is poorly exposed and equivalent rocks are much better displayed in the Cape Hansen area, to the east on Coronation Island.

- *Pedology*

Three main soil types have been identified on Lynch Island:

(i) An acidic (pH 3.8 – 4.5) moss peat, formed by the tall turf-forming mosses *Chorisodontium aciphyllum* and *Polytrichum strictum* (= *Polytrichum alpestre*), occurs mainly at the north-eastern end of the island. This peat reaches a depth of about 50 cm and is similar to peat on Signy Island where it reaches a depth of 2 m. Where the peat depth exceeds about 30 cm there is permafrost. In a few places where the substratum is moist, shallow peat of 10-15 cm depth (pH 4.8 - 5.5) has accumulated beneath the carpet-forming mosses *Warnstorfia laculosa* (= *Calliergidium austro-stramineum*) and *Sanionia uncinata* (= *Drepanocladus uncinatus*).

(ii) A shallow, gravelly loam-like soil resembling tundra brown soil occurs beneath dense swards of the grass *Deschampsia antarctica*. It is seldom more than about 30 cm in depth (pH 5.0 – 5.8) and probably represents one of the most advanced soil types in the Antarctic.

(iii) A glacial till with material ranging from fine clay (pH 5.2 – 6.0) and sand to gravel and larger stones. This covers the summit plateau and occurs in rock depressions throughout the island, as well as on parts of the rock terrace. On the plateau cryoturbation has in several places sorted the material into patterned features with small stone circles and polygons on level ground and stone stripes on sloping ground. At the north-eastern end of the island, the deposition of limpet shells (*Nacella concinna*) by gulls (*Larus dominicanus*) has resulted in a more calcareous mineral soil in rock depressions with a pH of 6.5 - 6.8.

- *Terrestrial Flora*

Cryptogamic and phanerogamic vegetation typical of the maritime Antarctic is found over much of the island (Figure 3). Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 35,000 m<sup>2</sup> (25% of the ASPA area). The most significant aspect of the vegetation is the abundance and reproductive success of the two native Antarctic flowering plants, the Antarctic hair grass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*), found especially on the northern slopes (Map 3). Both species flower in profusion and seed viability appears to be much greater than on Signy Island. Lynch Island possesses the largest stands of *Deschampsia* and the greatest abundance of *Colobanthus* known in the South Orkney Islands and one of the most extensive anywhere in the Antarctica Treaty area. On the rock terrace and moist slope rising above the northern coast, the grass forms extensive swards of up to 15 × 50 m. These swards range from continuous stands of relatively luxuriant plants on the moister sites and ledges to small, yellowish, more

isolated plants on the drier, stonier and more exposed terrain. *Colobanthus* is generally associated with the grass, but here the plants do not coalesce to form closed patches. This is one of very few sites where *Deschampsia* is known to grow directly on *Polytrichum-Chorisodontium* moss banks. Elsewhere on the island, the grass and, to a lesser extent, the pearlwort are frequent associates in other communities, especially stands of denser fellfield vegetation where there is quite high cover afforded by various mosses and lichens (particularly towards the western end of the northern terrace).

Shallow but occasionally extensive (about 50 m<sup>2</sup>) banks of *Chorisodontium aciphyllum* and *Polytrichum strictum* are frequent at the north-eastern end of the island and, to a lesser extent, on the southern side. These are typical of the moss banks which occur on Signy Island and elsewhere in the northern maritime Antarctic, with several fruticose and crustose lichens growing epiphytically on the moss surface. In small moist depressions, there are carpets of *Warnstorfia laculosa* and *Sanionia uncinata*, with some *Warnstorfia sarmentosa* (= *Calliergon sarmentosum*) and *Cephaloziella varians* (= *C. exiliflora*). On wet soil and rock ledges, *Brachythecium austro-salebrosum* is common. On the drier, more windswept, stonier soils and rock surfaces – notably in the plateau area – a typical open fellfield community of many bryophyte and lichen taxa form a complex mosaic. The dominant species in this locality are the lichens *Usnea antarctica* and *U. aurantiacotra* (= *U. fasciata*) and the moss *Andreaea depressinervis*; *Sphaerophorus globosus* and other species of *Alectoria*, *Andreaea*, *Cladonia*, and *Stereocaulon* are also common, while *Himantormia lugubris* and *Umbilicaria antarctica* are infrequent. Crustose lichens are abundant on all rock surfaces. The mosses and macrolichens in this area are loosely attached on thin soils and are easily damaged. Large thalli of *Usnea spp.* and *Umbilicaria antarctica* are found on moist sheltered boulders and rock faces, especially on the southern side of the island.

Communities of crustose lichen occur in the cliffs above the high water mark, especially where the rock is influenced by breeding or roosting birds. The distribution of several species forms distinctive zones in relation to inundation by sea spray and exposure to wind. The best developed communities of brightly coloured ornithocoprophilous taxa occur at the western end of the island where *Caloplaca spp.*, *Haematomma erythromma*, *Mastodia tessellata*, *Physcia caesia*, *Xanthoria candelaria*, *X. elegans*, and species of *Buellia* and *Verrucaria* are frequent. The uncommon halophilous moss *Muelleriella crassifolia* also occurs within the spray zone around the island.

The only rare moss recorded on Lynch Island is *Plagiothecium ovalifolium*, found in moist, shaded rock crevices near the shore. However, the island is possibly the only site known in the Maritime Antarctic where the moss *Polytrichastrum alpinum* develops sporophytes in profusion each year; this occurs among *Deschampsia*, *Colobanthus* and cryptogams on the northern side of the island; elsewhere in the Antarctic sporophytes are in some years very rare. Also, *Polytrichum strictum* produces male inflorescences in local abundance, a rare phenomenon in this species in the Antarctic. While the thalloid liverwort *Marchantia berteroana* is locally common on Signy Island, Lynch Island is one of very few other localities where it is

known in the South Orkney Islands. Several cryptogamic species of very restricted distribution in the Antarctic, but which are locally common on Signy Island and the mainland of Coronation Island only a few hundred metres away, have not been observed at Lynch Island.

- *Terrestrial Invertebrates*

The microinvertebrate fauna associated with the rich *Deschampsia* swards described thus far comprises 13 taxa: three springtails (*Cryptopygus antarcticus*, *Friesea woyciechowskii* and *Isotoma (Folsomotoma) octooculata* (= *Parisotoma octooculata*), one mesostigmatid mite (*Gamasellus racovitzai*), two cryptostigmatid mites (*Alaskozetes antarcticus* and *Globoppia loxolineata*), and seven prostigmatid mites (*Apotriophydeus* sp., *Ereynetes macquariensis*, *Nanorchestes berryi*, *Stereotydeus villosus*, and three species of *Eupodes*). The number of taxa identified is likely to increase with greater sampling. The community is dominated by the Collembolla, especially *Cryptopygus antarcticus* (84% of all arthropods extracted), with relatively large numbers of *I. octooculata*; the principal mite was an undetermined species of *Eupodes*. *Globoppia loxolineata* is near the northernmost limit of its known distribution. In general, the population density of the arthropod community of grass stands on Lynch Island appears unusually high, with some measurements suggesting it is one of the highest in the world. It also shows considerable diversity for an Antarctic site, although this observation was based on a small number of sample replicates and further sampling would be required to establish densities with greater reliability: this is difficult to achieve on Lynch Island given the very limited extent of communities available for sampling.

Lynch Island was the first site in the Antarctic where a terrestrial enchytraeid was found (in soil beneath a moss *Hennediella antarctica* on a rock ledge above the northern shore); only in a few other sites in the South Orkney Islands have these worms been found – although few samples have been gathered and the species has yet to be identified. Of the tardigrade fauna, most of the 16 individuals isolated from a sample of *Brachythecium* were *Hypsibius alpinus* and *H. pinguis* with some *H. dujardini*, while of 27 isolated from a *Prasiola crispa* sample, almost all were the latter species with a few that were other species of *Hypsibius*.

- *Microorganisms*

The mineral and organic soils of Lynch Island have a slightly higher pH than corresponding soils on nearby Signy Island. This higher base and nutrient status, together with the more favourable microclimate, is reflected in larger numbers of bacteria (including *Chromobacterium*), yeasts and fungi than occur in comparable soils on Signy Island. Bacterial numbers in the *Polytrichum* peat on Lynch Island are about eight times, and in the *Warnstorfia* peat about six times, greater than in corresponding Signy Island peats; yeasts and fungi are similarly much more abundant. Soil associated with the two flowering plants yielded several nematophagous fungi: in *Deschampsia* soil *Acrostalagmus goniodes*, *Cephalosporium balanoides* and *Dactylaria gracilis*; in *Colobanthus* soil, *Cephalosporium balanoides*, *Dactylaria gracilis*, *Dactylella stenobrocha* and

*Harposporium anguillulae* were found. The basidiomycete fungi *Galerina antarctica* and *G. longinqua* occur on moist moss.

- *Vertebrates*

The island has no penguin colonies or substantial breeding colonies of other birds. Groups of chinstrap (*Pygoscelis antarctica*), Adélie (*P. adeliae*) and gentoo (*P. papua*) penguins and, sometimes, blue-eyed cormorants (*Phalacrocorax atriceps*) often congregate at the north-eastern and the western ends of the island. Several pairs of brown skuas (*Catharacta lonnbergii*) and at least two pairs of kelp gulls (*Larus dominicanus*) were observed in the early 1980s to nest at the north-eastern corner. A small colony of Antarctic terns (*Sterna vittata*) may also occur in this vicinity, although in February 1994 breeding was not observed. Cape petrels (*Daption capense*) and snow petrels (*Pagodroma nivea*) breed on the higher cliffs at the eastern end and along the north-western coast of the island. A few pairs of snow petrels and Wilson's storm petrels (*Oceanites oceanicus*) nest on ledges and beneath boulders on the south side of the island.

Weddell seals (*Leptonychotes weddellii*), crabeater seals (*Lobodon carcinophagus*), occasional leopard seals (*Hydrurga leptonyx*), and small groups of southern elephant seals (*Mirounga leonina*) are regularly seen on the coast and on ice floes in the vicinity; none have been known to breed on Lynch Island. Since the early 1980s increasing numbers of Antarctic fur seals (*Arctocephalus gazella*), virtually all being immature non-breeding males, have been observed on Lynch Island, some gaining access up the more gentle north-eastern slopes to vegetated areas, where they have caused local, but severe, damage to *Polytrichum-Chorisodontium* moss banks and other communities.

Seal access to the island is principally from a beach on the northeast coast. Once seals have gained access, there are no further substantial geographical impediments to their more extensive travel over the island. Groups of seals have been observed near the summit. Destruction of swards of *Deschampsia* was first reported in 1988. At the time of the most recent inspection of the island (February 2016), it was observed that the most luxuriant areas of *Deschampsia* and *Colobanthus* on the northern and north-western slopes had not yet been affected. Accessible areas of vegetation in the eastern and north-eastern sides of the island, particularly *Polytrichum* and *Chorisodontium* moss banks, have been severely damaged by Antarctic fur seals. In some eastern and north-eastern areas that have been heavily impacted by fur seals, *Deschampsia* and *Colobanthus* have either been damaged or have died, but at less impacted locations at higher altitudes, these plants continue to grow and may be increasing their abundance and extending their distribution range on the island (see Map 3).

6(ii) *Access to the Area*

- Where possible, access shall be by small boat. Landings from the sea should be at the beach on the eastern end of the northern coast of the island (Lat. 60°39'05" S, Long. 045°36'12" W; Map 2), unless specifically authorised by

Permit to land elsewhere, or when landing at this location is impractical because of adverse conditions.

- Under exceptional circumstances, necessary for purposes consistent with the objectives of the Management Plan, helicopters may be permitted to land within the Area.
- Landing of helicopters within the Area shall be at the designated location on the rock platform (8 m) on the north-western end of the island (Lat. 60°39'04.5" S, Long. 045°36'12" W; Map 2).
- Within the Area the operation of aircraft should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit.
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used, all smoke grenades should be retrieved.

*6(iii) Location of structures within and adjacent to the Area*

There are no structures present in the Area apart from several cairns marking sites used for topographical survey. The island's summit cairn is located at Lat. 60°39'05" S, Long. 045°36'12" W. A sign notifying the protected status of Lynch Island was erected on a prominent rock outcrop above the recommended landing beach in February 1994, but this was destroyed by strong winds.

Signy Research Station (UK) is 6.4 km south at Factory Cove, Borge Bay, on Signy Island.

*6(iv) Location of other protected areas in the vicinity*

The nearest protected areas to Lynch Island are Moe Island (ASPA No. 109), which is about 10 km SSW, and Southern Powell Island and adjacent islands (ASPA No. 111), which is about 35 km to the east (Map 1).

*6(v) Special zones within the Area*

None.

## **7. Permit conditions**

*7(i) General permit conditions*

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

Conditions for issuing a Permit to enter the Area are that:

- it is issued for a compelling scientific purpose which cannot be served elsewhere; or
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- a report or reports are supplied to the authority or authorities named in the Permit;
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

*7(ii) Access to, and movement within or over, the Area*

- Land vehicles are prohibited within the Area
- Movement within the Area shall be on foot.
- Pilots, helicopter or boat crew, or other people on helicopters or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimise trampling effects, i.e. all movement should be undertaken carefully so as to minimise disturbance to the soil and vegetated surfaces, walking on rocky terrain if practical.
- Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority.

*7(iii) Activities which may be conducted in the Area*

- Compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the ecosystem of the Area
- Essential management activities, including monitoring

*7(iv) Installation, modification or removal of structures*



No new structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be clearly identified by country, name of the principal investigator and year of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil (see Section 7(vi)), and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

*7(v) Location of field camps*

Camping should be avoided within the Area. However, when absolutely necessary for purposes specified in the Permit, camping is allowed at the designated site at the north-western end of the island (Lat. 60°39'04" S, Long. 045°36'37" W; Map 2).

*7(vi) Restrictions on materials and organisms which may be brought into the Area*

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. Further guidance can be found in the *CEP non-native species manual* (CEP, 2016) and the *Environmental code of conduct for terrestrial scientific field research in Antarctica* (SCAR, 2009).

No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided. Fuel or other chemicals shall not be stored in the Area unless specifically authorised by Permit condition. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material in situ. The appropriate authority should be notified of anything released and not removed that was not included in the authorised Permit.

*7(vii) Taking, or harmful interference with, native flora or fauna*

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

*7(viii) The collection or removal of materials not brought into the Area by the Permit holder*

Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs.

Permits shall not be granted if there is a reasonable concern that the sampling proposed would take, remove or damage such quantities of soil, native flora or fauna that their distribution or abundance within the Area would be significantly affected.

Other material of human origin likely to compromise the values of the Area which was not brought into the Area by the permit holder or otherwise authorised, may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ; if this is the case the appropriate Authority must be notified and approval obtained.

*7(ix) Disposal of waste*

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

*7(ix) Measures that may be necessary to continue to meet the aims of the Management Plan*

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, or to carry out protective measures.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Scientific activities shall be performed in accordance with *SCAR's environmental code of conduct for terrestrial scientific field research in Antarctica*.

#### 7(xi) Requirements for reports

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

### 8. Supporting documentation

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Figure 1. Map showing the location of Lynch Island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica.

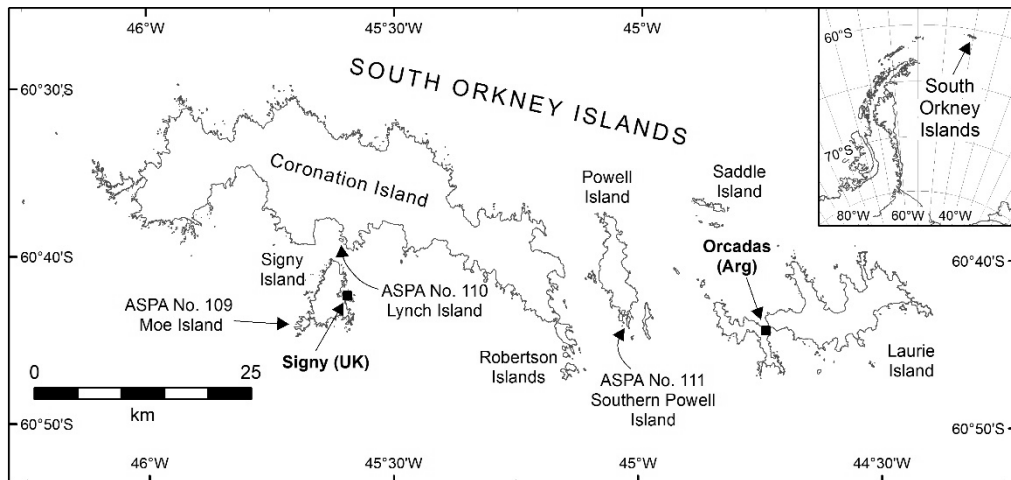


Figure 2. ASPA No. 110, Lynch Island, South Orkney Islands, topographic map.

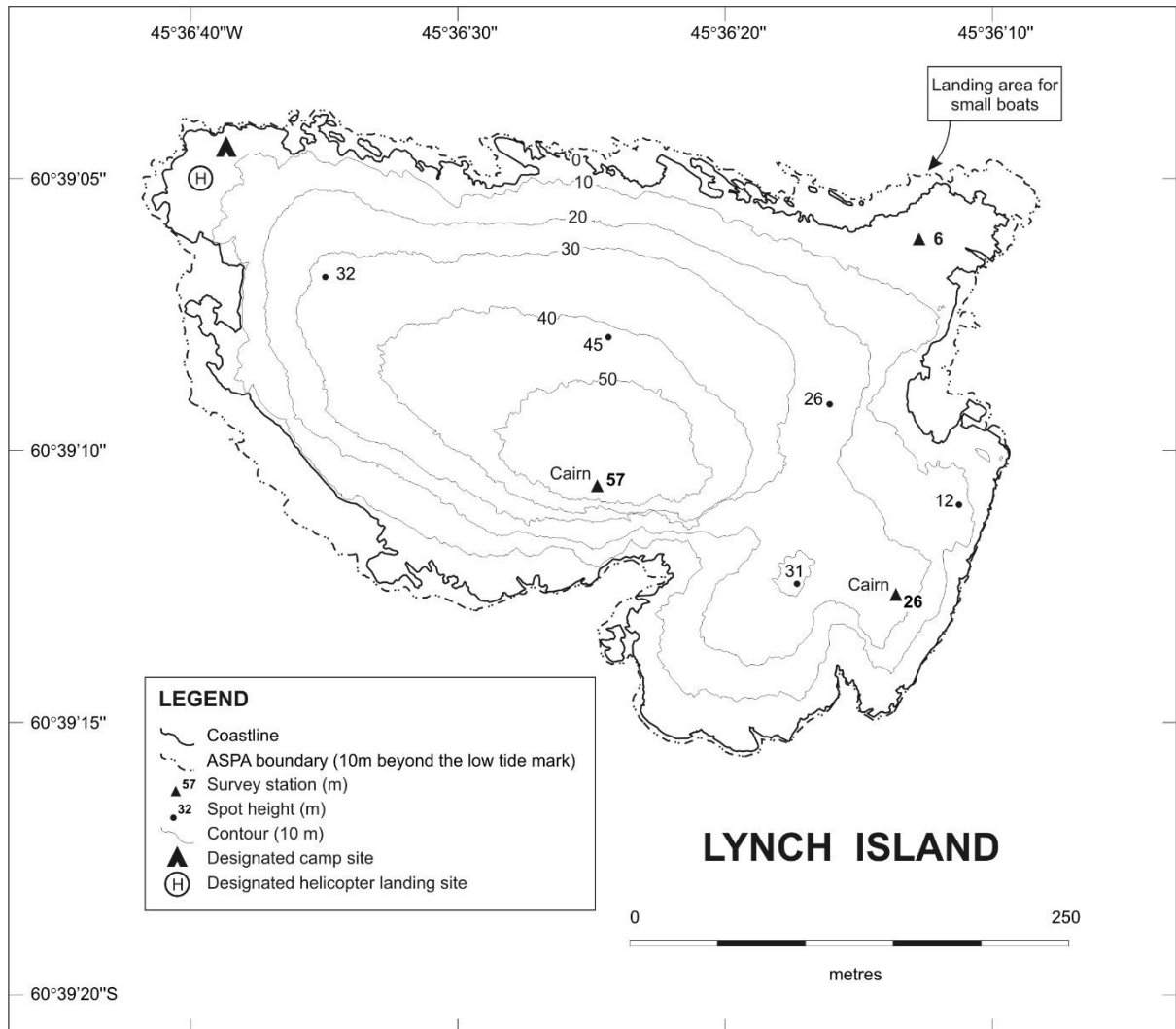
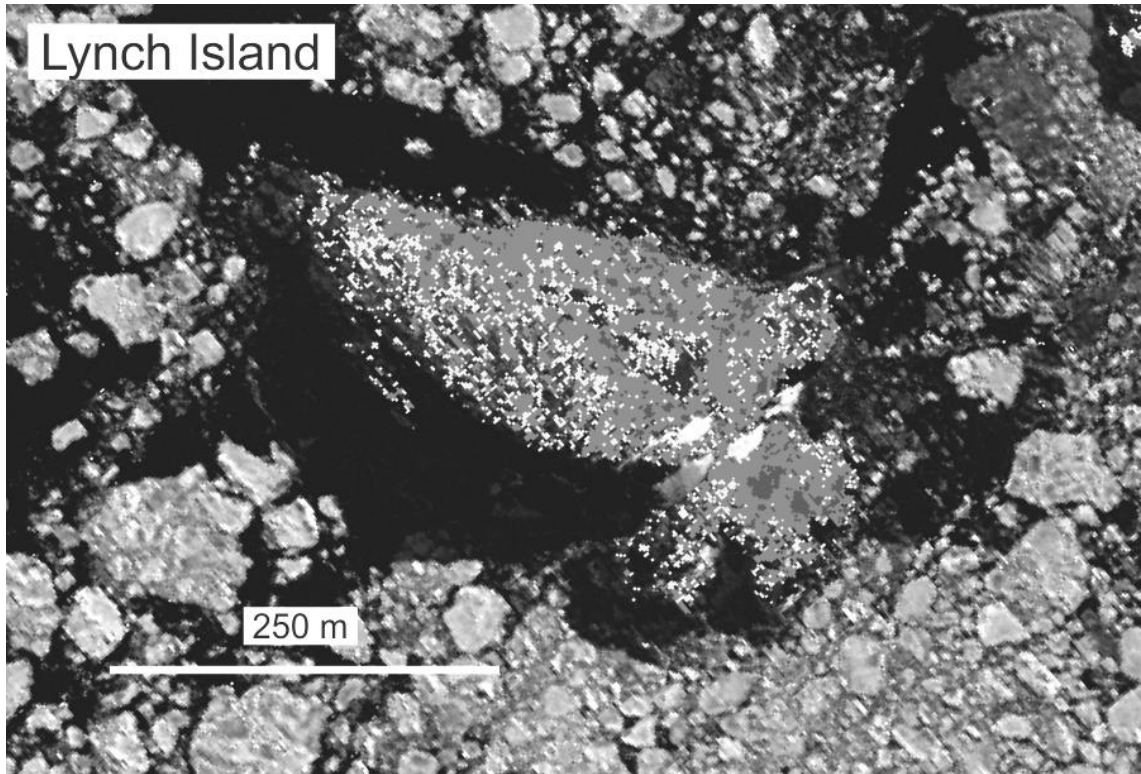


Figure 3. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 110 Lynch Island, South Orkney Islands, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values.



## Measure 3 (2017)

### **Antarctic Specially Protected Area No. 111 (Southern Powell Island and adjacent islands, South Orkney Islands): Revised Management Plan**

#### **The Representatives,**

*Recalling* Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (“the Protocol”) providing for the designation of Antarctic Specially Protected Areas (“ASPA”) and approval of Management Plans for those Areas;

#### *Recalling*

- Recommendation IV-15 (1966), which designated Southern Powell Island and adjacent islands, South Orkney Islands as Specially Protected Area (“SPA”) No. 15 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a Management Plan for SPA 15;
- Measure 1 (1995), which annexed a modified description and a revised Management Plan for SPA 15;
- Decision 1 (2002), which renamed and renumbered SPA 15 as ASPA 111;
- Measure 3 (2012), which adopted a revised Management Plan for ASPA 111;

*Recalling* that Recommendation XVI-6 (1991) did not become effective and was withdrawn by Decision (D) (2017) and Measure 1 (1995) did not become effective and was withdrawn by Measure 3 (2012);

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 111;

*Desiring* to replace the existing Management Plan for ASPA 111 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol:

That:

1. the revised Management Plan for Antarctic Specially Protected Area No. 111 (Southern Powell Island and adjacent islands, South Orkney Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No. 111 annexed to Measure 3 (2012) be revoked.



## **Management Plan for Antarctic Specially Protected Area No. 111**

### **SOUTHERN POWELL ISLAND AND ADJACENT ISLANDS, SOUTH ORKNEY ISLANDS**

#### **Introduction**

The primary reason for the designation of Southern Powell Island and Adjacent Islands, South Orkney Islands (Lat. 62°57'S, Long. 60°38'W) as an Antarctic Specially Protected Area (ASPA) is to protect environmental values, predominantly the breeding bird and seal populations, and to a lesser extent, the terrestrial vegetation within the Area.

The Area was originally designated in Recommendation IV-15 (1966, SPA No. 15) after a proposal by the United Kingdom on the grounds that southern Powell Island and the adjacent islands support substantial vegetation and a considerable bird and mammal fauna. The Area was representative of the natural ecology of the South Orkney Islands, and was rendered more important by the presence of a small colony of Antarctic fur seals (*Arctocephalus gazella*).

The Area is also recognised as having scientific value. It is now well established that climate change is affecting the Southern Ocean, and that the region around the Antarctic Peninsula, Scotia Sea and South Orkney Islands is showing some of the most evident impacts of climate change. Air temperatures and ocean temperatures have increased, some ice shelves have collapsed and seasonal sea ice is now much reduced. This has important consequences for biological communities with some of the most obvious consequences of environment change have been reported for pygoscelid penguins. In particular, Adélie penguins, a species of the pack ice, are now thought to be declining at most localities along the Peninsula and at the South Orkney Islands. Chinstrap penguins, a species of the more open ocean, are now also thought to be in decline. Consequently, understanding penguin foraging behaviour in an attempt to relate it to their preferred foraging habitat is particularly important. Understanding how pygoscelid penguins utilise the ocean around them is critical if we are to adequately protect their breeding colonies, including in highly biodiverse protected areas such as southern Powell Island.

Resolution 3 (2008) recommended that the “Environmental Domains Analysis for the Antarctic Continent”, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, ASPA 111 is contained within Environment Domain G (Antarctic Peninsula off-shore islands geologic). The scarcity of Environment Domain G, relative to the other environmental domain areas, means that substantial efforts have been made to conserve the values found within this environment type elsewhere: other protected areas containing Domain G include ASPAs 109, 112, 125, 126, 128, 140, 145, 149, 150, and 152 and ASMAs 1 and 4. Environment Domain A is also present (Antarctic Peninsula northern

geologic). Other protected areas containing Environment Domain A include ASPAs 128, 151 and ASMA 1.

Resolution 6 (2012) recommended that the Antarctic Conservation Biogeographic Regions (ACBRs) be used for the 'identification of areas that could be designated as Antarctic Specially Protected Areas within the systematic environmental-geographic framework referred to in Article 3(2) of Annex V to the Environmental Protocol. ASPA 111 sits within Antarctic Conservation Biogeographic Region (ACBR) 2 South Orkney Islands.

Through Resolution 5 (2015) Parties recognised the usefulness of the list of Antarctic Important Bird Areas (IBAs) in planning and conducting activities in Antarctica. Important Bird Area ANT015 Southern Powell Island and adjacent islands has the same boundary as ASPA 111, and was identified due to its extensive colonies of chinstrap penguins, Adélie penguins, gentoo penguins, blue-eyed cormorants and southern giant petrels.

The two other ASPAs present within the South Orkney Islands (ASPAs 109 Moe Island and ASPA 110 Lynch Island) were designated primarily to protect terrestrial vegetation. Therefore, ASPA 111 Southern Powell Island and adjacent islands complements the local network of ASPAs by protecting primarily breeding bird and seal populations, but also terrestrial vegetation.

## **1. Description of values to be protected**

Following a visit to the ASPA in February 2016, the values specified in the original designation were reaffirmed and expanded. These values are set out as follows:

- The breeding avifauna within the Area is diverse, including up to four species of penguin [chinstrap (*Pygoscelis antarctica*), gentoo (*P. papua*), Adélie (*P. adeliae*) and macaroni penguins (*Eudyptes chrysolophus*)], Wilson's storm petrels (*Oceanites oceanicus*), cape petrels (*Daption capense*), Dominican gulls (*Larus dominicanus*), southern giant petrels (*Macronectes giganteus*), black-bellied storm petrels (*Fregetta tropica*), blue-eyed cormorants (*Phalacrocorax atriceps*), brown skuas (*Catharacta loennbergi*), sheathbills (*Chionis alba*), snow petrels (*Pagodroma nivea*) and possibly Antarctic prions (*Pachyptila desolata*).
- The longest known breeding site of fur seals in the Antarctic, since their near extermination in the nineteenth century, is found within the Area.
- A diverse flora, typical of the region, including moss banks with underlying peat, moss carpet in wet areas, snow algae and the nitrophilous macroalga *Prasiola crispa* associated with the penguin colonies, is found within the Area.
- The Area has scientific value as a location for the collection of telemetry data in order to explore penguin foraging behaviour. This information will contribute to the development of habitat models that will describe the relationship between penguin foraging behaviour and seasonal sea ice extent.

## **2. Aims and objectives**

Management of southern Powell Island and adjacent islands aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- prevent or minimise the introduction to the Area of non-native plants, animals and microorganisms;
- minimise the possibility of introduction of pathogens which may cause disease in bird populations within the Area;
- preserve the natural ecosystem of the Area as a reference area for future comparative studies and for monitoring floristic and ecological change, colonisation processes and community development;
- allow visits for management purposes in support of the aims of the management plan;
- allow for the gathering of data on the population status of the resident penguins and seals on a regular basis and in a sustainable manner

## **3. Management activities**

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- The Management Plan shall be reviewed at least every five years and updated as required.
- Markers, signs or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- A copy of this Management Plan shall be made available at Signy Research Station (UK; 60°42'30" S, 045°36'30" W) and Orcadas Station (Argentina; 60°44'15" S, 044°44'20" W).
- Where appropriate, National Antarctic Programmes are encouraged to liaise closely to ensure management activities are implemented. In particular, National Antarctic Programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area. Also, National Antarctic Programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.

- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I of the Protocol on Environmental Protection to the Antarctic Treaty.

#### 4. Period of designation

ASPA 111 is designated for an indefinite period.

#### 5. Maps

Map 1. The location of southern Powell Island and adjacent island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica. Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71 °S. Central meridian 45 °W.

Map 2 shows the Area in greater detail.

#### 6. Description of the Area

*6(i) Geographical coordinates and natural features*

- *Boundaries and Co-ordinates*

The corner co-ordinates of the Area are shown in Table 1.

Corner	Latitude	Longitude
northwest	60°42'35'' S	45°04'00'' W
northeast	60°42'35'' S	44°58'00'' W
southwest	60°45'30'' S	45°04'00'' W
southeast	60°45'30'' S	44°58'00'' W

The Area includes all of Powell Island south of the southern summit of John Peaks (415 m altitude), together with the whole of Fredriksen Island, Michelsen Island (a tidal peninsula at the southern tip of Powell Island), Christoffersen Island, Grey Island and unnamed adjacent islands. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within the boundaries, but excludes the marine environment extending greater than 10 m offshore from the low tide water line. All but the Crutchley Ice Piedmont of southern Powell Island are ice-free in summer, though there are patches of semi-permanent or late-lying snow in places.

- *Geology*

The rocks of southern Powell Island, Michelsen Island and Christoffersen Island are conglomerates of Cretaceous-Jurassic age. The two promontories to the west of John Peaks are Carboniferous greywacke-shales. There are boulders containing plant fossils in the glacial deposits around Falkland Harbour. Much of central and southern Fredriksen Island is composed of sandstone and dark phyllitic shales. The north-east and probably most of the north of this island is highly sheared conglomerate with laminated mudstone. The Area has a thick mantle of glacial till, strongly influenced by seabird guano.

- *Biological Communities*

Michelsen Island has little land vegetation, although on the rocks there are extensive communities of lichens dominated by nitrophilous crustose species. These are also widespread on Fredriksen Island and elsewhere on bird-influenced cliffs and rocks near the shore. The most diverse vegetation on Powell Island occurs on the two promontories and associated scree west of Falkland Harbour. Here, and on Christoffersen Island and the northern part of Fredriksen Island, moss banks with underlying peat occur. Wet areas support stands of moss carpet. There are extensive areas of the nitrophilous macroalga *Prasiola crista* associated with the penguin colonies in the area. Snow algae are prominent on the ice piedmont and snow patches in late summer. Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 0.8 km<sup>2</sup> (c. 3% of the ASPA area).

No information is available on the arthropod fauna, but this is probably very similar to that at Signy Island. The springtails *Cryptopygus antarcticus* and *Parisotoma octoculata* and the mites *Alaskozetes antarcticus*, *Stereotydeus villosus* and *Gamasellus racovitzai* occur in great numbers beneath stones.

There are few observations on marine invertebrates and biota in the Area, but this is likely to be very similar to the well-researched Signy Island area. The relatively enclosed Falkland-Ellefsen Harbour area and the bay on the east side of the peninsula are highly influenced by glacial run-off from the ice piedmont.

Large numbers of penguins and petrels breed throughout the Area. There are many thousand pairs of chinstrap penguins (*Pygoscelis antarctica*), mostly on Fredriksen Island. Similarly large numbers of Adélie penguins (*P. adeliae*) occur principally on the southern Powell-Michelsen Island area. Here there are also several thousand pairs of gentoo penguins (*P. papua*) and a very few scattered pairs of macaroni penguins (*Eudyptes chrysolophus*) breeding among the gentoos (for more information see Harris et al., 2015).

Other breeding birds include southern giant petrels (*Macronectes giganteus*), cape petrels (*Daption capensis*), snow petrels (*Pagodroma nivea*), Wilson's storm petrels (*Oceanites oceanicus*), blue-eyed shags (*Phalacrocorax atriceps*), Dominican gulls (*Larus dominicanus*), brown skuas (*Catharacia lonnbergi*), sheathbills (*Chionis alba*), and possibly Antarctic prions (*Pachyptila desolata*) and blackbellied storm petrels (*Fregetta tropica*).

Michelsen Island is the longest known breeding site in the Antarctic of fur seals since their near extermination in the nineteenth century. The number of pups born annually has increased slowly but fairly steadily from 11 in 1956 to about 60 in 1989. Thirty-four live pups were recorded in January 1994. However, numbers have declined, with only four pups recorded during the 2013-14 and 2015-15 breeding seasons. Nevertheless, many transient non-breeding males and juveniles visit the Area during the summer. Other seals are frequent on the beaches, mainly elephant seals (*Mirounga leonina*) and Weddell seals (*Leptonychotes weddelli*). Leopard seals (*Hydrurga leptonyx*) and crabeater seals (*Lobodon carcinophagus*) are occasionally seen on ice floes.

#### *6(ii) Access to the Area*

- Access shall be by small boat.
- There are no special restrictions on boat landings from the sea, or that apply to the sea routes used to move to and from the Area. Due to the large extent of accessible coast around the Area, landing is possible at many locations. Nevertheless, if possible, landing of cargo and scientific equipment should be close to the recommended field camp at 60°43'20''S, 045°01'32''W.
- Under exceptional circumstances necessary for purposes consistent with the objectives of the Management Plan helicopters may be permitted to land at the designated landing site located beside the recommended field camp at 60°43'20''S, 045°01'32''W. Helicopters shall not land elsewhere within the Area.
- To prevent disturbance of breeding avifauna, helicopter landings are prohibited within the Area between the period 1 November to 15 February.
- Within the Area the operation of aircraft should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit.
- Overflying helicopters should avoid sites where there are concentrations of birds (e.g. southern Powell-Michelsen Island area or Fredriksen Island).
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used all smoke grenades should be retrieved.

#### *6(iii) Location of structures within and adjacent to the Area*

Marker boards denoting the Area's protected status are positioned in the following locations:

- Christoffersen Island: on a small promontory on the north-eastern shore of the island at the entrance to Falkland Harbour. The board is located at the back of the beach just below a small Adélie penguin rookery (60°43'36''S, 045°02'08''W).
- Fredriksen Island: at the northern end of the pebble boulder beach on the western side of the island, below a small chinstrap penguin rookery. The board is at the back of the beach on top of a small rock outcrop (60°44'06''S, 044°59'25''W).

Other structures in the area include a marker posts on top of a small rock outcrop at the back of the shingle beach on the east side of the southern promontory of Powell Island (60°43'20''S, 045°01'40''W) and various mooring chains, posts and rings associated with the use of Ellefsen and Falkland Harbours by floating whale factories in the 1910s that are located on the shore.

*6(iv) Location of other protected areas within close proximity of the Area*

ASPAs No. 109, Moe Island, and ASPA No. 110, Lynch Island, are located approximately 35 km west of the Area (see Map 1).

*6(v) Restricted zones within the Area*

None.

## **7. Permit Conditions**

*7(i) General permit conditions*

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

Conditions for issuing a Permit to enter the Area are that:

- it is issued for a compelling scientific purpose which cannot be served elsewhere;
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit must be carried within the Area;
- permits shall be issued for a stated period;

- a report or reports are supplied to the authority or authorities named in the Permit;
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

*7(ii) Access to and movement within or over the Area*

- Land vehicles are prohibited in the Area.
- No pedestrian routes are designated within the Area, but persons on foot should avoid walking on vegetated areas or disturbing wildlife wherever possible.
- To reduce disturbance of bird species, anchoring within Falkland Harbour and Ellefsen Harbour is strongly discouraged, except in an emergency.
- Pilots, air and boat crew, or other people on aircraft or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority.

*7(iii) Activities which may be conducted in the Area*

Activities include:

- compelling scientific research which cannot be undertaken elsewhere
- essential management activities, including monitoring.

*7(iv) Installation, modification or removal of structures*

No new structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be clearly identified by country, name of the principal investigator and year of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil (see Section 7(vi)), and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

*7(v) Location of field camps*

In order to minimise the area of ground within the ASPA impacted by camping activities, tents should be erected at the designated field campsite, located at 60°43'20''S, 045°01'32''W. When necessary for purposes specified in the Permit,



temporary camping beyond the designated field campsite is allowed within the Area. Camps should be located on non-vegetated sites, such as on the drier parts of the raised beaches, or on thick (>0.5 m) snow-cover when practicable, and should avoid concentrations of breeding birds or mammals.

*7(vi) Restrictions on materials and organisms which may be brought into the Area*

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. Further guidance can be found in the CEP Non-native Species Manual (Edition 2011) and COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species. In view of the presence of breeding bird colonies within the Area, no poultry products, including wastes from such products and products containing uncooked dried eggs, shall be released into the Area or into the adjacent sea.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided. Fuel or other chemicals shall not be stored in the Area unless specifically authorised by Permit condition. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material in situ. The appropriate authority should be notified of anything released and not removed that was not included in the authorised Permit.

*7(vii) Taking or harmful interference with native flora and fauna*

Taking of or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of or harmful interference with animals is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

*7(viii) Collection and removal of materials not brought into the Area by the Permit holder*

Collection or removal of anything not brought into the Area by the permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs.

Other material of human origin likely to compromise the values of the Area which was not brought into the Area by the permit holder or otherwise authorised, may be removed from the Area unless the environmental impact of the removal is likely to be greater than leaving the material in situ; if this is the case the appropriate Authority must be notified and approval obtained.

*7(ix) Disposal of waste*

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

*7(ix) Measures that may be necessary to ensure that the aims and objectives of the Management Plan continue to be met*

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, or to carry out protective measures.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Scientific activities shall be performed in accordance with *SCAR's environmental code of conduct for terrestrial scientific field research in Antarctica*.

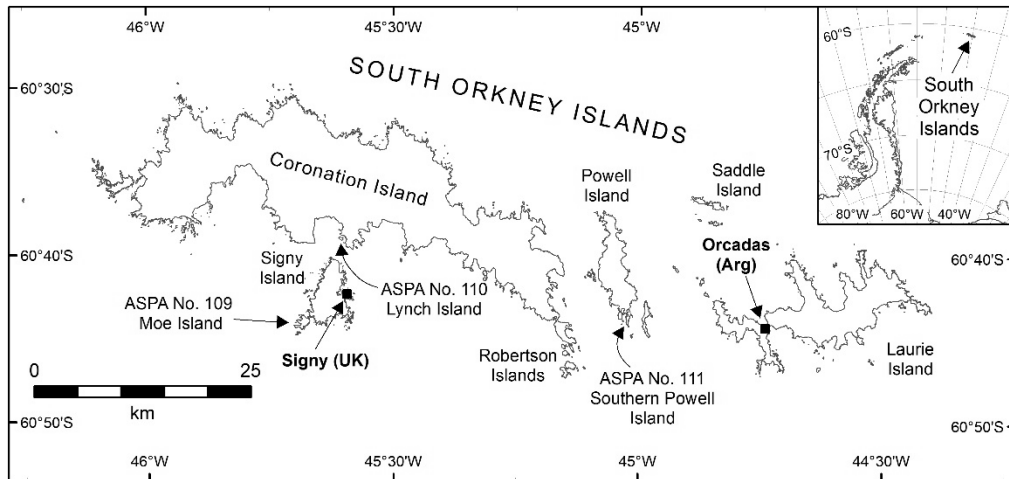
*7(xi) Requirements for reports*

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

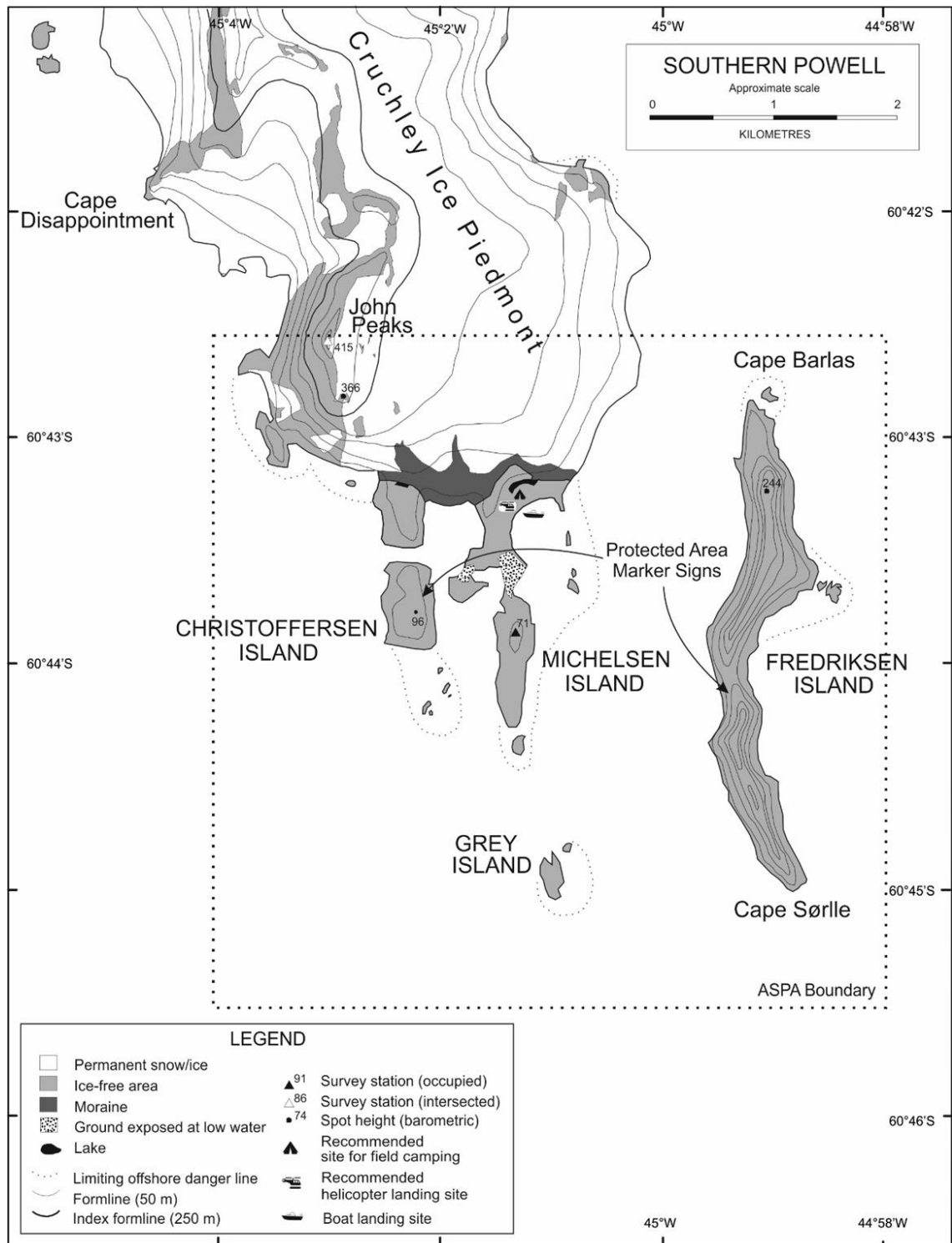
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Map 1. The location of Southern Powell Island and adjacent island in relation to the South Orkney Islands and the other protected areas in the region. Inset: the location of the South Orkney Islands in Antarctica.



Map 2. Southern Powell Island and adjacent islands Antarctic Specially Protected Area No. 111.



## Measure 4 (2017)

### **Antarctic Specially Protected Area No. 115 (Lagotellerie Island, Marguerite Bay, Graham Land): Revised Management Plan**

#### **The Representatives,**

*Recalling* Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (“the Protocol”) providing for the designation of Antarctic Specially Protected Areas (“ASPA”) and approval of Management Plans for those Areas;

#### *Recalling*

- Recommendation XIII-11 (1985), which designated Lagotellerie Island, Marguerite Bay, Graham Land as Specially Protected Area (“SPA”) No. 19 and annexed a map of the Area;
- Recommendation XVI-6 (1991), which annexed a Management Plan for the Area;
- Measure 1 (2000), which annexed a revised Management Plan for SPA 19;
- Decision 1 (2002), which renamed and renumbered SPA 19 as ASPA 115;
- Measure 5 (2012), which adopted a revised Management Plan for ASPA 15;

*Recalling* that Recommendation XVI-6 (1991) and Measure 1 (2000) did not become effective and were withdrawn by Decision (D) 2017;

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 115;

*Desiring* to replace the existing Management Plan for ASPA 115 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol:

That:

1. the revised Management Plan for Antarctic Specially Protected Area No. 115 (Lagotellerie Island, Marguerite Bay, Graham Land), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No. 115 annexed to Measure 5 (2012) be revoked.

## **Management Plan for Antarctic Specially Protected Area No. 115**

### **LAGOTELLERIE ISLAND, MARGUERITE BAY, GRAHAM LAND**

#### **Introduction**

The primary reason for the designation of Lagotellerie Island, Marguerite Bay, Graham Land (Latitude 67°53'20" S, Longitude 67°25'30" W; area 1.58 km<sup>2</sup>) as an Antarctic Specially Protected Area (ASP) is to protect environmental values, and primarily the terrestrial flora and fauna but also the avifauna within the Area.

Lagotellerie Island is approximately 2 km by 1.3 km, oriented generally in an east-west direction. The Area is 11 km south of Porquois Pas Island and 3.25 km west of the south end of Horseshoe Island. Lagotellerie Island was first mapped by Jean-Baptiste Charcot during the *Deuxième Expédition Antarctique Française* in 1908-10. There are no records of further visits until the 1940s, when the island was visited occasionally by American, Argentine and British field parties from nearby scientific stations. The island has not been the subject of any major scientific investigations and is thus largely undisturbed by human activities.

Lagotellerie Island was originally designated as a Specially Protected Area through Recommendation XIII-II (1985, SPA No. 19) after a proposal by the United Kingdom. It was designated on the grounds that the island contains a rich and diverse flora and fauna typical of the southern Antarctic Peninsula region. These values were reiterated in Recommendation XVI-6 (1991) when a management plan for the site was adopted, and are largely reaffirmed again in the present management plan.

Resolution 3 (2008) recommended that the Environmental Domains Analysis for the Antarctic Continent, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, ASPA 115 is contained within Environment Domain B (Antarctic Peninsula mid-northern latitudes geologic). Other protected areas containing Domain B include ASPAs 108, 134, 140 and 153 and ASMAs 4. Resolution 6 (2012) recommended that the Antarctic Conservation Biogeographic Regions (ACBRs) be used for the identification of areas that could be designated as Antarctic Specially Protected Areas within the systematic environmental-geographic framework referred to in Article 3(2) of Annex V to the Environmental Protocol. ASPA 115 Lagotellerie Island sits within ACBR 3 Northwest Antarctic Peninsula (Terauds et al., 2012). Through Resolution 5 (2015) Parties recognised the usefulness of the list of Antarctic Important Bird Areas (IBAs) in planning and conducting activities in Antarctica. Important Bird Area ANT098 Lagotellerie Island has the same boundary as ASPA 115, and was identified due to the presence of a large colony of blue-eyed cormorants.

The three other ASPAs are present within the Marguerite Bay area (ASPAs 107 Emperor Island, Dion Islands, ASPA 117 Avian Island and ASPA 129 Rothera Point). ASPA 107 Emperor Island and ASPA 117 Avian Island were designated to

protect predominantly the avifauna of the area, while ASPA 129 Rothera Point was designated to monitor the impact of the nearby station on an Antarctic fellfield ecosystem. Therefore, Lagotellerie Island complements the local network of ASPAs by primarily protecting terrestrial biological communities.

## 1. Description of values to be protected

Following a visit to the ASPA in February 2017, the values specified in the earlier designation were reaffirmed. These values are set out as follows:

- Lagotellerie Island contains a relatively diverse flora typical of the southern Antarctic Peninsula region. Of particular interest is the abundance of the only two Antarctic flowering plants *Deschampsia antarctica* and *Colobanthus quitensis* which form stands up to 10 m<sup>2</sup>. These are amongst the largest stands known south of the South Shetland Islands, being only 90 km north of their southern limit. Both species flower profusely and the seeds have a greater viability than those produced in the South Orkney or South Shetland Islands.
- Numerous mosses and lichens form well-developed communities on the island. A few of the mosses are fertile, which is a rare phenomenon in most Antarctic localities.
- The island is notable for the occurrence of *Deschampsia antarctica* at the highest recorded altitude south of 56° S, with scattered small plants observed at heights of up to 275 m. The island therefore has a particular future scientific value for study of the influence of altitudinal gradient on biological viability for plant species represented at this site.
- The invertebrate fauna is rich and the island is one of the southernmost sites for the apterous midge *Belgica Antarctica*.
- The shallow loamy soil developed beneath the vegetation and its associated invertebrate fauna and microbiota are probably unique at this latitude.
- There is a colony of Adélie penguins (*Pygoscelis adeliae*) and one of the farthest south colonies of a few dozen blue-eyed cormorants (*Phalacrocorax atriceps*) at the south-east corner of the island. Numerous pairs of brown and south polar skuas (*Catharacta lonnbergii* and *C. maccormicki*) breed on the island.
- The values associated with the penguin and skua colonies are now considered to be their ecological interrelationship with the other biological features of exceptional value noted above.
- Fossiliferous strata present at the eastern end of the island are of particular geological value, as such formations are not commonly exposed in the Antarctic Peninsula Volcanic Group.
- The island has not been subject to frequent visits, scientific research or sampling and therefore may be regarded as one of the most pristine highly vegetated areas in the region.



## **2. Aims and objectives**

Management at Lagotellerie Island aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere which will not jeopardise the natural ecological system in that Area;
- allow visits for management purposes in support of the aims of the management plan;
- prevent or minimise the introduction to the Area of non-native plants, animals and microorganisms;
- minimise the possibility of introduction of pathogens which may cause disease in bird populations within the Area;
- preserve the natural ecosystem of the Area as a reference area for future studies.

## **3. Management activities**

The following management activities are to be undertaken to protect the values of the Area:

- Visits shall be made as necessary to assess whether the ASPA continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- The Management Plan shall be reviewed at least every five years and updated as required.
- Markers, signs or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- A copy of this Management Plan shall be made available at Rothera Research Station (UK; Latitude 67°34' S, Longitude 68°07' W) and General San Martín Station (Argentina; Latitude 68°08' S, Longitude 67°06' W).
- All scientific and management activities undertaken within the Area should be subject to an Environmental Impact Assessment, in accordance with the requirements of Annex I of the Protocol on Environmental Protection to the Antarctic Treaty.

#### 4. Period of designation

The ASPA is designated for an indefinite period.

#### 5. Maps

Figure 1. Lagotellerie Island Antarctic Specially Protected Area No. 115, Marguerite Bay, location map, showing the location of General San Martín Station (Arg.), the station Teniente Luis Carvajal (Chile), Adelaide Island, Rothera Research Station (UK) and nearby ASPA 129 at Rothera Point, also on Adelaide Island, and the location of the other protected areas in the region [Emperor Island, Dion Islands (ASPAs 107) and Avian Island (ASPAs 117)]. 'Base Y' (UK) (Historic Monument No. 63) on Horseshoe Island is shown. Inset: the location of Lagotellerie Island along the Antarctic Peninsula.

Figure 2. Lagotellerie Island (ASPAs 115) topographic map. Map specifications: Projection: Lambert Conformal Conic. Standard parallels: 1st 63° 20' 00" S; 2nd 76° 40' 00" S. Central Meridian: 65° 00' 00" W. Latitude of Origin: 70° 00' 00" S. Spheroid: WGS84. Datum: Mean Sea Level. Vertical contour interval 20 m. Horizontal and vertical accuracy expected to be better than ±5 m.

Figure 3. Lagotellerie Island (ASPAs 115) geological sketch map.

Figure 4. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPAs No. 115 Lagotellerie Island, Marguerite Bay, Graham Land, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values

#### 6. Description of the Area

6(i) Geographical coordinates and natural features

- *Boundaries and Co-ordinates*

The corner co-ordinates of the Area are shown in Table 1.

Corner	Latitude	Longitude
northwest	67°52'30" S	67°27'00" W
northeast	67°52'30" S	67°22'00" W
southwest	67°54'00" S	67°27'00" W
southeast	67°54'00" S	67°22'00" W

The Area includes all of Lagotellerie Island and unnamed adjacent islands and islets. The Area encompasses all of the ice-free ground, permanent ice and semi-permanent ice found within the boundaries, but excludes the marine environment extending greater than 10 m offshore from the low tide water line (Figure 2).

Boundary markers have not been installed because the coast itself is a clearly defined and visually obvious boundary.

Lagotellerie Island is steep-sided and rocky, with about 13% permanent ice cover, most of which is on the southern slopes. The island rises to twin peaks of 268 m and 288 m separated by a broad saddle at around 200 m, with precipitous cliffs up to this height on the south, west and east sides. The upper northern slopes also have steep cliffs, intersected by gullies, screes and traversed by broad rock terraces. The lower northern slopes are more gentle, particularly on the eastern half of the island, with a broad rocky terrace at an elevation of about 15 m which is formed of frost-shattered raised beach debris.

- *Geology*

The bulk of Lagotellerie Island is formed of quartz diorite of unknown age, cut by pink, coarse-grained granodiorite and numerous basic and felsic dykes (Figure 3). At the eastern end of the island the plutonic rocks are in fault contact with folded, mildly hornfelsed volcanic rocks of Jurassic–Cretaceous age. These consist of agglomerates, andesitic lavas and tuffs of the Antarctic Peninsula Volcanic Group, with plant remains – probably Jurassic – present in shaly beds interbedded with tuff. Such fossiliferous strata are not commonly exposed in the Antarctic Peninsula Volcanic Group, and are therefore of particular geological importance.

Locally extensive areas of coarse sand and gravel derived from weathered quartz-diorite occur on slopes, ledges, gullies and depressions; the most extensive accumulations are on the saddle between the two summits where the soil is sorted into well-developed stone polygons, circles and stripes. On the broad rock terraces closed stands of moss and grass have developed a relatively rich loamy earth up to 25 cm in depth. Glacial erratics are common on the island.

- *Terrestrial Biological Communities*

The island has a relatively diverse flora and luxuriant development of plant communities, representative of the southern maritime Antarctic region. Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA to be 0.06 km<sup>2</sup> (c. 3.7% of the ASPA area) (see Figure 4). The rich terrestrial biology of Lagotellerie Island was first noted by Herwil Bryant, biologist at East Base (US, on Stonington Island; now Historic Monument No. 55), during a visit in 1940-41 when he observed growths of moss, the Antarctic hair grass *Deschampsia antarctica*, and "a small flowering plant" (almost certainly the Antarctic pearlwort *Colobanthus quitensis*), in a small gully – believed to be that found at the north-eastern end of the island – which he considered of such unusual richness for the region that he unofficially referred to it as "Shangri-la Valley". He did not describe the less luxuriant but more extensive communities of *Deschampsia antarctica* and *Colobanthus quitensis* found on the higher north-facing slopes of the island. These slopes and terraces also provide favourable microclimatic conditions for growth, with a relatively long snow-free growing season, and support an abundance of *Deschampsia antarctica* and *Colobanthus quitensis*, the grass

forming closed swards of up to 10 m<sup>2</sup> on some of the terraces. These are among the largest stands of these plants known south of the South Shetland Islands. Both species flower abundantly and the seeds have a greater viability than those produced in the South Orkney or South Shetland Islands, yet they are close to the southern limit of their range. Lagotellerie Island, however, is notable for the growth of *Deschampsia antarctica* at the highest altitude recorded south of 56° S, with scattered small plants observed at heights of up to 275 m. *Colobanthus quitensis* has been observed growing up to 120 m on the island.

Lagotellerie Island also has a rich cryptogamic flora, with small stands of well-developed communities containing several mosses and lichens which are rare at this latitude (notably the mosses *Platydictya jungermannioides* and *Polytrichastrum alpinum*, and lichens *Caloplaca isidioclada*, *Fuscoparmelia gerlachei* and *Usnea trachycarpa*). The number of bryophyte species thus far identified include 20 mosses and two liverworts (*Barbilophozia hatcheri* and *Cephaloziella varians*), and there are at least 60 lichen species. A comprehensive floristic survey of the island has not yet been undertaken, and numerous species, especially of crustose lichens, remain to be accurately determined.

Vegetation is best developed on a series of rock terraces at around 30-50 m a.s.l. on the northern side of the island. Here, both *Deschampsia* and *Colobanthus* are abundant, and closed grass swards form stands of several square metres. Associated with these, especially on the moister terraces, are usually the mosses *Brachythecium austro-salebrosum*, *Bryum* spp., *Pohlia nutans*, *Polytrichastrum alpinum* and *Sanionia uncinata*, and liverworts *Barbilophozia hatcheri* and *Cephaloziella varians*. Many of these grass swards are used as nest sites by skuas.

In drier habitats, especially on scree and rock faces, there are locally dense stands dominated by the macrolichens *Usnea sphacelata* and *U. subantarctica*, with *Pseudephebe minuscula*, *Umbilicaria decussata*, and a large number of crustose taxa. Several lichens are associated with the grass and moss communities (e.g. *Cladonia* spp., *Leproloma* spp., *Leptogium puberulum*, *Ochrolechia frigida*, *Psoroma* spp.). Near the penguin and cormorant colonies several colourful nitrophilous lichens are abundant (e.g. *Buellia* spp., *Caloplaca* spp., *Fuscoparmelia gerlachei*, *Xanthoria* spp.).

Numerous lichens (notably *Caloplaca isidioclada*, *Pseudephebe minuscula*, *Usnea sphacelata*, *Umbilicaria decussata* and many crustose taxa) and a few mosses (notably *Grimmia reflexidens*) occur close to the summit of the island, as do scattered individual plants of *Deschampsia*. Few bryophytes produce sporophytes at far southern latitudes, but several mosses are fertile on Lagotellerie Island (e.g. *Andreaea regularis*, *Bartramia patens*, *Bryum amblyodon*, *B. pseudotriquetrum*, *Grimmia reflexidens*, *Hennediella heimii*, *Pohlia nutans*, *Schistidium antarctici*, *Syntrichia princeps*).

Specific studies of the invertebrate fauna have not been conducted on Lagotellerie Island. However, at least six species of arthropod have been recorded: *Alaskozetes antarcticus*, *Gamasellus racovitzai*, *Globoppia loxolineata* (Acari), *Cryptopygus*

*antarcticus*, *Friesea grisea* (Collembola), and *Belgica antarctica* (Diptera, Chironomidae). Several species of nematophagous fungi have been isolated from the soils associated with mosses and *Deschampsia* on Lagotellerie Island (*Cephalosporium balanoides*, *Dactylaria gracilis*, *Dactylella ellipsozona*), species widely distributed in similar habitats throughout the Antarctic and also commonly found in temperate soils.

Bryant reported several small pools present on the island in the early 1940s, which presumably are the same as, or close to, those observed more recently on the extensive flat low-lying ground on the northern side of the island. He recorded the pools contained many phyllopod crustaceans identified as *Branchinecta granulosa*. Rocks in one of the pools were coated in a bright green filamentous alga, on which the mites *Alaskozetes antarcticus* were observed. *A. antarcticus* was also common under pebbles on the pool floor. Other microorganisms of the trochelminth type were observed living in the algae, with a pink rotifer identified as *Philodina gregaria* being especially numerous. Small tufts of a grey-green alga were observed on large pebbles close to the pool bottom. The algae have not been described in more detail, although the presence of *Prasiola crispa* has been noted. More recent observations in the early 1980s suggested there were no permanent freshwater bodies on the island, but temporary runnels in summer were found, with some brackish pools in rock depressions near the northern coast. Inspection visit January 1989 and more recently noted the presence of several small melt pools of around 5-10 m<sup>2</sup>, some with fringing wet moss carpets, and suggested these were probably the habitat of *Belgica antarctica*.

#### - Vertebrate Fauna

A small Adélie penguin (*Pygoscelis adeliae*) colony occupies the eastern promontory of the island (Figure 2). Numbers have varied from a low of perhaps 350-400 pairs based on an estimate made in December 1936 to a high of 2402 pairs recorded in an accurate nest count in November 1955. A count of the colony made on 19 February 2011 noted approximately 1850 adult and juvenile birds (accurate to within 10%). The colony was regularly used as a source of eggs for personnel stationed at the nearby British Base Y on Horseshoe Island between 1955-60. It was reported that some 800 eggs were taken during 1955. The number of breeding pairs dropped to around 1000 in 1959 and 1960. Adélie penguin colonies are known to exhibit high interannual change in numbers as a result of a variety of natural factors, and in March 1981 it was observed that all of the approximately 1000 chicks in the colony had died. A chick count made in February 1983 suggested the colony consisted of approximately 1700 pairs, which is considered accurate to within 15-25%.

A small colony of blue-eyed cormorants (*Phalacrocorax atriceps*) has been observed on the eastern promontory of the island, which is one of the most southerly breeding sites reported for the species. Some 200 immature birds were observed close to the island, within view of the colony, on 16 January 1956. The colony was reported to consist of 10 nests on 17 February 1983. The colony was not seen in the January 1989 inspection on Lagotellerie Island; however, in February 2011, c. 250 adults and chicks were observed and with many nest containing two large chicks.

Brown and south polar skuas (*Catharacta loenbergi* and *C. maccormicki*) are also present, with 12 nests reported in 1956, when it was noted that many of the chicks were definitely south polar skua (*C. maccormicki*). It was estimated in 1958 that five pairs nested around the penguin colony and that both species occurred. A group of 59 non-breeding birds of both species was recorded on 12 January 1989 mid-way along the northern side of the island. Two Wilson's storm petrel (*Oceanites oceanicus*) nests were recorded on 14 January 1956. A kelp gull (*Larus dominicanus*) nest, with eggs, was recorded in the 'Shangri-La Valley' by Bryant in December 1940 (for more information on bird life in the Area see Harris et al., 2015).

The inspection visit in January 1989 reported 12 Weddell seals (*Leptonychotes weddellii*) hauled out on a small shingle beach at the base of a rocky spit on the north coast, but no other seals were seen. In contrast, the inspection visit of February 2011 noted c. 200 fur seals on northern side of the island and within the Adélie penguins colony (particular to the south of the colony above the pebble beaches). Twenty Weddell seals were also observed.

- *Human Impact*

The most significant environmental impact at Lagotellerie Island appears to have been from the practice of egg harvesting to feed personnel at bases operating nearby in the period 1955-60. The inspection visit of February 2017 reported there was no evidence of any recent physical or biological change on the island and it was concluded that the Area was continuing to serve the purpose for which it was designated.

6(ii) *Access to the Area*

- Access to the Area shall be by boat. Access from the sea should be to the northern coast of the island (Figure 2), unless specifically authorised by Permit to land elsewhere or when landing along this coast is impractical because of adverse conditions. The coastline is generally rocky and recommended landing sites are located on the north coast at Lat. 67°52'57'' Long. 067°24'03'' and Lat. 67°53'04'' Long. 067°23'30'' (see Figure 2).
- Access to the Area is not permitted 100 m either side of the gulley on the northeast coast at Lat. 67°53'10'' Long. 067°23'13'' (i.e. the coast below the valley unofficially referred to as "Shangri-la Valley" by Bryant; see Figure 2). The valley inland of this coastline contains the richest vegetation growth on the island, and to reduce trampling impacts, non-essential activity within this area is discouraged (Figure 2). These restrictions apply equally to persons wishing to access the Area via sea ice in the winter.
- Under exceptional circumstances necessary for purposes consistent with the

objectives of the Management Plan helicopters may be permitted to land at the designated landing site located beside the recommended field camp on the broad rock/permanent snow platform about half-way along the northwest coast at about 15 m altitude, and 200 m inland from the sea (Lat. 67°53'04'' Long. 067°23'43''). Helicopters shall not land elsewhere within the Area unless specifically authorized by Permit.

- Within the Area the operation of aircraft should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). When conditions require aircraft to fly at lower elevations than recommended in the guidelines, aircraft should maintain the maximum elevation possible and minimise the time taken to transit.
- Overflight of the eastern end of the island over the penguin/cormorant colony is prohibited below 610 m (2000 feet) (Figure 2).
- Use of helicopter smoke grenades is prohibited within the Area unless absolutely necessary for safety. If used all smoke grenades should be retrieved.

#### *6(iii) Location of structures within and adjacent to the Area*

A cairn and the remains of a mast erected for survey purposes in the 1960s are present on the summit of the island. During the inspection visit in February 2011, some of the cabling and the remains of black survey flag associated with the mast were removed. The five 8-10 m long bamboo posts, from which the original mast was constructed, were collected together and secured along with six metal stakes near the eastern summit of the island (288 m). In February 2017 all of the bamboo posts and metal stakes were removed.

A cairn (c. 1 m high) is present on the north coast of the island (Lat. 67°53'16'' Long. 067°22'51'') and a 30 cm high pile of stones containing a short wooden post with a 2.5 cm diameter metal disc at one end inscribed with the number '10' is present on cliffs west of the penguin colony (Lat. 67°53'17'' Long. 067°22'46''). No other structures are known to exist on the island.

Two year-round scientific research stations operate in the vicinity: General San Martín (Argentina; Lat. 68°08' S, Long. 67°06' W) which is 29.5 km south-southeast, and Rothera Research Station (UK; Lat. 67°34' S, Long. 68°07' W) which is 46 km to the northwest. A summer-only station, Teniente Luis Carvajal (Lat. 67°46' S, Long. 68°55' W), has been operated by Chile at the southern end of Adelaide Island since 1985.

#### *6(iv) Location of other protected areas in the vicinity*

The nearest protected areas to Lagotellerie Island are Emperor Island, Dion Islands (ASPA 107) about 55 km west, Avian Island (ASPA 117) 65 km west and Rothera Point (ASPA 129) 46 km to the northwest (Figure 1). Several Historic Sites and Monuments are located in the vicinity: 'Base Y' (UK) on Horseshoe Island (HSM No. 63); 'Base E' (UK) (HSM No. 64) and buildings and artefacts at and near East

Base (US) (HSM No. 55), both on Stonington Island; and installations of San Martín Station (Argentina) at Barry Island (HSM No. 26).

*6(v) Special zone within the Area*

None.

## **7. Permit conditions**

*7(i) General permit conditions*

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority as designated under Article 7 of Annex V of the Protocol on Environmental Protection to the Antarctic Treaty.

Conditions for issuing a Permit to enter the Area are that:

- it is issued for a compelling scientific purpose which cannot be served elsewhere;
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the natural ecological system in the Area;
- any management activities are in support of the objectives of this Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit must be carried within the Area;
- permits shall be issued for a stated period;
- a report or reports are supplied to the authority or authorities named in the Permit;
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

*7(ii) Access to and movement within over the Area*

- Vehicles are prohibited within the Area.
- Movement within the Area shall be on foot.
- Pilots, helicopter or boat crew, or other people on helicopters or boats, are prohibited from moving on foot beyond the immediate vicinity of their landing site unless specifically authorised by Permit.
- Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimise trampling effects, i.e. all movement should be undertaken carefully so as to minimise disturbance to the soil and vegetated surfaces, walking on rocky terrain if practical.
- Overflight of bird colonies within the Area by Remotely Piloted Aircraft



Systems (RPAS) shall not be permitted unless for scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority.

*7(iii) Activities which may be conducted in the Area*

- Scientific research that will not jeopardise the ecosystem or scientific values of the Area and which cannot be served elsewhere;
- Essential management activities, including monitoring.

*7(iv) Installation, modification or removal of structures*

No new structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be clearly identified by country, name of the principal investigator and year of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area (see Section 7(vi)). Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

*7(v) Location of field camps*

When necessary for purposes specified in the Permit, temporary camping is allowed at the designated site on the broad rock/permanent snow platform about half-way along the northwest coast at about 15 m altitude, and 200 m inland from the sea (Lat. 67°53'04'' Long. 067°23'43''; Figure 2).

*7(vi) Restrictions on materials and organisms which can be brought into the Area*

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. Further guidance can be found in the *CEP non-native species manual* (CEP, 2016) and the *Environmental code of conduct for terrestrial scientific field research in Antarctica* (SCAR, 2009). In view of the presence of breeding bird colonies within the Area, no poultry products, including wastes from such products and products containing uncooked dried eggs, shall be released into the Area or into the adjacent sea.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable should be avoided. Fuel or other chemicals shall not be stored in the Area unless specifically authorised by Permit condition. They shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment. Materials introduced into the Area shall be for a stated period only and shall be removed by the end of that stated period. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*. The appropriate authority should be notified of anything released and not removed that was not included in the authorised Permit.

*7(vii) Taking or harmful interference with native flora or fauna*

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

To prevent human disturbance of the breeding cormorant colony and in particular the premature fledging of juvenile cormorants, visitors shall not approach within 10 m of the cormorant colony on the eastern tip of the island between 15 October and 28 February, unless authorised by Permit for specific scientific or management purposes.

*7(viii) Collection and removal of materials not brought into the Area by the Permit holder*

Collection or removal of anything not brought into the Area by the Permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs. Permits shall not be granted in instances where it is proposed to take, remove or damage such quantities of soil, native flora or fauna that their distribution or abundance on Lagotellerie Island would be significantly affected. Anything of human origin likely to compromise the values of the Area, which was not brought into the Area by the Permit Holder or otherwise authorised, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ*: if this is the case the appropriate authority should be notified.

*7(ix) Disposal of waste*

As a minimum standard, all waste shall be disposed of in accordance with Annex III to the Protocol on Environmental Protection to the Antarctic Treaty. In addition, all wastes shall be removed from the Area. Liquid human wastes may be disposed of

into the sea. Solid human waste should not be disposed of to the sea, but shall be removed from the Area. No solid or liquid human waste shall be disposed of inland.

*7(x) Measures that may be necessary to ensure that the aims and objectives of the Management Plan continue to be met*

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, or to carry out protective measures.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Scientific activities shall be performed in accordance with *SCAR's environmental code of conduct for terrestrial scientific field research in Antarctica*.

*7(xi) Requirements for reports*

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

## **8. Supporting documentation**

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Figure 1. Lagotellerie Island Antarctic Specially Protected Area No. 115, Marguerite Bay, location map, showing the location of General San Martín Station (Arg.), the station Teniente Luis Carvajal (Chile), Adelaide Island, Rothera Research Station (UK) and nearby ASPA 129 at Rothera Point, also on Adelaide Island, and the location of the other protected areas in the region [Emperor Island, Dion Islands (ASPAs 107) and Avian Island (ASPAs 117)]. 'Base Y' (UK) (Historic Monument No. 63) on Horseshoe Island is shown. Inset: the location of Lagotellerie Island along the Antarctic Peninsula.

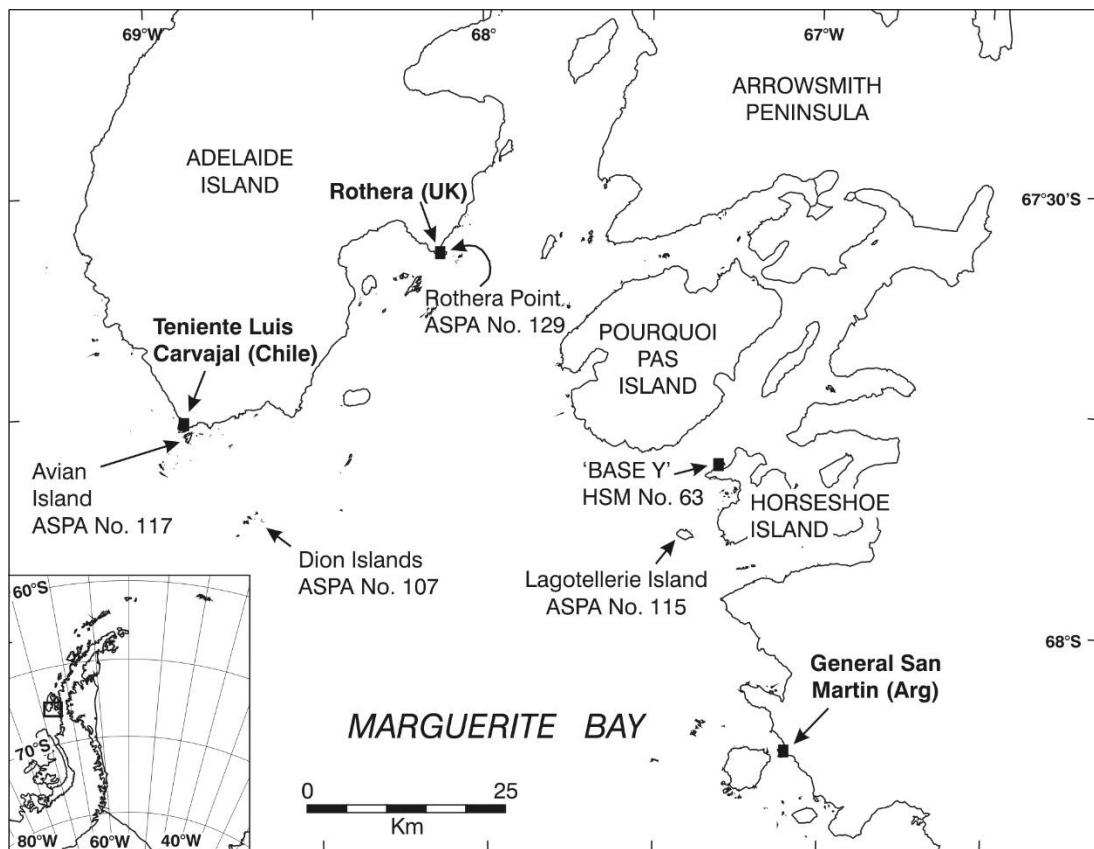


Figure 2. Lagotellerie Island (ASPA 115) topographic map.

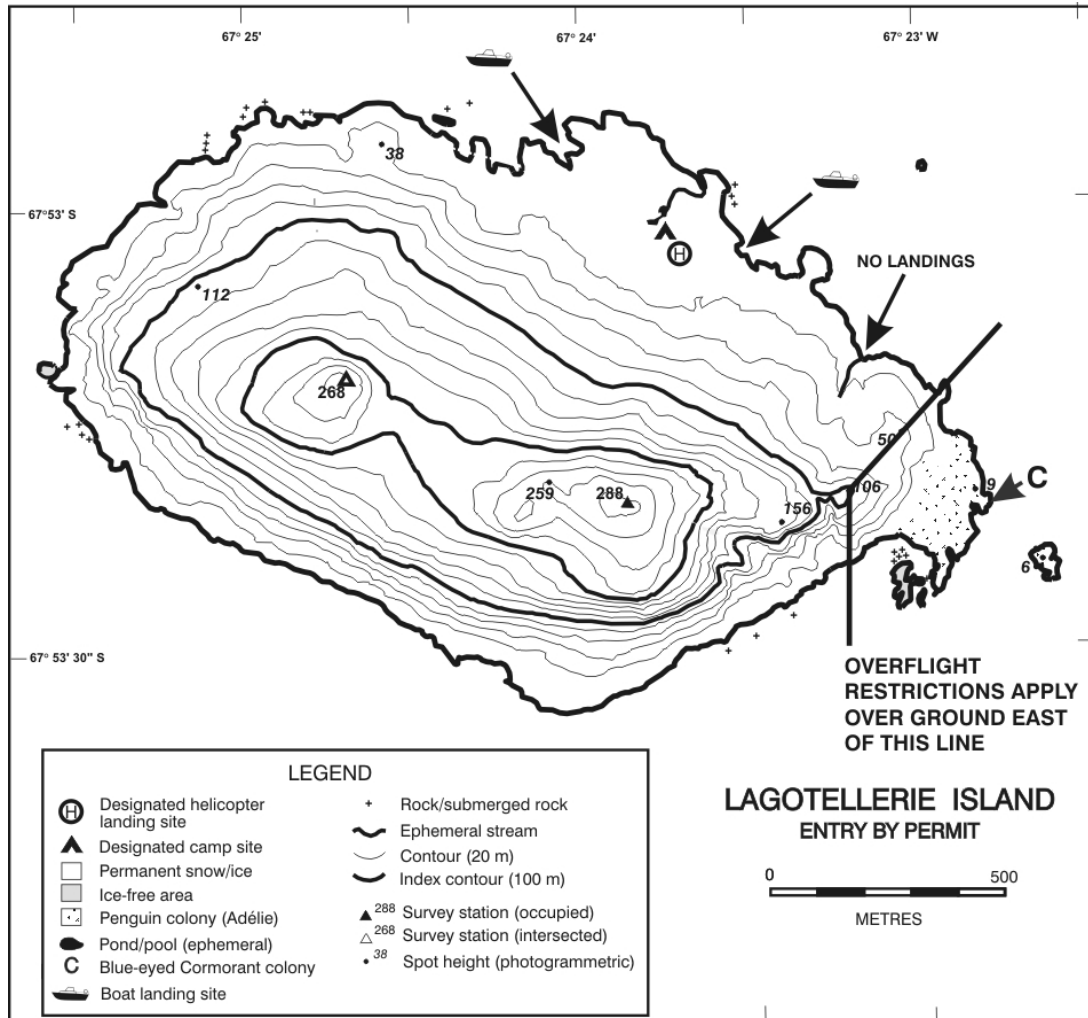


Figure 3. Lagotellerie Island (ASPA 115) geological sketch map.

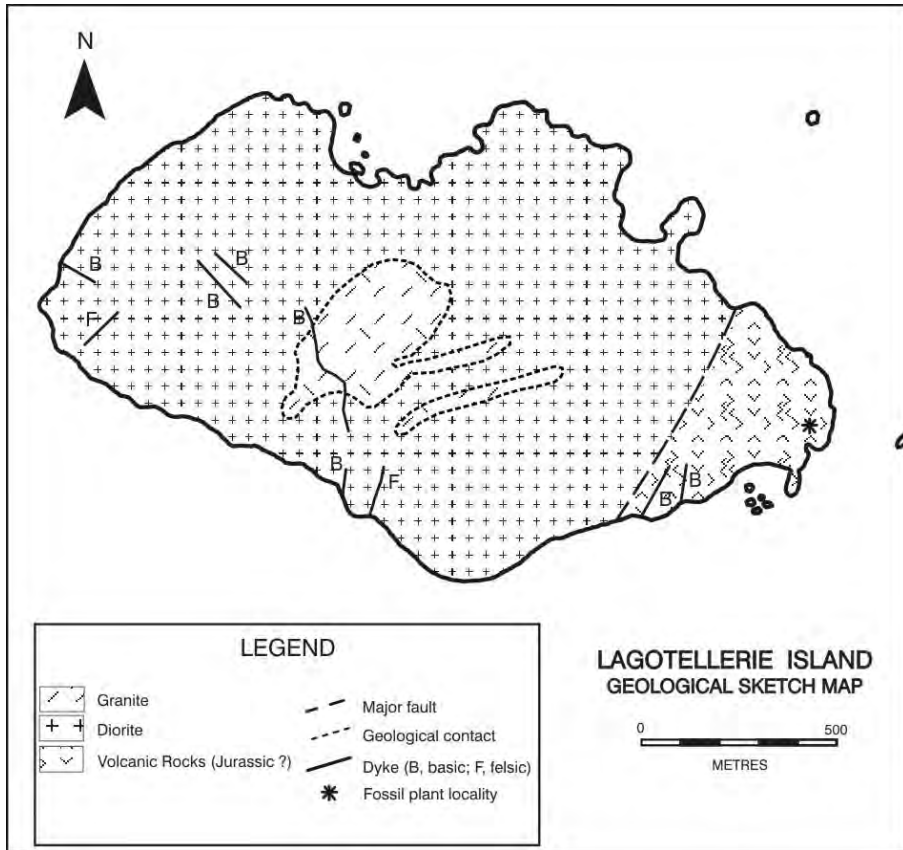
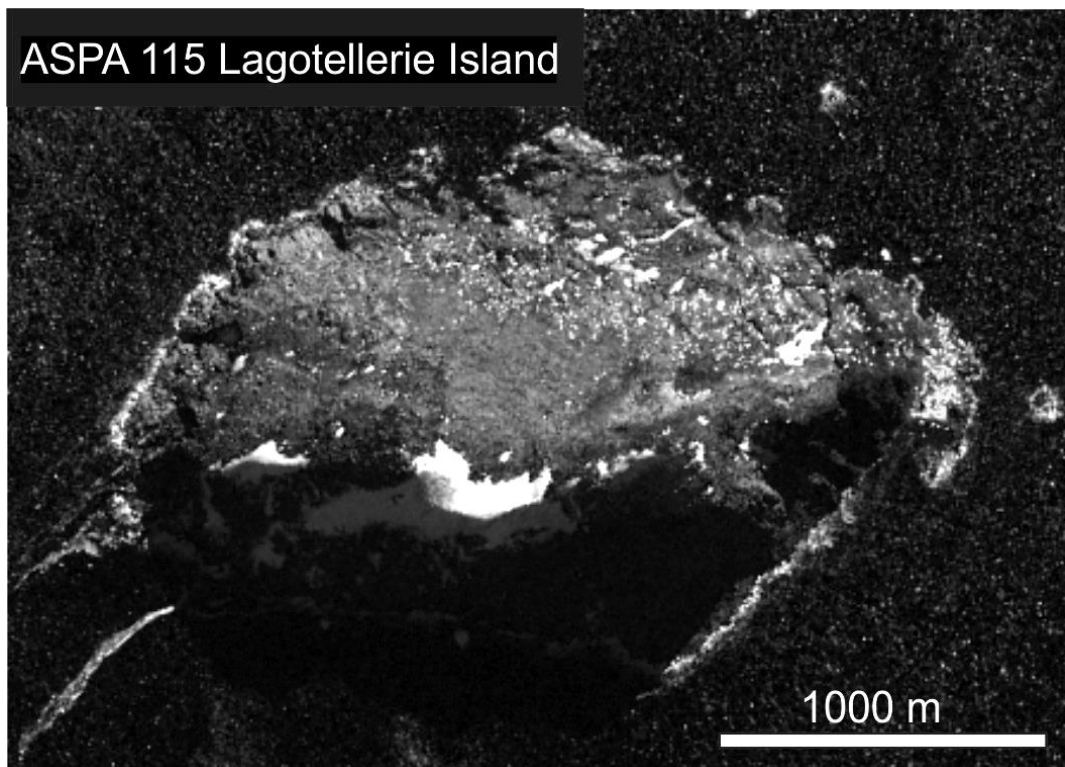




Figure 4. Normalised Difference Vegetation Index (NDVI), derived from satellite imagery, for ASPA No. 115 Lagotellerie Island, Marguerite Bay, Graham Land, showing green vegetation cover using a colour scale of yellow → orange → red, with red indicating the highest NDVI values.



## Measure 5 (2017)

### **Antarctic Specially Protected Area No. 129 (Rothera Point, Adelaide Island): Revised Management Plan**

#### **The Representatives,**

*Recalling* Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (“the Protocol”) providing for the designation of Antarctic Specially Protected Areas (“ASPAs”) and approval of Management Plans for those Areas;

#### *Recalling*

- Recommendation XIII-8 (1985), which designated Rothera Point, Adelaide Island as Site of Special Scientific Interest (“SSSI”) No. 9 and annexed a Management Plan for the Site;
- Resolution 7 (1995), which extended the expiry date of SSSI 9;
- Measure 1 (1996), which annexed a revised description and a revised Management Plan for SSSI 9;
- Decision 1 (2002), which renamed and renumbered SSSI 9 as ASPA 129;
- Measure 1 (2007), which adopted a revised Management Plan for ASPA 129 and revised its boundaries;
- Measure 6 (2012), which adopted a revised Management Plan for ASPA 129;

*Recalling* that Resolution 7 (1995) was designated as no longer current by Decision 1 (2011) and that Measure 1 (1996) did not become effective and was withdrawn by Measure 10 (2008);

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 129;

*Desiring* to replace the existing Management Plan for ASPA 129 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol:

That:

1. the revised Management Plan for Antarctic Specially Protected Area No. 129 (Rothera Point, Adelaide Island), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No. 129 annexed to Measure 6 (2012) be revoked.

## **Management Plan for Antarctic Specially Protected Area (ASP) No. 129**

### **ROTHERA POINT, ADELAIDE ISLAND**

#### **Introduction**

The primary reason for the designation of Rothera Point, Adelaide Island (Lat. 68°07'S, Long. 67°34'W), South Shetland Islands, as an Antarctic Specially Protected Area (ASP) is to protect scientific values, primarily that the Area would serve as a control area, against which the effects of human impact associated with the adjacent Rothera Research Station (UK) could be monitored in an Antarctic fellfield ecosystem. Rothera Point was originally designated in Recommendation XIII-8 (1985, SSSI No. 9) after a proposal by the United. The Area itself has little intrinsic nature conservation value.

The Area is unique in Antarctica as it is the only protected area currently designated solely for its value in the monitoring of human impact. The objective is to use the Area as a control area which has been relatively unaffected by direct human impact, in assessing the impact of activities undertaken at Rothera Research Station on the Antarctic environment. Monitoring studies undertaken by the British Antarctic Survey (BAS) began at Rothera Point in 1976, before the establishment of the station later that year. On-going environmental monitoring activities within the Area and Rothera Point include: (i) assessment of heavy metal concentrations in lichens; (ii) measurement of hydrocarbon and heavy metal concentrations in gravel and soils and (iii) survey of the breeding bird populations.

Resolution 3 (2008) recommended that the “Environmental Domains Analysis for the Antarctic Continent”, be used as a dynamic model for the identification of Antarctic Specially Protected Areas within the systematic environmental-geographical framework referred to in Article 3(2) of Annex V of the Protocol (see also Morgan et al., 2007). Using this model, Rothera Point is predominantly Environment Domain E (Antarctic Peninsula and Alexander Island main ice fields) which is also found in ASPAs 113, 114, 117, 126, 128, 129, 133, 134, 139, 147, 149, 152 and ASMA 1 and 4. However, given that Rothera Point is predominantly ice-free this domain may not be full representative of the environment encompassed within the Area. Although not specifically described as such, Rothera Point may also contain Environment Domain B (Antarctic Peninsula mid-northern latitudes geologic). Other protected areas containing Environment Domain B include ASPAs 108, 115, 134, 140 and 153 and ASMA 4. Resolution 6 (2012) recommended that the Antarctic Conservation Biogeographic Regions (ACBRs) be used for the ‘identification of areas that could be designated as Antarctic Specially Protected Areas within the systematic environmental-geographic framework referred to in Article 3(2) of Annex V to the Environmental Protocol. ASPA No. 129 sits within Antarctic Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula.

## **1. Description of values to be protected**

- The Area itself has little intrinsic nature conservation value. However, it has scientific value as a control area, against which the effects of human impact associated with the adjacent Rothera Research Station (UK) could be monitored in an Antarctic fellfield ecosystem.
- The Area also has value as a biological research site, particularly for scientists working in the Bonner Laboratory (Rothera Research Station).

## **2. Aims and objectives**

Management of the Area aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- avoid major changes to the structure and composition of the terrestrial ecosystems, in particular to the fellfield ecosystem and breeding birds, by (i) preventing physical development within the site, and (ii) limiting human access to the Area to maintain its value as a control area for environmental monitoring studies;
- allow scientific research and monitoring studies in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- minimize to the maximum extent practicable, the introduction of non-native species, which could compromise the scientific values of the Area;
- preserve the natural ecosystem of the Area as a reference area for future comparative studies;
- allow regular visits for management purposes in support of the objectives of the management plan.

## **3. Management activities**

The following management activities are to be undertaken to protect the values of the Area:

- Signboards illustrating the location and boundary of the Area and stating entry restrictions shall be erected at the major access points and serviced on a regular basis;
- A map showing the location and boundaries of the Area and stating entry requirements shall be displayed in a prominent position at Rothera Research Station;
- Visits shall be made as necessary to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate;
- Abandoned equipment or materials shall be removed to the maximum

extent possible provided doing so does not adversely impact on the environment and the values of the Area.

#### 4. Period of designation

Designated for an indefinite period.

#### 5. Maps

Map 1. ASPA No. 129 Rothera Point, location map.

Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45'W.

Map 2. ASPA No. 129 Rothera Point, topographic map.

Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45'W.

#### 6. Description of the Area

##### *6 (i) Geographical coordinates, boundary markers and natural features*

##### *- Boundaries and Coordinates*

Rothera Point (67°34'S, 68°08'W) is situated in Ryder Bay, at the south-east corner of Wright Peninsula on the east side of Adelaide Island, south-west Antarctic Peninsula (Map 1). The Area is the north-eastern one-third of Rothera Point (Map 2), and is representative of the area as a whole. It extends about 280 m from west to east and 230 m from north to south, and rises to a maximum altitude of 36 m. At the coast, the Area boundary is the 5 m contour. No upper shore, littoral or sublittoral areas of Rothera Point are therefore included within the ASPA. The southern boundary of the Area, running across Rothera Point, is partially marked by rock filled gabions, in which are placed ASPA boundary signs. The remaining boundary is unmarked. There are two signboards just outside the perimeter of the Area located at the starting points of the pedestrian access route around Rothera Point (see Map 2). The boundary is broadly represented by the following co-ordinates, listed in a clockwise direction, starting with the most northerly point:

Area	Number	Latitude	Longitude
ASPA 129 Rothera Point	1	67°33'59'' S	068°06'47'' W
	2	67°34'06'' S	068°06'48'' W
	3	67°34'06'' S	068°07'00'' W
	4	67°34'02'' S	068°07'08'' W

Rothera Research Station (UK) lies about 250 m west of the western boundary of the Area (see inset on Map 2).

- *General Description*

Small areas of permanent ice occur to the north and south of the summit of the ASPA. There are no permanent streams or pools. The rocks are predominantly heterogeneous intrusions of diorite, granodiorite and adamellite of the mid-Cretaceous-Lower Tertiary Andean Intrusive Suite. Veins of copper ore are prominent bright green stains on the rock. Soil is restricted to small pockets of glacial till and sand on the rock bluffs. Local deeper deposits produce scattered small circles and polygons of frost sorted material. There are no extensive areas of patterned ground. Accumulations of recent and decaying limpet (*Nacella concinna*) shells forming patches of calcareous soil around prominent rock outcrops used as bird perches by Dominican gulls (*Larus dominicanus*). There are no accumulations of organic matter. There are no special or rare geological or geomorphological features in the Area.

The limited terrestrial biological interest within the Area is confined to the rock bluffs where there is a locally abundant growth of lichens. The vegetation is representative of the southern "maritime" Antarctic fellfield ecosystem and is dominated by the fruticose lichens *Usnea antarctica*, *Usnea sphacelata*, and *Pseudephebe minuscula*, and the foliose lichen *Umbilicaria decussata*. Numerous crustose lichens are found, but bryophytes (mainly *Andreaea* spp.) are sparse. The invertebrate fauna is impoverished and consists only of a few species of mites and springtails, of which *Halozetes belgicae* and *Cryptopygus antarcticus* are the most common. There are no special or rare terrestrial flora or fauna in the Area. During monitoring studies undertaken in January 2015, no non-native springtails were found within the ASPA or elsewhere on Rothera Point.

Brown and south polar skuas (*Catharacta lonnbergii* and *C. maccormicki*) are the most abundant breeding birds found in the Area, with up to five pairs of skuas recorded nesting. A pair of Dominican gulls (*Larus dominicanus*) nest in the Area and one Wilson's storm petrels (*Oceanites oceanicus*) nest has been found.

6(ii) *Access to the Area*

- Access to the Area shall be by foot.
- Helicopter landings are prohibited within the Area.
- The operation of aircraft should be carried out, to the maximum extent possible, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). However, the Area is only c. 250 m from the Rothera Research Station runway and for reasons of safety it is recognized that full compliance may not always be possible.
- The Area boundary extends to the 5 m contour at the coast. There is unrestricted pedestrian access below this contour height around the boundary of the Area. The recommended pedestrian access route follows the Mean High Water Mark (MHW) and is shown on Map 2. During periods when the ground is snow-covered and sea ice has formed, pedestrians should ensure that they are at a safe distance from the shoreline and are not in danger of straying onto unreliable sea ice or into tide cracks.

*6 (iii) Location of structures within and adjacent to the Area*

A rock cairn marks the summit of the Area (36 m; Lat. 68°34'01.5'' S, Long. 068°06'58'' W) and 35 m to the east south east of it there is another cairn marking a survey station (35.4 m; Lat. 68°34'02'' S, Long. 068°06'55'' W).

Rothera Research Station (UK) lies about 250 m west of the western boundary of the Area (see inset on Map 2). A number of masts and aerials exist on the raised beach that is adjacent to the southern boundary of the Area.

*6 (iv) Location of other protected areas in the vicinity*

ASPAs No. 107, Emperor Island, Dion Islands, Marguerite Bay, lies about 15 km south of Adelaide Island. ASPA No. 115, Lagotellerie Island, Marguerite Bay, lies about 11 km south of Pourquoi Pas Island. ASPA No. 117, Avian Island, Marguerite Bay, lies about 0.25 km south of the south-west tip of Adelaide Island. The locations of these ASPAs are shown on Map 1.

*6 (v) Special zones within the Area*

None.

## **7. Permit Conditions**

*7(i) General permit conditions*

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit to enter the Area are that:

- it is issued only for compelling scientific reasons which cannot be served elsewhere or it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the environmental or scientific values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

*7(ii) Access to, and movement within or over, the Area*

- Access to, and movement within, the Area shall be on foot.
- Land vehicles are prohibited in the Area.
- Landing of helicopters within the Area is prohibited.
- All movement shall be undertaken carefully so as to minimize disturbance to soil and vegetation.
- Overflight of bird colonies within the Area by Remotely Piloted Aircraft Systems (RPAS) shall not be permitted unless for scientific or operational purposes, and in accordance with a permit issued by an appropriate national authority.

*7(iii) Activities which may be conducted in the Area*

Activities which are or may be conducted within the Area are:

- scientific research or monitoring which will not jeopardise the ecosystems of the Area;
- essential management activities.

*7(iv) Installation, modification or removal of structures*

No new structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons and for a pre-established period, as specified in a permit. Installation (including site selection), maintenance, modification or removal of structures and equipment shall be undertaken in a manner that minimises disturbance to the values of the Area. All structures or scientific equipment installed in the Area shall be clearly identified by country, name of the principal investigator and year of installation. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination of the Area. Removal of specific structures or equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures or installations are prohibited.

*7(v) Location of field camps*

Camping in the Area is prohibited. Accommodation may be available at Rothera Research Station.

*7(vi) Restrictions on materials and organisms that may be brought into the Area*

No living animals, plant material or microorganisms shall be deliberately introduced into the Area. To ensure that the values of the Area are maintained, special precautions shall be taken against accidentally introducing microbes, invertebrates or plants from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other



equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. No poultry or egg products shall be taken into the Area. Further guidance can be found in the CEP Non-native Species Manual and COMNAP/SCAR Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species. No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable shall not be permitted. Fuel, food and other materials are not to be deposited within the Area, unless authorized by Permit for specific scientific or management purposes. Permanent depots are not permitted. All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of the stated period, and shall be stored and handled so that risk of their introduction into the environment is minimised. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material in situ. The appropriate authority shall be notified of any materials released and not removed that were not included in the authorised Permit.

*7(vii) Taking of, or harmful interference with, native flora and fauna*

Taking of or harmful interference with native flora and fauna is prohibited, except in accordance with a Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of, or harmful interference with, animals is involved this should be in accordance with the SCAR Code of Conduct for the use of Animals for Scientific Purposes in Antarctica, as a minimum standard.

*7 (viii) The collection or removal of materials not brought into the Area by the Permit holder*

Material of a biological or geological nature may be collected and/or removed from the Area only in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs. Permits shall not be granted if there is reasonable concern that the sampling proposed would take, remove or damage such quantities of soil, sediment, flora or fauna that their distribution or abundance within the Area would be significantly affected. Material of human origin not brought into the site by the Permit holder, or otherwise authorised, which is likely to compromise the values of the Area shall be removed unless the impact of removal is likely to be greater than leaving the material in situ. In the latter case the appropriate authority shall be notified.

*7 (ix) Disposal of wastes*

All wastes shall be removed from the Area in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998). All solid and/or liquid human waste shall be removed From the Area.

*7 (x) Measures that may be necessary to continue to meet the aims of the Management Plan*

- Permits may be granted to enter the Area to carry out scientific research, monitoring and site inspection activities, which may involve the collection of a small number of samples for analysis, to erect or maintain signboards, or to carry out protective measures.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Scientific activities shall be performed in accordance with SCAR's environmental code of conduct for terrestrial scientific field research in Antarctica.

*7 (xi) Requirements for reports*

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable and no later than six months after the visit has been completed. Such visit reports should include, as applicable, the information identified in the recommended visit report form (contained as an Appendix in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (available from the website of the Secretariat of the Antarctic Treaty; [www.ats.aq](http://www.ats.aq))). If appropriate, the national authority should also forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any Review of the management plan.

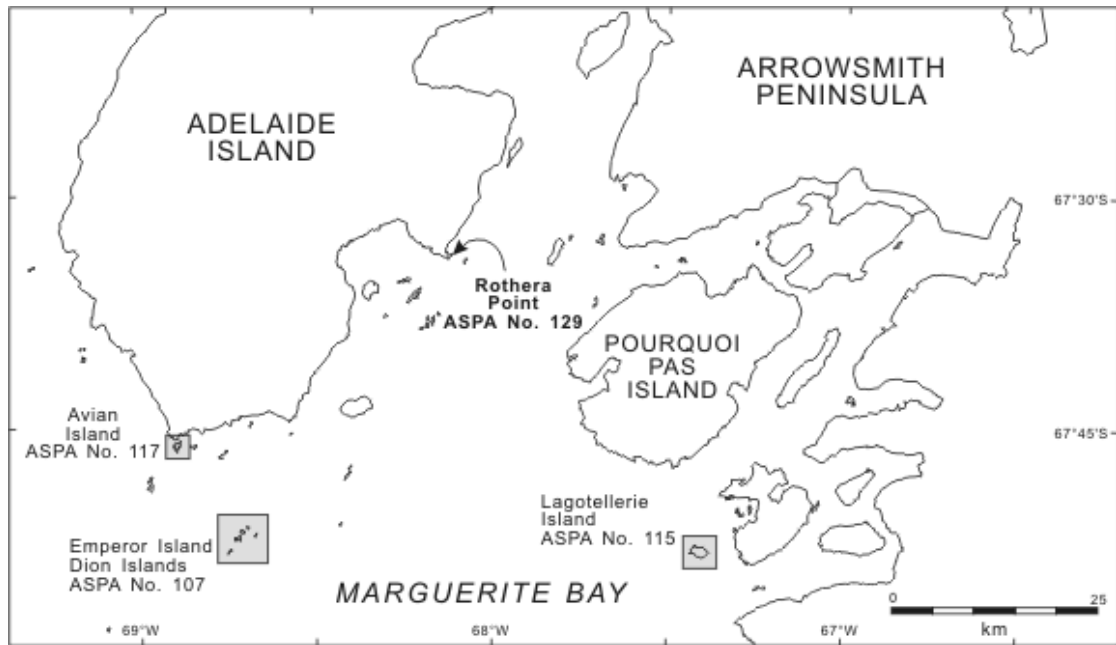
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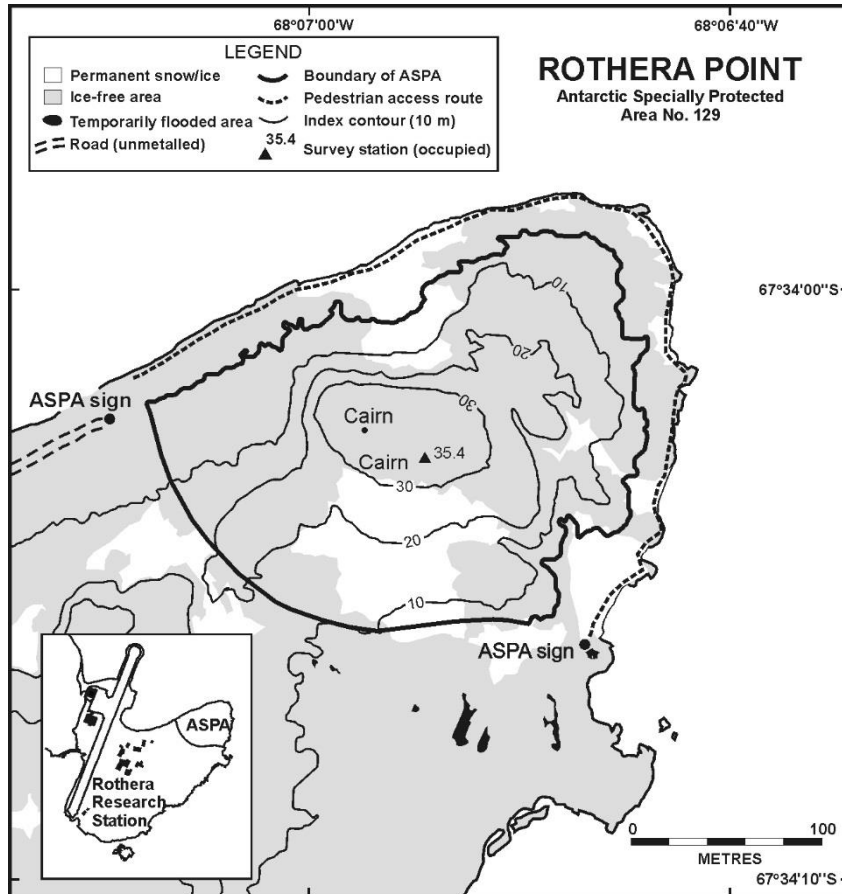
Map 1. ASPA No. 129 Rothera Point, location map.

Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45'W.



Map 2. ASPA No. 129 Rothera Point, topographic map.

Map specifications: Projection: WGS84 Antarctic Polar Stereographic. Standard parallel: 71°S. Central meridian 67°45'W.



## Measure 6 (2017)

### **Antarctic Specially Protected Area No. 140 (Parts of Deception Island, South Shetland Islands): Revised Management Plan**

#### **The Representatives,**

*Recalling* Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (“the Protocol”) providing for the designation of Antarctic Specially Protected Areas (“ASPAs”) and approval of Management Plans for those Areas;

#### *Recalling*

- Recommendation XIII-8 (1985), which designated Shores of Port Foster, Deception Island, South Shetland Islands as Site of Special Scientific Interest (“SSSI”) No. 21 and annexed a Management Plan for the Site;
- Resolution 7 (1995) and Measure 2 (2000), which extended the expiry date for SSSI 21;
- Decision 1 (2002), which renamed and renumbered SSSI 21 as ASPA 140;
- Measures 3 (2005) and 8 (2012), which adopted revised Management Plans for ASPA 140;

*Recalling* that Resolution 7 (1995) was designated as no longer current by Decision 1 (2011) and that Measure 2 (2000) did not become effective and was withdrawn by Measure 5 (2009);

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 140;

*Desiring* to replace the existing Management Plan for ASPA 140 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol:

That:

1. the revised Management Plan for Antarctic Specially Protected Area No. 140 (Parts of Deception Island, South Shetland Islands), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No. 140 annexed to Measure 8 (2012) be revoked.

## Management Plan for Antarctic Specially Protected Area No 140

### PARTS OF DECEPTION ISLAND, SOUTH SHETLAND ISLANDS

#### Introduction

The primary reason for the designation of Parts of Deception Island, (Lat. 62°57'S, Long. 60°38'W), South Shetland Islands, as an Antarctic Specially Protected Area (ASPA) is to protect environmental values, predominantly the terrestrial flora within the Area. The flora of the island is unique in Antarctic terms, particularly where associated with these geothermal areas, but also because of the recently formed surfaces that provide known-age habitats for the study of colonisation and other dynamic ecological processes by terrestrial organisms (Smith 1988).

Deception Island is an active volcano. Recent eruptions occurring in 1967, 1969 and 1970 (Baker *et al.* 1975) altered many of the topographical features of the island and created new, and locally transient, surfaces for the colonisation of plants and other terrestrial biota (Collins 1969; Cameron & Benoit 1970; Smith 1984 a,b,c). There are a number of sites of geothermal activity, some with fumaroles (Smellie *et al.* 2002).

Five small Sites around the coast of Port Foster were adopted under Recommendation XIII-8 (ATCM XIII, Brussels, 1985) as Site of Special Scientific Interest No 21 on the grounds that '*Deception Island is exceptional because of its volcanic activity, having had major eruptions in 1967, 1969 and 1970. Parts of the island were completely destroyed, new areas were created, and others were covered by varying depths of ash. Few areas of the interior were unaffected. The island offers unique opportunities to study colonization processes in an Antarctic environment*'. Following an extensive scientific survey, protection of the island's botanical values was enhanced through Measure 3 (2005) when the number of Sites of botanical interest included within the ASPA was increased to 11.

ASPA 140 makes a substantial contribution to the Antarctic protected areas system as it (a) contains a particularly wide diversity of species, (b) is distinct from other areas due to the geothermally-heated ground in some parts of the island which create habitats of great ecological importance unique to the Antarctic Peninsula region and (c) is vulnerable to human interference, in particular, due to highly restricted spatial distribution of many plant species, particularly those associated with heated ground. While ASPA 140 is protected primarily for its outstanding environmental values (specifically its biological diversity) it is also protected for its scientific values (ie, for terrestrial biology, zoology, geomorphology and geology). In particular, scientific research includes long-term colonisation studies and ground temperature measurements.

The 11 Sites within the Area (c. 2.7 km<sup>2</sup>) encompass terrestrial and lagoon habitats around geo-thermally heated ground, areas of rich flora and known-age surfaces created following eruptions of 1967, 1969 and 1970, which are potentially useful for recolonisation studies. The Area is considered to be of sufficient size to provide

adequate protection of the values identified, which may be highly susceptible to direct physical disturbance, due to activities of national and non-governmental visitors, and the identified boundaries provide an adequate buffer around sensitive features.

Deception Island is predominantly Environment Domain G (Antarctic Peninsula off-shore islands geologic) under the “Environmental Domains Analysis for the Antarctic Continent” (Resolution 3 (2008)). Environment Domain G is scarce relative to the other environmental domain and substantial efforts are required to conserve the values found within this environment type.

ASPA 140 sits within Antarctic Conservation Biogeographic Region (ACBR) 3 Northwest Antarctic Peninsula (Resolution 6 (2012)).

No IBAs are within the boundaries of the ASPA sites (Resolution 5 (2015)).

## **1. Description of values to be protected**

Following a detailed botanical survey of the island in 2002 (reviewed in 2010 and 2014/15), 11 Sites of unique botanical interest were identified. Consequently, the values specified in the original designation were reaffirmed and considerably augmented.

These values are set out as follows:

- The island has the greatest number of rare (i.e., known to grow at a few localities in the Antarctic and often in small quantity) and extremely rare (i.e., known to grow at only one or two localities in the Antarctic) plant species of any site in the Antarctic. Twenty eight of the 54 mosses recorded on the island, four of the eight liverworts and 14 of the *c.* 75 lichens are considered to be rare or extremely rare. Annex 1 lists the plant species classed as rare or extremely rare in the Antarctic Treaty area, which occur on Deception Island. These represent 25%, 17% and *c.* 4% of the total number of mosses, liverworts and lichens, respectively, known from the Antarctic (Aptroot & van der Knaap 1993; Bednarek-Ochyra *et al.* 2000; Ochyra *et al.* 2008; Øvstedal & Lewis Smith 2001). Thirteen species of moss (including two endemics), two species of liverwort and three species of lichen growing on Deception Island have not been recorded elsewhere in the Antarctic. No other site in the Antarctic is comparable. This suggests that there is a significant deposition of immigrant propagules (by wind and seabirds), particularly of southern South American provenance, over the Antarctic, which become established only where favourable germinating conditions prevail (eg, the heat and moisture provided around fumaroles) (Smith 1984b; c). Such sites are unique in the Antarctic Treaty area.
- The more stable geothermal areas, some of which have fumaroles issuing steam and sulphurous gas, have developed bryophyte communities of varying complexity and density, each with a distinct and unique flora. Most of these



areas were created during the 1967-70 series of eruptions, but at least one (Mt. Pond) predates that period. Species growing close to active vents are continuously subjected to temperatures between 30 to 50°C, thereby posing important questions regarding their physiological tolerance.

- Areas of volcanic ash, mudflows, scoria and lapilli deposited between 1967 and 1970 provide unique known-age surfaces. These are currently being colonised by vegetation and other terrestrial biota, allowing the dynamics of immigration and colonisation to be monitored. These areas are unstable and subject to wind and water erosion, so exposing some areas to continual surface change and a cycle of recolonisation.
- Kroner Lake, the only intertidal lagoon with hot springs in Antarctica, supports a unique community of brackish-water algae.
- Several Sites within the Area, unaffected by ash deposits during the 1967-70 eruptions, support long-established mature communities with diverse vegetation and are typical of the older stable ecosystems on the island.
- The largest known stand of Antarctic pearlwort (*Colobanthus quitensis*), one of only two flowering plants in the Antarctic, is located within the Area. After being virtually eradicated by burial in ash during the 1967 eruption, it has recovered and is now spreading at an unprecedented rate. This correlates with the current trend in regional climate change, particularly increasing temperature.
- The Area contains some Sites where on-going scientific research is performed including long-term colonization experiments (Collins Point) and long-term ground temperature variation measurements (Caliente Hill).
- The Area also contains some Sites with surfaces that date from the eruption in 1967, which allowing accurate monitoring of colonisation by plants and other biota and are of important scientific value.

## 2. Aims and objectives

Management of the Area aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- allow scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere and which will not jeopardise the natural ecological system in that Area;
- prevent or minimise the introduction to the Area of alien plants, animals and microorganisms;
- ensure that the flora is not adversely affected by excessive sampling within the Area;
- preserve the natural ecosystem of the Area as a reference area for future comparative studies and for monitoring floristic and ecological change, colonisation processes and community development.

### **3. Management activities**

The following management activities shall be undertaken to protect the values of the Area:

- Visits shall be made as necessary to assess whether the individual Sites continue to serve the purposes for which they were designated and to ensure management and maintenance measures are adequate.
- Markers, signs or other structures (e.g., fences, cairns) erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer required.
- In accordance with the requirements of Annex III of the Protocol on Environmental Protection to the Antarctic Treaty, abandoned equipment or materials shall be removed to the maximum extent possible provided doing so does not adversely impact on the environment and the values of the Area.
- A map showing the location of each Site on Deception Island (stating any special restrictions that apply) shall be displayed prominently and a copy of this Management Plan shall be made available at Gabriel de Castilla Station (Spain) and Decepción Station (Argentina). Copies of the Management Plan shall be freely available and carried aboard all vessels planning visits to the island.
- Where appropriate, National Antarctic Programmes are encouraged to liaise closely to ensure management activities are implemented (including through the Deception Island Antarctic Specially Managed Area Management Group). In particular, National Antarctic Programmes are encouraged to consult with one another to prevent excessive sampling of biological material within the Area, particularly given the often slow rate of re-growth and limited quantity and distribution of some flora. Also, National Antarctic Programmes are encouraged to consider joint implementation of guidelines intended to minimize the introduction and dispersal of non-native species within the Area.
- At Site K Ronald Hill to Kroner Lake, any wind-blown debris from HSM No 71 shall be removed. At Site G Pendulum Cove, any wind-blown debris from HSM No 76 shall be removed (see Section 7(viii)).
- At Site A Collins Point, the existing staked plots should be maintained to allow continued monitoring of vegetation change since 1969.

### **4. Period of designation**

Designated for an indefinite period.

### **5. Maps**

Figure 1: Antarctic Specially Protected Area No 140, Deception Island, showing the location of Sites A – L (Scale 1:100 000).

Figures 1a–d: Topographic Maps of Antarctic Specially Protected Area No 140 showing Sites A – L (Scale 1: 25 000). The ‘hill shade’ effect has been added to highlight the topography of the areas.

## 6. Description of the Area

### 6 (i) Geographical co-ordinates, boundary markers and natural features

#### - General Description

Research by Smith (1984a) and Peat *et al.* (2007) described the recognised biogeographical regions present within the Antarctic Peninsula. Antarctica can be divided into three major biological provinces: northern maritime, southern maritime and continental. Deception Island lies within the northern maritime zone (Smith 1984a).

#### - Natural Features, Boundaries, and Scientific Values

ASPA 140 comprises 11 Sites, shown in Figures 1 and 1a-1d. Annotated photographs of each Site are shown in Annex 2. This fragmented distribution is characteristic of the vegetation cover of Deception Island. Because of the patchy nature of stable and moist substrata not subjected to erosion, the vegetation has a disjunct distribution and is consequently restricted to widely scattered, and often very small, habitats. Use of satellite remote sensing techniques (Normalised Difference Vegetation Index) showed the area of green vegetation within the ASPA sites to be 0.10 km<sup>2</sup> (4% of the ASPA area).

The Sites are lettered A to L (but excluding I), in a clockwise direction from the south-west of the caldera and referred to by the most prominent named geographical feature associated with each Site. Photographs of each Site are shown in Annex 2. Boundary co-ordinates are listed in Annex 3, but as many of the boundaries follow natural features, the boundary description outlines below should also be consulted.

#### Site A - Collins Point

Area encompassed. The north-facing slopes between Collins Point and the unnamed point 1.15 km to the east (0.6 km west of Entrance Point), directly opposite Fildes Point, and extending from the back of the beach to a ridge extending up to *c.* 1 km inland from the shoreline.

Boundaries. The eastern boundary of Site A runs south from the shore at the unnamed point 0.6 km west of Entrance Point, following the outline of a ridge to an elevation of 184 m. The western boundary extends from Collins Point, following a ridge south to an elevation of 145 m. The southern boundary is delimited by the arcuate ridge crest (following a line of summits east to west at 172, 223 and 214 m) joining points 184 and 145 m. The beach area, including the Collins Point light beacon (maintained by the Chilean Navy), to the 10 m contour is excluded from the Site.

Scientific value. No geothermally-heated ground is known within the Site boundary. The Site contains some of the best examples of the island's longest established vegetation, largely unaffected by the recent eruptions, with high species diversity and several Antarctic rarities, some in considerable abundance. A few small plants of *Colobanthus quitensis* have recently become established, while the large liverwort (*Marchantia berteroana*) is a fairly recent and spreading colonist. Research on seals is undertaken on the beach to the north of the Site, and the Site also contains a colony of kelp gulls in the low cliffs above the beach. Six 50 × 50 cm plots marked with wooden corner stakes (Lat. 62°60'00''S, Long. 060°34'48''W) were established by the British Antarctic Survey in 1969 to monitor changes in the vegetation in subsequent years (Collins 1969).

Human impact. The non-native springtail *Hypogastrura viatica* is found within the Site A.

#### Site B - Crater Lake

Area encompassed. Crater Lake and its shoreline, the flat ground to its north and the scoria-covered lava tongue to the south.

Boundaries. The northern boundary extends along the foot of the slope to the north of the broad valley c. 300 m north of Crater Lake (at c. 30 m altitude). The western boundary follows the ridgeline immediately west of the lake, and to the east of the small unnamed lake at Lat. 62°59'00''S, Long. 060°40'30''W. The southwestern and southern boundaries follow the top of the slope (at altitude c. 80 m) that extend to the southwest and south of the lake. The eastern boundary passes to the east of the lava tongue south of Crater Lake, around the eastern rim of the lake and c. 300 m across the flat plain to the north of the Crater Lake.

Scientific value. No geothermally-heated ground is known within the Site boundary. The principal area of botanical interest lies on a scoria-covered lava tongue south of the lake. The Site was unaffected by the recent eruptions. The vegetation on the scoria tongue has a diverse cryptogamic flora, including several Antarctic rarities, and exceptional development of turf-forming moss, dominated by one relatively common species (*Polytrichastrum alpinum*). Of particular interest is that it reproduces sexually in great abundance here. Sporophytes of this species are not known in such profusion in this, or any other moss, anywhere else in the Antarctic. The extensive, virtually monospecific, moss carpet (*Sanionia uncinata*), on the flat ground to the north of Crater Lake, is one of the largest continuously vegetated stands on the island.

#### Site C – Caliente Hill, southern end of Fumarole Bay

Area encompassed. A narrow line of fumaroles extending c. 40 × 3 m along the gently sloping summit ridge at c. 95 to 107 m elevation on Caliente Hill above the north-west side of Albufera Lagoon northwest of Decepción Station (Argentina) at the southern end of Fumarole Bay.

Boundaries. The area includes all the ground above the 90 m contour on the hill, with the exception of the ground south east of a point 10 m north west of the cairn (Lat. 62°58'27''S, Long. 060°42'31''W ) at the southeast end of the ridge. Access to the cairn at the southeast end of the ridge is not restricted.

Scientific value. Geothermally-heated ground is included within the Site. Several rare species of moss, some unique to the island, colonise the heated soil crust close to the vents, of which only two or three are visible. The vegetation is extremely sparse and not obvious, in total encompassing less than *c.* 1 m<sup>2</sup> in area, and is therefore particularly vulnerable to trampling and over-sampling. Structures within the Site include experimental apparatus monitoring long-term ground temperature variations (operated by the Spanish Antarctic programme) and several short metal stakes arranged along the ridgeline near the highest point of the ridge.

Human impact. The non-native springtail *Proisotoma minuta* is found within the Site C. In recent years, the sparse vegetation, containing rare and very rare bryophyte assemblages, has been subject to cumulative human trampling, which has reduced the vegetation cover in the area. Minimizing new entries and sample collections within the site is highly advisory given the delicate nature and endangered status of the local plant communities.

#### Site D - Fumarole Bay

Area encompassed. The unstable moist scree slopes below the precipitous lava cliffs on the east side of the southern end of Stonethrow Ridge to the break of slope beyond the beach west of mid-Fumarole Bay. No structures are located within the Site, although much timber debris is found at the back of the beach several metres above the high tide mark. The timber may have been deposited at this location by a tsunami generated by earlier vulcanological activity.

Boundaries. The southern end of the cliffs terminate in a prominent ridge sloping southeastward down to the beach. The southern boundary of the Site extends from the base of this ridge (at altitude *c.* 10 m) along the ridge line to the base of the cliffs at an altitude of *c.* 50 m. The western boundary follows the limit of the scree at the base of the cliffs roughly northwards for 800m at altitude of approximately 50 m. The eastern boundary extends northwards along the break-of-slope at the back of the beach for 800 m including all the large boulders. The northern boundary (*c.* 100 m in length) joins the break of slope at the back of the beach to the scree at the base of the lava flow cliffs. The flat beach area from the shore, including two prominent inter-tidal fumaroles to the south of Fumarole Bay, to the break-of-slope is excluded from the Site.

Scientific value. No geothermally-heated ground is known within the Site, although fumarole activity is present in the inter-tidal zone east of the Site. The Site has a complex geology and contains the most diverse flora on the island, including several Antarctic rarities. It was unaffected by the recent eruptions.

#### Site E – west of Stonethrow Ridge

Area encompassed. The Site encompasses an area of fumarole activity and includes a red scoria cone at *c.* 270 m altitude, on the northern side of the east-west trending ridge, *c.* 600 m south-southwest of the highest point on Stonethrow Ridge (330 m), west of central Fumarole Bay. It comprises two fumaroles about 20 m apart, the more easterly fumarole being more highly vegetated with lichens, mosses and liverworts covering an area of *c.* 15 × 5 m.

Boundaries. The boundary extends to 10 m beyond all evidence of geothermal activity and the non-heated ground linking the two fumaroles.

Scientific value. Areas of geothermally-heated ground are present within the Site. The Site possesses several very rare mosses, liverworts and lichens, two of the dominant species being a liverwort (*Clasmatocolea grandiflora*) and lichen (*Stereocaulon condensatum*), neither of which is known elsewhere in Antarctica. Photographs taken in the mid-1980s indicate that the development and diversity of this vegetation has advanced considerably. A skua nest (noted in 1993 and 2002 and occupied in 2010) is present within the vegetation. These birds may be responsible for introducing some of the plants from Tierra del Fuego, notably the dominant liverwort.

#### Site F - Telefon Bay

Area encompassed. The Site incorporates several features created during the 1967 eruption in Telefon Bay: Pisagua Hill on the south side of the Site, the small shallow Ajmonecat Lake on the ash plain north of Stancomb Cove and the low flat ash plain extending from the shoreline of Telefon Bay to the steep slopes and lava outcrops *c.* 0.5 km inland. Pisagua Hill was created as a new island in 1967, but is now joined to the main island by the aforementioned ash plain. At the northern end of the plain is Extremadura Cove, which was a lake until the narrow isthmus (*c.* 2 m wide and 50 m long) separating it from Port Foster was breached sometime around 2006. Extremadura Cove is excluded from the Site.

Boundaries. The north shoreline of the lagoon (Stancomb Cove) at the southwest of Telefon Bay marks the southern boundary of the Site, while the southwest shore of the Extremadura Cove to the north of Telefon Bay marks the northeastern boundary of the Site. The southeast boundary extends along the shore south of Pisagua Hill, northwards to the shoreline of the Extremadura Cove at the northern end of Telefon Bay. The northwest boundary is roughly delineated by the 10 m contour of Telefon Ridge that links Stancomb Cove to Extremadura Cove. Ajmonecat Lake (Lat. 62°55'23''S, Long. 060°40'45''W), including its shoreline, is included in the Site. The shoreline of Telefon Bay is excluded from the Site to allow access past the Site. Those boating within Extremadura Cove without a permit to enter the ASPA should be careful not to land passengers on the southwest shore of the Cove, as this marks the boundary of Site F (see Figure 1c).

Scientific value. No geothermally-heated ground is known within the Site. The main point of botanical interest is that all surfaces within the Site date from 1967, thereby allowing accurate monitoring of colonisation by plants and other biota. The Site has a generally barren appearance, but close inspection reveals an abundance of

inconspicuous mosses and lichens. In the absence of geothermal activity here, colonisation processes may be related to aspects of the current trend in climate change. Although species diversity is low, the developing communities are typical of non-heated habitats throughout the island.

Human impact. The non-native springtail *Hypogastrura viatica* is found within the Site F.

#### Site G - Pendulum Cove

Area encompassed. The Site comprises the uneven gentle slope of coarse grey, crimson, and red scoria and occasional disintegrating blocks of yellowish tuff, east-northeast of Crimson Hill and c. 0.4 – 0.8 km east of Pendulum Cove. It extends c. 500m from west to east and is up to c. 400m wide from north to south. It was created largely by the 1969 eruption which destroyed the nearby abandoned Chilean Base (Historic Site and Monument No 76). The Site includes the slope and undulating “plateau” behind Pendulum Cove.

Boundaries. The western boundary follows the 40m contour line and the eastern boundary follows the 140 m contour line east-southeast of Pendulum Cove. The northern and southern boundaries follow the edge of the volcanic debris-covered permanent ice that borders the Site.

Scientific value. Geothermal activity was recorded during a survey in 1987, with substantial heat being emitted from crevices amongst scoria. There was no such evidence in 2002. Although vegetation is very sparse, this known-age site is being colonised by numerous moss and lichen species. Two of the mosses (*Racomitrium lanuginosum* and *R. heterostichoides*) are unique both on the island and in the Antarctic, and both are very rare here. Several other mosses are Antarctic rarities.

Human impact. The non-native springtail *Deuteraphorura cebennaria* has been found in Pendulum Cove, but just outside Site G.

#### Site H - Mt. Pond

Area encompassed. The Site is situated c. 1.4 to 2 km north-north-west of Mount Pond summit. The extensive area of geothermally-heated ground includes an area (c. 150 × 500 m) on the north eastern side of the gently sloping upper part of a broad ridge at c. 385 to 500m elevation (Smith 1988). At the northern end of the Site there are numerous inconspicuous fumarole vents in low mounds of very fine, compacted baked soil. The higher, southern, part of the Site is close to a large rime dome at 512 m, in the lee of which (at c. 500 to 505 m) are numerous active fumaroles, also surrounded by fine, compacted baked soil, on a steep, moist, sheltered slope. The extensive areas of heated ground surrounding the fumaroles comprise a fine soil with a soft crust that is extremely vulnerable to trampling. There are several stands of dense, thick (up to 10 cm) bryophyte vegetation associated with these areas. The adjacent yellowish tuff outcrops support a different community of mosses and lichens.

Boundaries. The northern boundary is marked by Lat. 62°55'51''S, the southern boundary by Lat. 62°56'12''S and the eastern boundary is marked by Long. 060°33'30''W. The western boundary follows the ridgeline of the broad ridge that slopes north northwest from the summit of Mt. Pond between Long. 060°33'48''W and Long. 060°34'51''W.

Scientific value. This is an outstanding site of botanical interest, unique in the Antarctic. It possesses several moss species which are either unique to the Antarctic or are extremely rare in Antarctica. The development of the moss turf (*Dicranella hookeri* and *Philonotis polymorpha*) in the main upper part of the Site is exceptional, and two or more species have colonised profusely since last inspected in 1994. The large liverwort (*Marchantia berteroana*) is rapidly colonising the warm moist soil crust at the periphery of the moss stands. At least one species of toadstool fungus also occurs amongst the moss, the highest known record for these organisms in Antarctica. A totally different community of mosses and lichens occurs on the rock outcrops, and also includes several extremely rare species (notably *Schistidium andinum* and *S. praemorsum*).

#### Site J - Perchuc Cone

Area encompassed. This ash cone lies *c.* 750 m northeast of Ronald Hill and comprises a very narrow line of fumaroles and adjacent heated ground on the west-facing slope at *c.* 160-170 m elevation (Lat. 62°58'00.9" S; Long. 060°33'39.7" W). The geothermal area covers *c.* 25 × 10 m, and the fine ash and lapilli surface of the entire slope is very vulnerable to pedestrian damage.

Boundaries. The northern boundary is marked by Lat. 62°57'50''S, the southern boundary by Lat. 62°58'05''S, the eastern boundary is marked by Long. 060°33'25''W and the western boundary by Long. 060°33'50''W. Site J Perchuc Cone has been designated as a Prohibited Zone to protect the vulnerable vegetation and soil structures at this location. Access to Site J Perchuc Cone is strictly prohibited.

Scientific value. The Site contains several mosses that are extremely rare in Antarctica. Photographic evidence suggests that the extent of moss colonisation has decreased since the mid-1980s.

#### Site K – Ronald Hill to Kroner Lake

Area encompassed. This Site includes the circular flat plain of the crater immediately to the south of Ronald Hill, and extends along the prominent broad shallow outwash gully with a low bank on either side, leading southwards from here to Kroner Lake. The substratum throughout the area is consolidated mud, fine ash and lapilli deposited by the lahar during the 1969 eruption. Part of the Site, notably the gully, remains geothermally active. The Site also includes the intertidal geothermal lagoon (Kroner Lake) as it is part of the same volcanological feature. This small, shallow, circular, brackish crater lake was broached by the sea during the 1980's, and is now the only geothermally heated lagoon in the Antarctic.



Boundaries. The boundary surrounds the crater basin, gully, Kroner Lake and an area between *c.* 100 – 150 m wide around the lake. A corridor below Ronald Hill, from the break-of-slope to the lowermost massive boulders about 10 to 20 m beyond, remains outside the boundary to allow access past the Area.

Scientific value. The surfaces of this Site are of a known age and are being colonised by numerous moss, liverwort and lichen species, several of which are extremely rare in the Antarctic (eg, the mosses *Notoligotrichum trichodon* and *Polytrichastrum longisetum*, and a rare lichen, *Peltigera didactyla*, is colonising >1 ha of the crater floor). The geothermal northern intertidal shore of Kroner Lake possesses a unique community of algae.

Human impact. The non-native springtails *Hypogastrura viatica*, *Mesaphorura macrochaeta* and *Proisotoma minuta* and mites *Speleorchestes* sp., *Terpnacarus gibbosus* and *Coccotydaeolus* cf. *krantzii* are found at several site around Whalers Bay and may be present within Site K. The non-native springtails *Protaphorura fimata* and *Folsomia candida* were reported from Whalers Bay in the 1960s but have not be found in subsequent surveys.

#### Site L - South East Point

Area encompassed. An east-west trending rocky ridge *c.* 0.7 km north of South East Point, extending from the top of the sea cliff (*c.* 20 m altitude) westwards for *c.* 250 m, to a point about 80m altitude. The north edge of the ridge is a low vertical lava outcrop, giving way to a steep unstable slope leading to the floor of a gully parallel to the ridge. The south side of the Site is the gently sloping ridge crest covered with ash and lapilli.

Boundaries. The Site extends 50 m north and south of the lava outcrop.

Scientific value. This Site has the most extensive population of Antarctic pearlwort (*Colobanthus quitensis*) known in the Antarctic. It was the largest population before the 1967 eruption (Longton 1967), covering *c.* 300 m<sup>2</sup>, but was almost completely destroyed by ash burial. It gradually recovered, but since about 1985-1990 there has been a massive increase in seedling establishment and the population has expanded downwind (westwards, uphill). It is now very abundant in an area of *c.* 2 ha. It is also remarkable for the absence of the other native vascular plant, Antarctic hairgrass (*Deschampsia antarctica*), almost always associated with this plant. Photographs of the Site immediately after the eruption revealed almost total loss of lichens, but these too have recolonised rapidly and extensively, the large bushy *Usnea antarctica* being particularly abundant and attaining a considerable size after the relatively short period since recolonisation. The cryptogamic flora of the Site is generally sparse and typical of most of the island. The Site is particularly important for monitoring the reproduction and spread of the pearlwort in a known-age site.

#### *6(ii) Access to the Area*

- Access to the Sites shall be by foot or small boat.

- Helicopter landings are prohibited within the Area. The Management Plan for Deception Island ASMA 4 shows recommended helicopter landing sites on Deception Island, which are also shown in Figure 1. Helicopter landings sites which may be useful for accessing Sites are located at: Decepción Station (Argentina; Lat. 62°58'30''S, Long. 060°42'00''W), northern Fumarole Bay (Lat. 62°57'18''S, Long. 060°42'48''W), the south of Cross Hill (Lat. 62°56'39''S, Long. 060°41'36''W), eastern Telefon Bay (Lat. 62°55'18''S, Long. 060°38'18''W), Pendulum Cove (Lat. 62°56'12''S, Long. 060°35'45''W) and Whalers Bay (Lat. 62°58'48''S, Long. 060°33'12''W).
- All travel to the Sites shall be undertaken carefully so as to minimize disturbance to soil and vegetation en route.
- The operation of aircraft should be carried out, as a minimum requirement, in compliance with the 'Guidelines for the Operation of Aircraft near Concentrations of Birds' contained in Resolution 2 (2004). Particular care should be taken when overflying Site A Collins Point, which contains a colony of kelp gulls in the low cliffs above the beach.

*6(iii) Location of structures within and adjacent to the Area*

Two research stations are found close to the ASPA sites: Decepción Station (Argentina; Lat. 62°58'30''S, Long. 060°41'54''W) and Gabriel de Castilla Station (Spain; Lat. 62°58'36''S, Long. 060°40'30''W). Two Historic Sites or Monuments are found close to the ASPA sites: Whalers Bay (HSM 71; Lat. 62°58'42''S, Long. 060°33'36''W) and the ruins of the Base Pedro Aguirre Cerda Station (HSM 76; Lat. 62°56'12''S, Long. 060°35'36''W). Collins Point navigation beacon is situated at Lat. 62°59'42''S, Long. 060°35'12''W. At Site A, Collins Point, there are six 50 × 50cm plots marked with wooden corner stakes, although not all of the four stakes per plot remain (Lat. 63°00'00''S, Long. 060°34'48''W). These were established by the British Antarctic Survey in 1969 to monitor changes in the vegetation in subsequent years (Collins 1969); data were obtained in 1969 and 2002. These markers should be maintained.

Structures within the Site C, Caliente Hill, include some experimental apparatus monitoring long-term ground temperature variations (operated by the Spanish National Antarctic Programme) and several short metal stakes arranged along the ridgeline near the summit.

Other structures near to the Area are listed in the ASMA Management Plan for Deception Island.

*6(iv) Location of other protected areas in the vicinity*

ASPA 145 comprises two sites of benthic importance within Port Foster. Deception Island and Port Foster are managed within ASMA 4 Deception Island.

*6(v) Special zones within the Area*

Site J Perchuc Cone has been designated as a Prohibited Zone to protect the vulnerable vegetation and soil structures at this location. Access to Site J Perchuc Cone is strictly prohibited.

## **7. Permit conditions**

### *7(i) General permit conditions*

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit to enter the Area are that:

- it is issued only for compelling scientific reasons which cannot be served elsewhere; or
- it is issued for essential management purposes such as inspection, maintenance or review;
- the actions permitted will not jeopardise the floristic, ecological or scientific values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with this Management Plan;
- the Permit, or an authorised copy, must be carried within the Area;
- permits shall be issued for a stated period;
- the appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

### *7(ii) Access to, and movement within or over, the Area*

- Land vehicles are prohibited in the Area.
- Helicopter landings are prohibited within the Area. The Management Plan for Deception Island ASMA 4 shows recommended helicopter landing sites on Deception Island (see also Figure 1).
- Rowing boats are permitted for sampling purposes in the lakes in Site B – Crater Lake and Site F - Telefon Bay, and the lagoon in Site K - Ronald Hill to Kroner Lake. Prior to use at each Site, boats shall be cleaned to reduce the risk of introductions of non-native species from outside the Treaty area and other Antarctic locations, including other Sites within ASPA 140. Engine powered boats must not be used.
- Movement within the Area Sites shall be on foot.
- Movements into the Area shall consider the *SCAR Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica*.
- All movement shall be undertaken carefully so as to minimize disturbance to soil and vegetation:

- a) The vegetation at Site C - Caliente Hill is sparse and not obvious and is therefore particularly vulnerable to trampling. Extreme care should be taken to avoid trampling of vegetation when visiting this site.
- b) The soil in the vicinity of Site J Perchué Cone is extremely friable and exceptionally vulnerable to damage by trampling. Compared to other fumaroles on Deception Island, Perchué Cone has experienced relatively little human visitation and associated trampling impact and may provide a representative site for future scientific studies. Consequently, Site J has been designated as a Prohibited Zone and entry is strictly prohibited.

*7(iii) Activities which may be conducted in the Area*

Activities include:

- compelling scientific research which cannot be undertaken elsewhere and which will not jeopardize the flora and ecology of the Area;
- essential management activities, including monitoring.
- surveys, to be undertaken as necessary, to determine the state of the botanical values for which each Site has been designated, in support of the aims of this Management Plan.

*7(iv) Installation, modification or removal of structures*

Structures shall not be erected within the Area except as specified in a Permit. All scientific equipment, botanical quadrats or other markers installed in the Area must be approved by Permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be made of materials that pose minimal risk of contamination of the Area (see Section 7(vi)).

*7(v) Location of field camps*

Camping is not permitted within the Area. The ASMA Management Plan for Deception Island shows recommended sites for field camps on the island, but outside ASPA 140. Campsites which may be useful for accessing Sites are located at: northern Fumarole Bay (Lat. 62°57'18''S, Long. 060°42'42''W), the south of Cross Hill (Lat. 62°56'36''S, Long. 060°41'30''W), eastern Telefon Bay (Lat. 62°55'18''S, Long. 060°38'12''W), Pendulum Cove (Lat. 62°56'12''S, Long. 060°35'42''W) and Whalers Bay (Lat. 62°58'54''S, Long. 060°33'0''W) (see Figure 1). When planning camping locations and activities, recommendation within the SCAR *Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica*, should be taken into consideration, as appropriate.

*7(vi) Restrictions on materials and organisms which may be brought into the Area*

The deliberate introduction of animals, plant material, microorganisms and non-sterile soil into the Area shall not be permitted. To ensure that the floristic and ecological values of the Area are maintained, special precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and

non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area). Care should be taken to prevent distribution of species between ASPA sites. Visitors should take into consideration the recommendations contained within the biosecurity guidelines that are found in Appendix 11 of the Antarctic Specially Managed Area No. 4 Deception Island management plan as well as the SCAR *Environmental code of conduct for terrestrial scientific field research in Antarctica* and in the SCAR *Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica* as appropriate (both available at: <http://www.scar.org/codes-of-conduct>). Visitors should also consult and follow, as appropriate, recommendations contained in the *CEP non-native species manual* (available at: [http://www.ats.aq/e/ep\\_faflo\\_nns.htm](http://www.ats.aq/e/ep_faflo_nns.htm)). In particular, all sampling equipment or markers brought into the Area shall be cleaned or sterilized. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including bags or backpacks) shall be thoroughly cleaned before entering the Area. No poultry or egg products shall be taken into the Area.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted. Release of radio-nuclides or stable isotopes directly into the environment in a way that renders them unrecoverable shall not be permitted.

Fuel, food and other materials are not to be deposited within the Area, unless authorized by Permit for specific scientific or management purposes. Permanent depots are not permitted. All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of the stated period, and shall be stored and handled so that risk of their introduction into the environment is minimised. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*. The appropriate authority shall be notified of any materials released and not removed that were not included in the authorised Permit.

*7(vii) Taking of, or harmful interference with, native flora and fauna*

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking of or harmful interference with animals is involved, the SCAR *Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

*7(viii) The collection or removal of materials not brought into the Area by the Permit holder*

Material of a biological, geological (including soil and lake sediment), or hydrological nature may be collected or removed from the Area only in accordance with a Permit and should be limited to the minimum necessary to meet scientific or

management needs. Permits shall not be granted if there is reasonable concern that the sampling proposed would take, remove or damage such quantities of soil, sediment, flora or fauna that their distribution or abundance within the Area would be significantly affected. Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the Permit Holder or otherwise authorised, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ*; if this is the case the appropriate authority should be notified. If wind-blown debris is found in the Area it should be removed. Plastic debris should be disposed of in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998). Other wind-blown material should be returned to the Historic Site or Monument from which it originated and secured to prevent further dispersal by wind. A report describing the nature of the material removed from the ASPA and the location within the Historic Site and Monument where it has been secured and stored, should be submitted to the Deception Island Antarctic Specially Managed Area (ASMA) Management Group, via the Chair, to establish the most appropriate way to deal with the debris (ie, conservation to preserve any historic value or appropriate disposal) (see Deception Island ASMA website: <http://www.deceptionisland.aq/contact.php>).

#### *7(ix) Disposal of waste*

All wastes shall be removed from the Area in accordance with Annex III (Waste disposal and waste management) of the Protocol on Environmental Protection to the Antarctic Treaty (1998). In order to avoid anthropogenic microbial and nutrient enrichment of soils, no solid or liquid human waste should be deposited within the Area. Human wastes may be disposed of within Port Foster, but avoiding ASPA 145.

#### *7(x) Measures that may be necessary to continue to meet the aims of the Management Plan*

- Permits may be granted to enter the Area to carry out biological, vulcanological or seismic monitoring and site inspection activities.
- Any long-term monitoring sites shall be appropriately marked and the markers or signs maintained.
- Permits may be granted to allow for monitoring of the Area, or to allow for some active management as set out in Section 3.

#### *7(xi) Requirements for reports*

The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority as soon as practicable, and no later than six months after the visit has been completed. Such visit reports should include, as applicable, the information identified in the recommended visit report form (contained as an Appendix in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (available from the website of the Secretariat of the Antarctic Treaty; [www.ats.aq](http://www.ats.aq))). If appropriate, the national authority should also

forward a copy of the visit report to the Party that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan. Wherever possible, Parties should deposit the original or copies of the original visit reports, in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.

## 8. Supporting documentation

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Figure 1. Map of Deception Island showing the 11 sites that make up ASPA 140 Parts of Deception Island, South Shetland Islands.

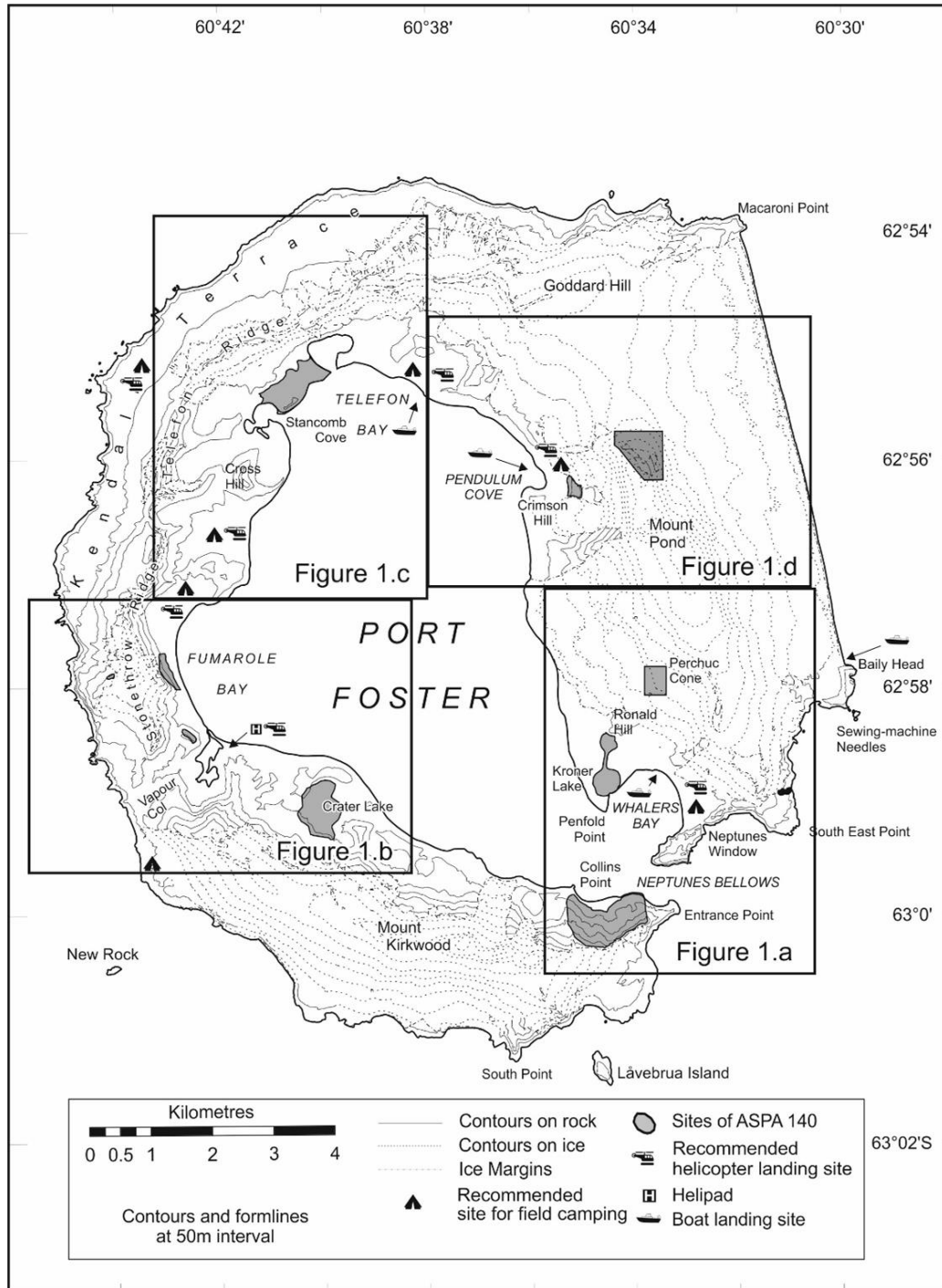


Figure 1a. Map showing the location of ASPA No. 140 Sites A, J, K and L.

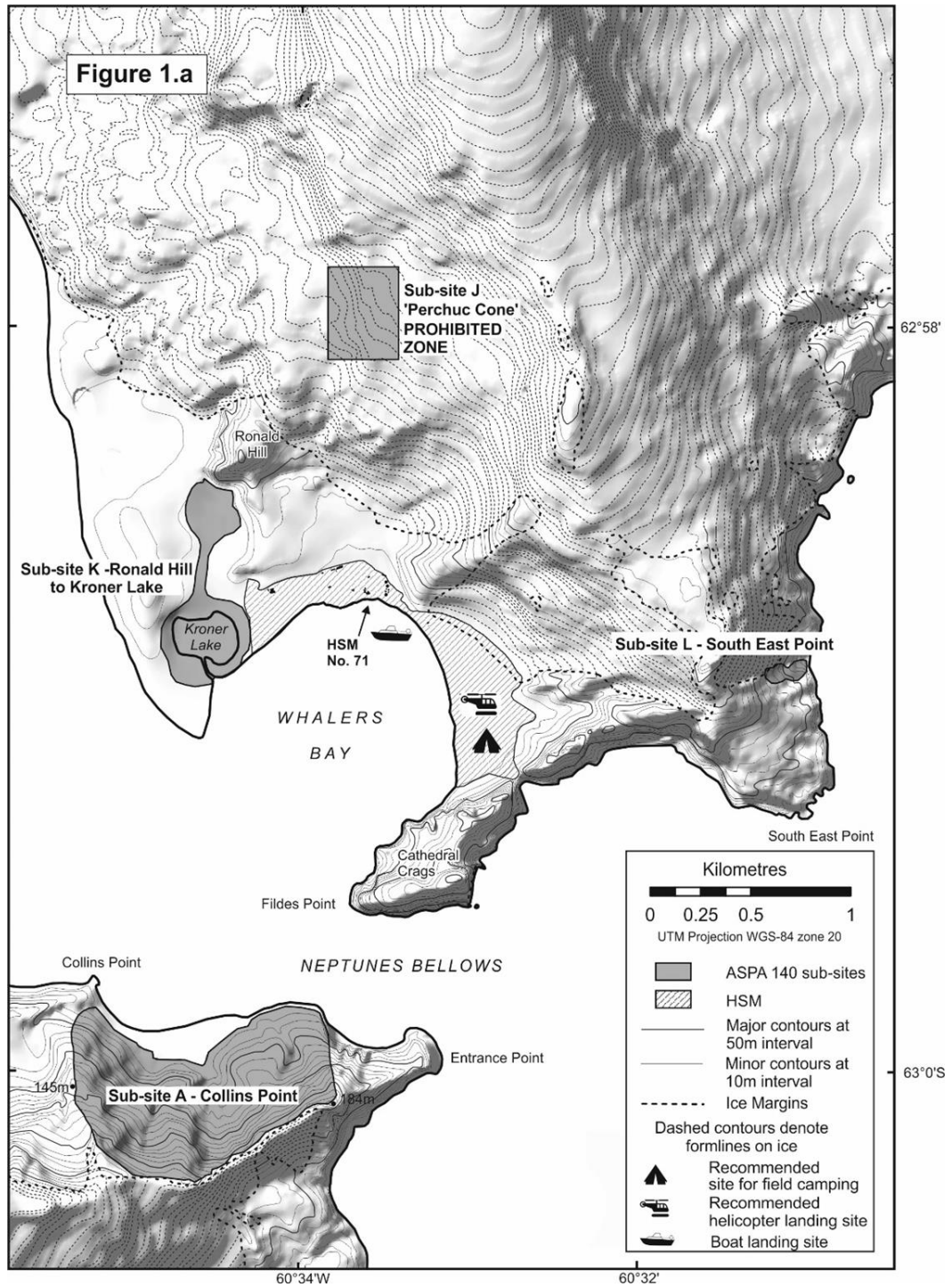


Figure 1b. Map showing the location of ASPA No. 140 Sites B, C, D and E.

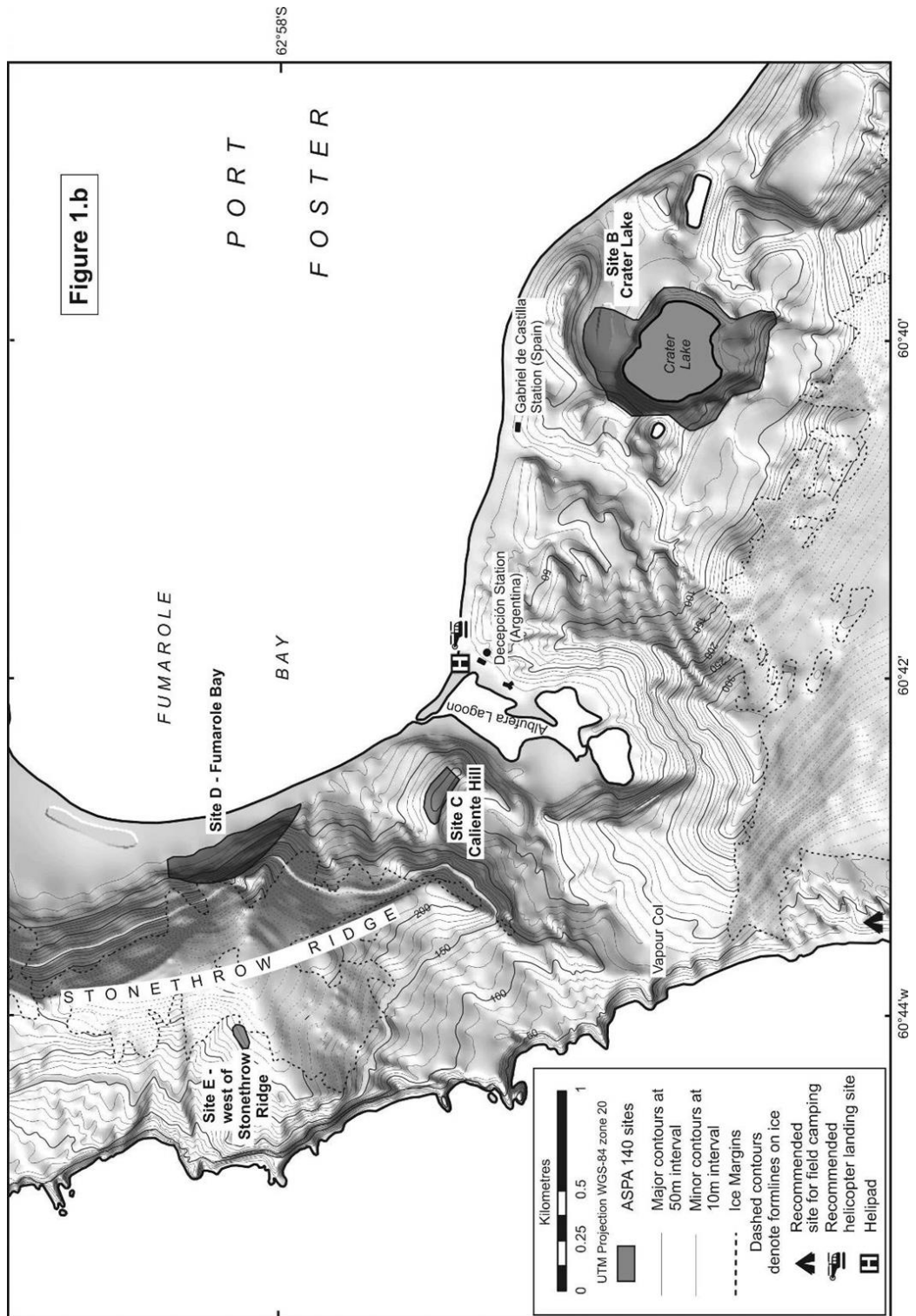


Figure 1c. Map showing the location of ASPA No. 140 Site F.

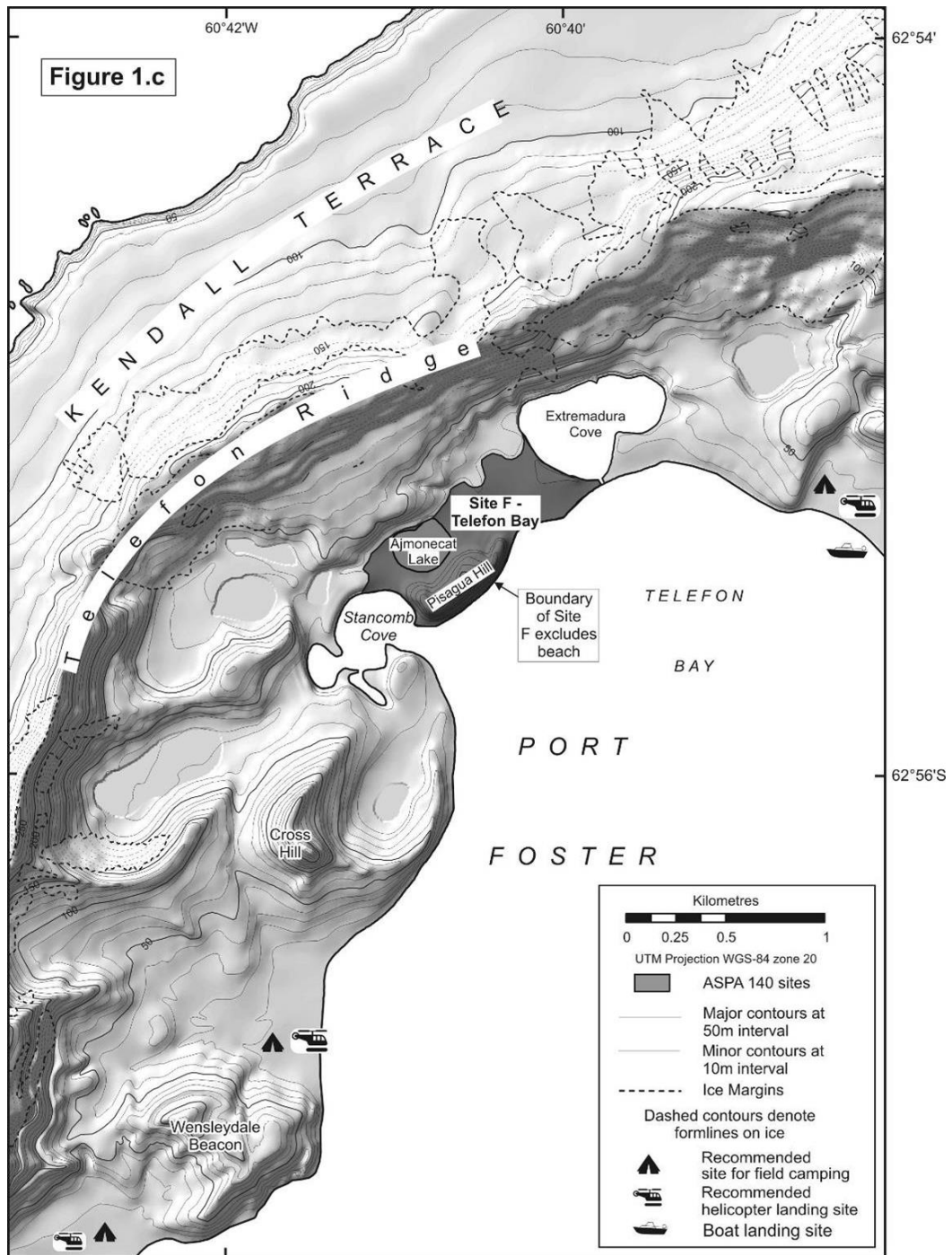
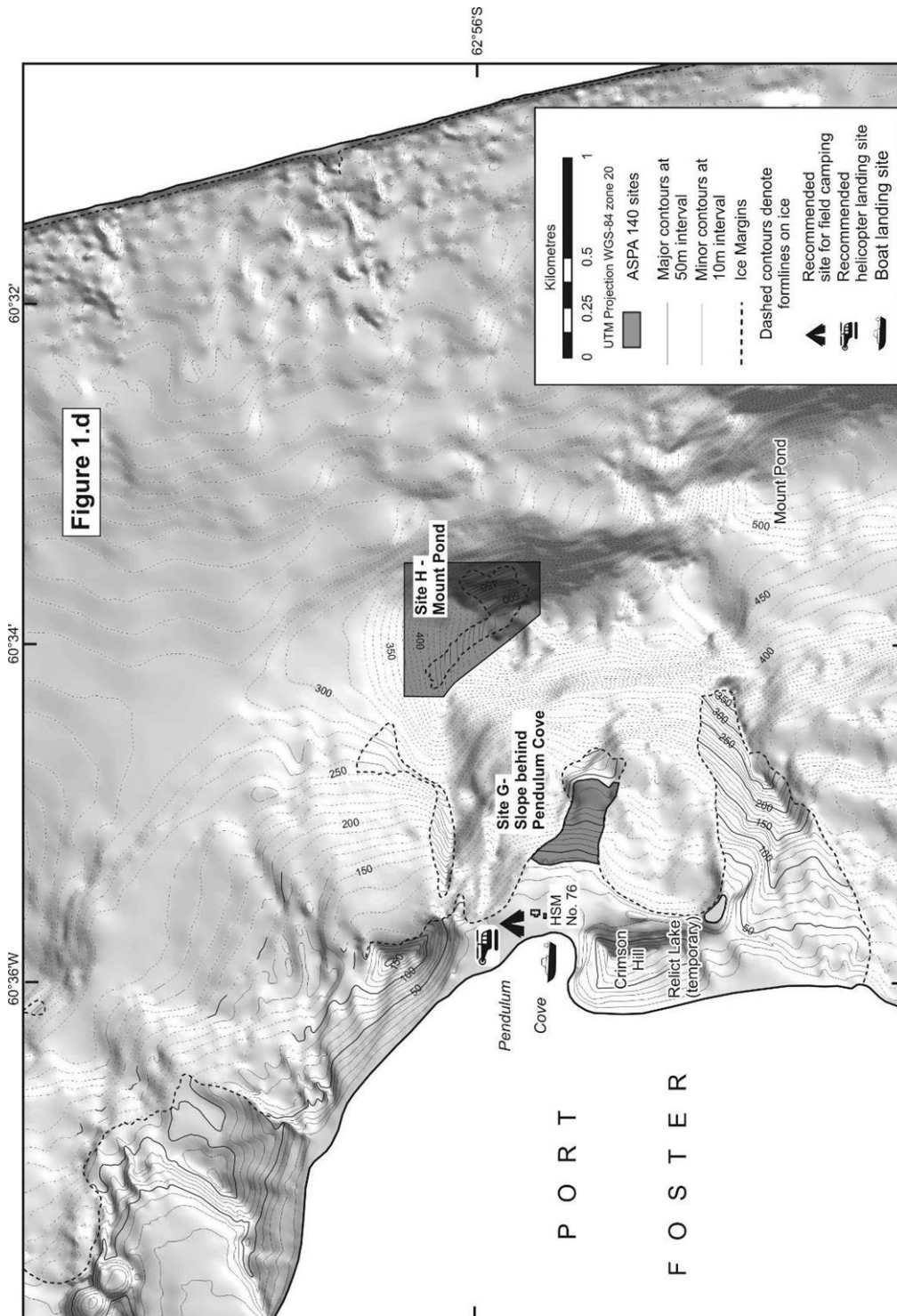


Figure 1d. Map showing the location of ASPA No. 140 Sites G and H.



**Annex 1.** List of plant species, classed as rare or very rare in the Antarctic Treaty Area, occurring on Deception Island.

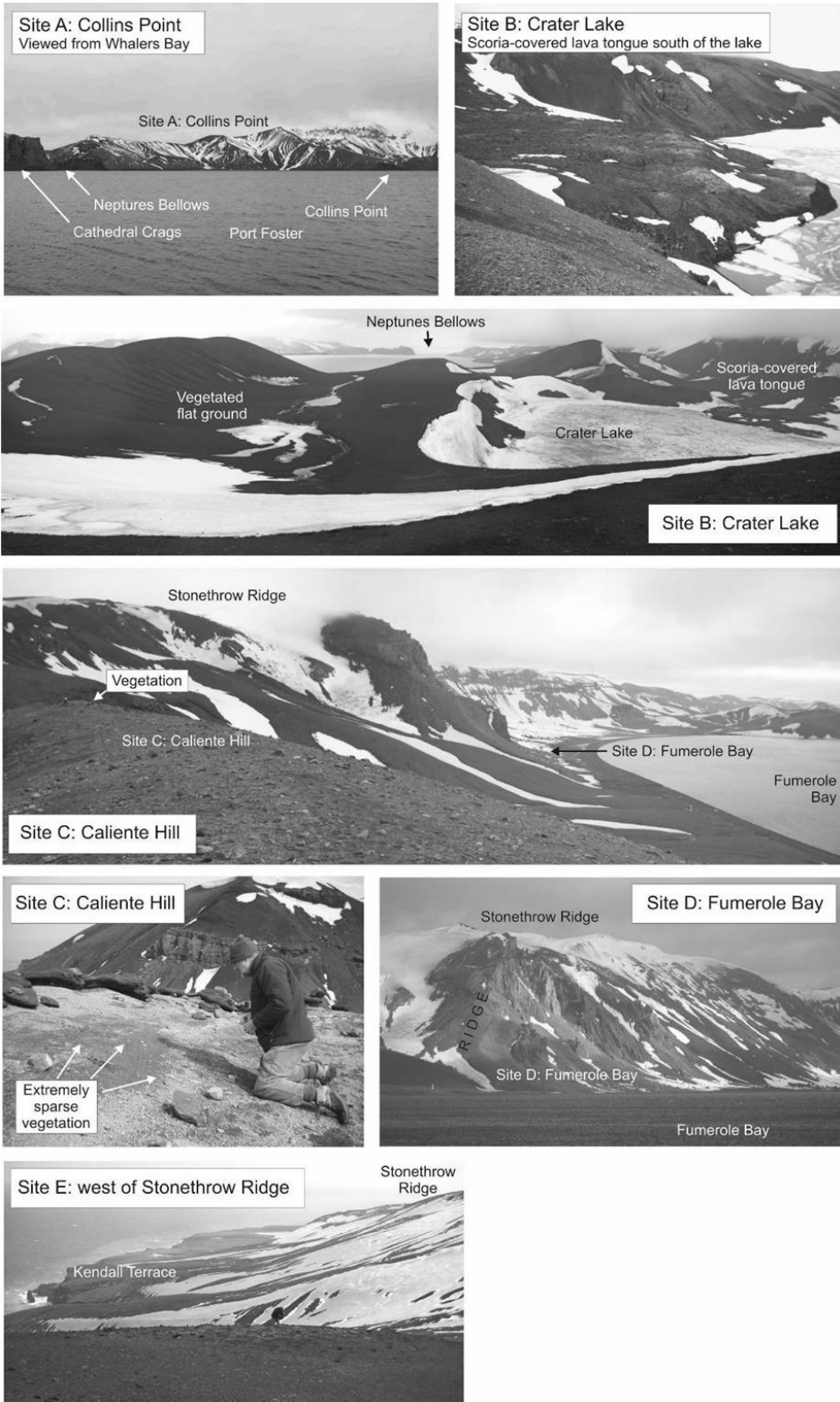
A. Bryophytes (L = Liverwort)

Species	Sites where species occurs	Notes
<i>Brachythecium austroglareosum</i>	D	Few other known Antarctic sites
<i>B. fuegianum</i>	G	Only known Antarctic site
<i>Bryum amblyodon</i>	C, D, G, K	Few other known Antarctic sites
<i>B. dichotomum</i>	C, E, H, J	Only known Antarctic site
<i>B. orbiculatifolium</i>	H, K	One other known Antarctic site
<i>B. pallescens</i>	D	Few other known Antarctic sites
<i>Cryptochila grandiflora</i> (L)	E	Only known Antarctic site
<i>Dicranella hookeri</i>	C, E, H	Only known Antarctic site
<i>Didymodon brachyphillus</i>	A, D, G, H	Locally more abundant than any other known Antarctic site
<i>Ditrichum conicum</i>	E	Only known Antarctic site
<i>D. ditrichoideum</i>	C, G, J	Only known Antarctic site
<i>D. heteromallum</i>	C, H	Only known Antarctic site
<i>D. hyalinum</i>	G	Few other known Antarctic sites
<i>D. hyalinocuspdatum</i>	G	Few other known Antarctic sites
<i>Grimmia plagiopodia</i>	A, D, G	A continental Antarctic species
<i>Hymenoloma antarcticum</i>	B, C, D, E, G, K	Few other known Antarctic sites
<i>H. crispulum</i>	G	Few other known Antarctic sites
<i>Notoligotrichum trichodon</i>	K	One other known Antarctic site
<i>Philonotis polymorpha</i>	E, H	Only known Antarctic site
<i>Platyneurum jungermannioides</i>	D	Few other known Antarctic sites
<i>Polytrichastrum longisetum</i> (L)	K	One other known Antarctic site
<i>Pohlia wahlenbergii</i>	C, E, H	One other known Antarctic site
<i>Racomitrium heterostichoides</i>	G	Only known Antarctic site
<i>R. lanuginosum</i>	G	Only known Antarctic site
<i>R. subsecundum</i>	C	Only known Antarctic site
<i>S. amblyophyllum</i>	C, D, G, H	Few other known Antarctic sites
<i>S. andinum</i>	H	Few other known Antarctic sites
<i>S. deceptionensis</i> sp. nov.	C	Deception endemic
<i>S. leptoneurum</i> sp. nov.	D	Deception endemic
<i>Schistidium praemorsum</i>	H	One other known Antarctic site
<i>Syntrichia andersonii</i>	D, L	Only known Antarctic site

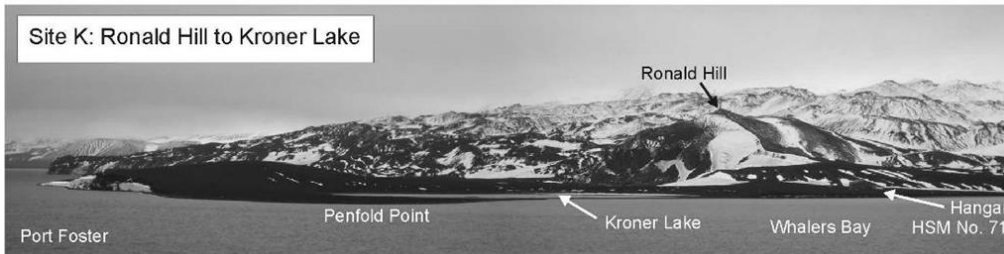
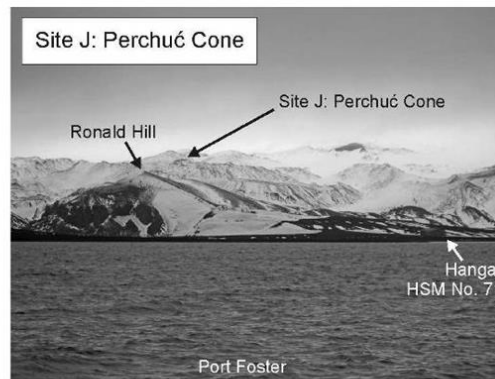
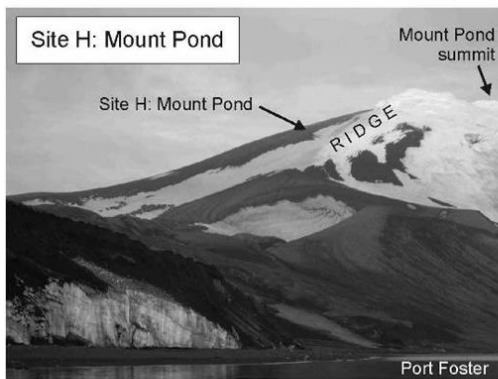
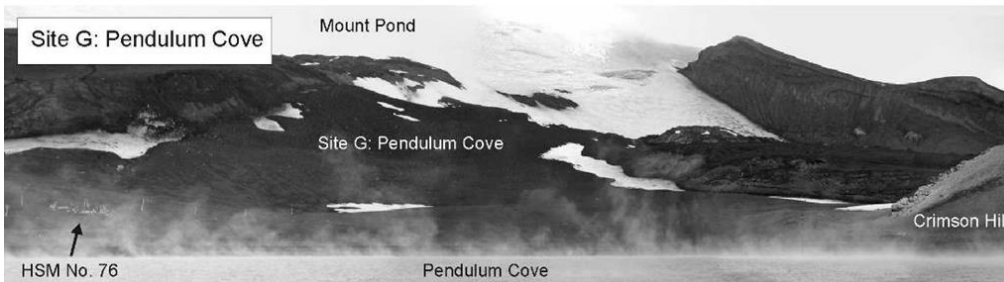
B. Lichens

Species	Sites where species occurs	Notes
<i>Acarospora austroshetlandica</i>	A	One other known Antarctic site
<i>Caloplaca johnstonii</i>	B, D, F, L	Few other known Antarctic sites
<i>Catapyrenium lachneoides</i>	?	Few other known Antarctic sites
<i>Cladonia galindezii</i>	A, B, D	More abundant than any other known site
<i>Degelia sp.</i>	K	Only known Antarctic site
<i>Ochrolechia parella</i>	A, B, D	More abundant than any other known site
<i>Peltigera didactyla</i>	B, K	Very rare in B; very small colonising form abundant in K
<i>Pertusaria excludens</i>	D	Few other known Antarctic sites
<i>P. oculae-ranae</i>	G	Only known Antarctic site
<i>Placopsis parellina</i>	A, B, D, G, H	More abundant than any other known site
<i>Protoparmelia loricata</i>	B	Few other known Antarctic sites
<i>Psoroma saccharatum</i>	D	Only known Antarctic site
<i>Stereocaulon condensatum</i>	E	Only known Antarctic site
<i>S. vesuvianum</i>	B, G	Few other known Antarctic sites

**Annex 2.** Photographs of the Sites comprising ASPA 140. Photographs were taken between 19-26 Jan 2010 (K. Hughes: A, B, C, E, F, G, J, K, L; P. Convey: D, H).







**Annex 3.** Boundary coordinates for the Sites that comprise ASPA 140 Parts of Deception Island. Many of the boundaries follow natural features and detailed descriptions of the boundaries are found in Section 6. The boundary coordinates are numbered, with number 1 the most northerly co-ordinate and further coordinates numbered sequentially in a clockwise direction around each Site.

<b>Site</b>	<b>Number</b>	<b>Latitude</b>	<b>Longitude</b>
A: Collins Point	1	62°59'50" S	060°33'55" W
	2	63°00'06" S	060°33'51" W
	3	63°00'16" S	060°34'27" W
	4	63°00'15" S	060°34'53" W
	5	63°00'06" S	060°35'15" W
	6	62°59'47" S	060°35'19" W
	7	62°59'59" S	060°34'48" W
	8	62°59'49" S	060°34'07" W
B: Crater Lake	1	62°58'48" S	060°40'02" W
	2	62°58'50" S	060°39'45" W
	3	62°58'56" S	060°39'52" W
	4	62°59'01" S	060°39'37" W
	5	62°59'11" S	060°39'47" W
	6	62°59'18" S	060°39'45" W
	7	62°59'16" S	060°40'15" W
	8	62°59'04" S	060°40'31" W
	9	62°58'56" S	060°40'25" W
C: Caliente Hill	1	62°58'33" S	060°42'12" W
	2	62°58'27" S	060°42'28" W
	3	62°58'29" S	060°42'33" W
	4	62°58'25" S	060°42'51" W
D: Fumarole Bay	1	62°57'42" S	060°43'05" W
	2	62°58'04" S	060°42'42" W
	3	62°57'53" S	060°43'08" W
	4	62°57'43" S	060°43'13" W
E: west of Stonethrow Ridge	1	62°57'51" S	060°44'00" W
	2	62°57'54" S	060°44'00" W
	3	62°57'54" S	060°44'10" W
	4	62°57'51" S	060°44'10" W
F: Telefon Bay	1	62°55'02" S	060°40'17" W
	2	62°55'11" S	060°39'45" W
	3	62°55'35" S	060°40'43" W
	4	62°55'30" S	060°41'13" W

	5	62°55'21'' S	060°41'07'' W
G: Pendulum Cove	1	62°56'10'' S	060°35'15'' W
	2	62°56'20'' S	060°34'41'' W
	3	62°56'28'' S	060°34'44'' W
	4	62°56'21'' S	060°35'16'' W
H: Mt. Pond	1	62°55'51'' S	060°33'30'' W
	2	62°56'12'' S	060°33'30'' W
	3	62°56'12'' S	060°33'48'' W
	4	62°55'57'' S	060°34'42'' W
	5	62°55'51'' S	060°34'42'' W
J: Perchué Cone	1	62°57'50'' S	060°33'50'' W
	2	62°57'50'' S	060°33'25'' W
	3	62°58'05'' S	060°33'25'' W
	4	62°58'05'' S	060°33'50'' W
K: Ronald Hill to Kroner Lake	1	62°58'25'' S	060°34'22'' W
	2	62°58'32'' S	060°34'20'' W
	3	62°58'34'' S	060°34'27'' W
	4	62°58'41'' S	060°34'30'' W
	5	62°58'44'' S	060°34'18'' W
	6	62°58'50'' S	060°34'18'' W
	7	62°58'58'' S	060°34'38'' W
	8	62°58'49'' S	060°34'53'' W
	9	62°58'41'' S	060°34'40'' W
	10	62°58'24'' S	060°34'44'' W
L: South-east Point	1	62°58'53'' S	060°31'01'' W
	2	62°58'56'' S	060°30'59'' W
	3	62°58'57'' S	060°31'13'' W
	4	62°58'55'' S	060°31'14'' W

**Annex 4.** Recommended access to the Sites that comprise ASPA 140.

<b>Site</b>	<b>Name</b>	<b>Recommended access route</b>
A	Collins Point	By boat: land at the coast to the north of the site (Port Foster)
B	Crater Lake	Overland: traverse the west side of the ridge that rises to the south of Gabriel de Castilla Station for 500m, then travel east for 200 m until the western boundary of the Areas is reached.
C	Caliente Hill	Overland: access the site from Fumarole Bay to the north of the site, or along the prominent ridge that lies to the south west of the summit of Caliente Hill.
D	Fumarole Bay	By boat: access anywhere along the coast of Fumarole Bay.
E	west of Stonethrow Ridge	Overland: from Fumarole Bay, head southwest pass Albufera Lagoon then head north, traversing the west slope of Stonethrow Ridge. The Site lies on the north side of the east-west trending ridge that lies <i>c.</i> 600m south-southwest of the highest point on Stonethrow Ridge.
F	Telefon Bay	By boat: access the Site from either Telefon Bay or Stancomb Cove.
G	Pendulum Cove	By boat: access the site from Pendulum Cove, Port Foster, then overland past HSM No 76.
H	Mt. Pont	Overland: access with caution from Pendulum Cove via the prominent ice-free ridge to the west of the Site.
J	Perchuć Cone	Prohibited Zone: DO NOT ENTER
K	Ronald Hill to Kroner Lake	By boat: land in Whalers Bay, south of the Site - do not take boats into Kroner Lake to access the site (see Section 7(ii) for details) Over land: access from Whalers Bay to the east of the Site.
L	South-east Point	On foot: Access overland, with caution, from either Whalers Bay (to the west of the Site) or Bailey Head (to the north of the Site)

## Measure 7 (2017)

### **Antarctic Specially Protected Area No. 165 (Edmonson Point, Wood Bay, Ross Sea): Revised Management Plan**

#### **The Representatives,**

*Recalling* Articles 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty providing for the designation of Antarctic Specially Protected Areas (“ASPA”) and approval of Management Plans for those Areas;

*Recalling* Measure 1 (2006), which designated Edmonson Point, Wood Bay, Ross Sea as ASPA 165 and annexed a Management Plan for the Area;

*Recalling* Measure 8 (2011), which adopted a revised Management Plan for ASPA 165;

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASPA 165;

*Desiring* to replace the existing Management Plan for ASPA 165 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with paragraph 1 of Article 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty:

That:

1. the revised Management Plan for Antarctic Specially Protected Area No. 165 (Edmonson Point, Wood Bay, Ross Sea), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Protected Area No. 165 annexed to Measure 8 (2011) be revoked.

## **Management Plan for Antarctic Specially Protected Area No. 165**

### **EDMONSON POINT, WOOD BAY, VICTORIA LAND, ROSS SEA**

#### **1. Description of values to be protected**

Edmonson Point (74°20' S, 165°08' E, 5.49 km<sup>2</sup>), Wood Bay, Victoria Land, Ross Sea, is proposed as an Antarctic Specially Protected Area (ASPA) by Italy on the grounds that it has outstanding ecological and scientific values which require protection from possible interference that might arise from unregulated access. The Area includes ice-free ground and a small area of adjacent sea at the foot of the eastern slopes of Mount Melbourne (2732 m), which is of limited extent and is the subject of ongoing and long-term scientific research.

The terrestrial and freshwater ecosystem at Edmonson Point is one of the most outstanding in northern Victoria Land. An exceptional diversity of freshwater habitats is present, with numerous streams, lakes, ponds and seepage areas, exhibiting nutrient conditions ranging from eutrophic to oligotrophic. Such a range of freshwater habitats is rare in Victoria Land. Consequently, these habitats support a high diversity of algal and cyanobacterial species, with over 120 species so far recorded, and the stream network is the most extensive and substantial in northern Victoria Land. The volcanic lithology and locally nutrient-enriched (by birds) substrata, together with a localised abundance of water, provides a habitat for relatively extensive bryophyte development. Plant communities are highly sensitive to changes in the hydrological regime, and environmental gradients produce sharply defined community boundaries. Thus, the range of vegetation is diverse, and includes epilithic lichen communities, some of which are dependent on high nitrogen input from birds, communities associated with late-lying snow patches, and moss-dominated communities that favour continually moist or wet habitats. The site represents one of the best examples of the latter community-type in Victoria Land. Invertebrates are unusually abundant and extensively distributed for this part of Antarctica.

The nature and diversity of the terrestrial and freshwater habitats offer outstanding scientific opportunities, especially for studies of biological variation and processes along moisture and nutrient gradients. The site is considered one of the best in Antarctica for studies of algal ecology. These features were among those that led to the selection of Edmonson Point as a key site in the Scientific Committee on Antarctic Research's Biological Investigations of Terrestrial Antarctic Systems (BIOTAS) programme in 1995-96. A coordinated multinational research programme, known as BIOTEX-1, established study sites and made extensive collections of soil, rock, water, snow, guano, bacteria, vegetation (cyanobacterial mats, fungi, algae, lichens, bryophytes) and of terrestrial invertebrates.

The scientific value of Edmonson Point is also considered exceptional for studies on the impact of climate change on terrestrial ecosystems. Its location at approximately the mid-point in a north-south latitudinal gradient extending along Victoria Land is complementary to other sites protected for their important terrestrial ecological

values, such as Cape Hallett (ASPA No. 106) and Botany Bay, Cape Geology (ASPA No. 154), which are about 300 km to the north and south respectively. This geographical position is recognised as important in a continent-wide ecological research network (e.g. the Scientific Committee on Antarctic Research 'RiSCC' programme). In addition, the lakes are among the best in northern Victoria Land for studies of biogeochemical processes with short- and long-term variations. Together with the unique properties of the permafrost active layer, which is unusually thick in this location, these features are considered particularly useful as sensitive indicators of ecological change in response to levels of UV radiation and in shifting climate.

A colony of approximately 2000 pairs of Adélie penguins (*Pygoscelis adeliae*) has been a focus of ongoing research since 1994-95 together with a colony of approximately 120 pairs of south polar skuas (*Catharacta maccormicki*). The Edmonson Point Adélie penguin colony is included in the ecosystem monitoring network of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). The site is considered a good example of this species assemblage, which is representative of those found elsewhere. It is unusual, however, for the diverse range of breeding habitat available for south polar skuas, and also because of the unusually high skua to penguin ratio (1:20). The geographical position, the size of the colonies, the terrain and habitat features of the site, the natural protection given by the summer fast ice extension and the distance from Mario Zucchelli Station at Terra Nova Bay (which isolates the colony from research station disturbance but allows for logistic support) make Edmonson Point particularly suitable for the research being undertaken on these birds. The research contributes to the CCAMLR Ecosystem Monitoring Programme (CEMP), focusing on population monitoring, reproductive success, feeding and foraging strategies, migration, and behaviour. This research is important to broader studies of how natural and human-induced variations in the Antarctic ecosystem may affect the breeding success of Adélie penguins, and to understand the potential impact of harvesting of Antarctic krill (*Euphausia superba*).

The near-shore marine environment is a good and representative example of the sea-ice habitat used by breeding Weddell seals to give birth and wean pups early in the summer season. Only one other ASPA in the Ross Sea region has been designated to protect Weddell seals (ASPA No. 137 Northwest White Island, McMurdo Sound), although this site is designated because the small breeding group of seals in that locality is highly unusual; in contrast, inclusion here is as a representative example similar to breeding sites throughout the region.

In addition to the outstanding biological values, a diversity of geomorphic features is present, including a series of ice-cored moraines incorporating marine deposits, raised beaches, patterned ground, a cusplate foreland, and fossil penguin colonies. The cusplate foreland at Edmonson Point is a rare feature in Victoria Land, and is one of the best examples of its kind. It is unusual in that it is not occupied by a breeding colony of penguins, as is the case at Cape Hallett and Cape Adare. The glacial moraines that incorporate marine deposits, including seal bones and shells of the bivalves *Laternula elliptica* and *Adamussium colbecki*, are particularly valuable for dating regional glacier fluctuations. Sedimentary sequences in the north-west of

Edmonson Point contain fossils from former penguin colonies. These are useful for dating the persistence of bird breeding at the site, which contributes to reconstructions of Holocene glacial phases and palaeoclimate.

The wide representation and the quality of phenomena at Edmonson Point have attracted interest from a variety of disciplines and research has been carried out at the site for more than 20 years. Over this period, substantial scientific databases have been established, which adds to the value of Edmonson Point for current, on-going and future research. It is important that pressures from human activities in the Area are managed so that the investments made in these long-term data sets are not inadvertently compromised. These factors also make the site of exceptional scientific value for multi-disciplinary studies.

Given the duration and range of past activities, Edmonson Point cannot be considered pristine. Some environmental impacts have been observed, such as occasional damage to soils and moss communities by trampling, dispersal of materials from scientific equipment by wind, and alteration of habitat by construction of facilities. In contrast, the ice-free area at Colline Ippolito (Ippolito Hills) (1.67 km<sup>2</sup>) approximately 1.5 km to the north-west, has received relatively little visitation and human disturbance at this site is believed to be minimal. As such, Colline Ippolito is considered particularly valuable as a potential reference area for comparative studies to the main Edmonson Point, and it is important that this potential scientific value is maintained. While the precise effects of scientific research and human presence at both sites are uncertain, because detailed studies on human impact have not yet been undertaken, contaminants in the local marine ecosystem remain very low and human impacts on the ecosystem as a whole, particularly at Colline Ippolito, are considered to be generally minor.

The biological and scientific values at Edmonson Point and Colline Ippolito are vulnerable to human disturbance. The vegetation, water-saturated soils and freshwater environments are susceptible to damage from trampling, sampling and pollution. Scientific studies could be compromised by disturbance to phenomena or to installed equipment. It is important that human activities are managed so that the risks of impacts on the outstanding values of the Area are minimised.

The total Area of 5.49 km<sup>2</sup> comprises the ice-free area of Edmonson Point (1.79 km<sup>2</sup>), the smaller but similar ice-free area at Colline Ippolito (1.12 km<sup>2</sup>) approximately 1.5 km to its north which is designated a Restricted Zone, and the adjacent marine environment (2.58 km<sup>2</sup>) extending 200 m offshore from Edmonson Point and Colline Ippolito and including Baia Siena (Siena Bay) (Map 1).

## **2. Aims and objectives**

Management at Edmonson Point aims to:

- avoid degradation of, or substantial risk to, the values of the Area by



- preventing unnecessary human disturbance;
- allow scientific research while ensuring protection from mutual interference and/or over- sampling;
- allow scientific research provided it is for reasons which cannot reasonably be served elsewhere;
- protect sites of long-term scientific studies from disturbance;
- preserve a part of the natural ecosystem as a potential reference area for the purpose of future comparative studies;
- minimise the possibility of introduction of alien plants, animals and microbes to the Area;
- allow visits for management purposes in support of the aims of the Management Plan.

### **3. Management activities**

The following management activities shall be undertaken to protect the values of the Area:

- Copies of this management plan, including maps of the Area, shall be made available at Mario Zucchelli Station at Terra Nova Bay (Italy), Gondwana Station (Germany), and at any other permanent stations established within 100 km of the Area;
- Structures, markers, signs, fences or other equipment erected within the Area for scientific or management purposes shall be secured and maintained in good condition and removed when no longer necessary;
- Durable wind direction indicators should be erected close to the designated helicopter landing sites whenever it is anticipated there will be a number of landings in a given season;
- Markers, which should be clearly visible from the air and pose no significant risk to the environment, should be placed to mark the designated helicopter landing sites;
- Markers, such as a series of durable sticks, should be placed to mark the preferred inland walking routes between the Adélie penguin colony and the designated helicopter landing sites;
- Visits shall be made as necessary (no less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate;
- National Antarctic Programmes operating in the region shall consult together with a view to ensuring these steps are carried out.

#### *3(i) Management issues*

Key management issues relate to the protection of potentially sensitive features, such as: moist soils that can be easily disturbed; the extensive but fragile vegetation cover; a variety of lakes and streams; two species of breeding birds and one breeding species of seal.

Priority issues are also the management of activities that may be harmful or interfere with fauna and flora including aircraft access, movements within the area, camping, facilities, installation/removal of equipment, use of materials, waste disposal and coordination of the multidisciplinary scientific activities.

Logistics constraints imposed restrictions to the study seasons that often started after penguins arrival at the colony. The necessity to decrease impacts for nesting penguins and skuas, made impossible to put in activity the CEMP research camp (Map 2 and 4). Moreover snow coverage and distance from the colony made difficult the use of the alternative camping site (site A Map 2). For this reason during the 2011 summer campaign, a new camp position, suitable for research activity with reduced impacts on birds, was identified. Its position,  $74^{\circ}19'44.58''\text{S}$   $165^{\circ} 8'4.99''\text{E}$ , is near the helicopter landing site B (Map 2 and 4). The camp included 1 big apple, 1 toilet tent and 1 generator and some fuel drums for 40 days of autonomy and was removed at the end of the study season. It is recommended to use this location for future CEMP research activities.

#### **4. Period of designation**

Designated for an indefinite period.

#### **5. Maps and photographs**

Map 1: Edmonson Point ASPA No. 165, Wood Bay, Victoria Land, Ross Sea. Map specifications: Projection: UTM Zone 58S; Spheroid: WGS84; Ice-free areas and coastline derived from rectified Quickbird satellite image with a ground pixel resolution of 70 cm, acquired 04/01/04 by Programma Nazionale di Ricerche in Antartide (PNRA), Italy. Horizontal accuracy approx  $\pm 10$  m; elevation information unavailable.

*Inset 1:* The location of Wood Bay in Antarctica.

*Inset 2:* The location of Map 1 in relation to Wood Bay and Terra Nova Bay. The location of Mario Zucchelli Station (Italy), Gondwana Station (Germany), and the nearest protected areas are shown.

Map 2: Edmonson Point, ASPA No. 165, Physical / human features and access guidelines. Map derived from digital orthophotograph with ground pixel resolution of 25 cm, from ground GPS surveys and observations, and from Quickbird satellite image (04/01/04).

Map specifications: Projection: Lambert Conformal Conic; Standard parallels: 1st  $72^{\circ} 40' 00''$  S; 2nd  $75^{\circ} 20' 00''\text{S}$ ; Central Meridian:  $165^{\circ} 07' 00''$  E; Latitude of

Origin: 74° 20' 00" S; Spheroid: WGS84; Vertical datum: Mean Sea Level. Vertical contour interval 10 m. Horizontal accuracy:  $\pm 1$  m; vertical accuracy expected to be better than  $\pm 1$  m.

Map 3: Restricted Zone, Colline Ippolito: Edmonson Point ASPA No. 165. Map derived from Quickbird satellite image (04/01/04). Map specifications as for Map 2, except for horizontal accuracy which is approx  $\pm 10$  m, and elevation information is not available. Sea level is approximated from coastline evident in satellite image.

Map 4: Edmonson Point ASPA No. 165, topography, wildlife and vegetation. Map specifications as for Map 2, except for contour interval which is 2 m.

Map data and preparation: PNRA, Dipartimento di Scienze Ambientali (Università di Siena), Environmental Research & Assessment (Cambridge), Gateway Antarctica (Christchurch).

## **6. Description of the Area**

### *6(i) Geographical coordinates, boundary markers and natural features*

#### *- General Description*

Edmonson Point (74°20' S, 165°08' E) is a coastal ice-free area of 1.79 km<sup>2</sup> situated at Wood Bay, 50 km north of Terra Nova Bay, and 13 km east of the summit and at the foot of Mount Melbourne (2732 m), Victoria Land. The Area comprises a total of 5.49 km<sup>2</sup>, including the entire ice-free ground of Edmonson Point (1.79 km<sup>2</sup>), the separate ice-free area of Colline Ippolito (Ippolito Hills) (1.12 km<sup>2</sup>) approximately 1.5 km north-west of Edmonson Point, and the nearshore marine environment and intervening sea of Baia Siena (Siena Bay) between these ice-free areas (2.58 km<sup>2</sup>), which lie east and at the foot of the permanent ice sheet extending from Mount Melbourne (Map 1). Part of the glacier from Mount Melbourne separates the two ice-free areas on land. A broad pebbly beach extends the length of the coastline of Edmonson Point, above which cliffs rise up to 128 m towards the south of the Area. The topography of the Area is rugged, with several hills of volcanic origin of up to 134 m in height, and ice-free slopes rising to around 300 m adjacent to the ice sheet, although accurate elevation information in these areas is not currently available. Undulating ice-cored moraines, boulder fields and rock outcrops are separated by small ash plains and shallow valleys. The Area is dissected by numerous valleys and melt streams, with several small lakes, and seepage areas being common features throughout the Area. In the central region of Edmonson Point are several wide shallow basins, at about 25 m elevation, covered by fine scoria and coarse sand, mixed with extensive carpets of vegetation and areas of patterned ground. The northern coast of Edmonson Point is a cusped foreland comprising several raised beaches.

The environmental character of Colline Ippolito is similar to that of Edmonson Point.

This area has a narrow boulder beach backed by a ridge running parallel to the coast. Small meltwater streams run through shallow gullies and across flats into two lakes behind the coastal ridge in the north. Ridges and cones rise to about 200 m before merging with the snow fields and glaciers of Mount Melbourne in the south.

- *Boundaries*

The margin of the permanent ice sheet extending from Mount Melbourne is defined as the boundary in the west, north and south of the Area (Maps 1-3). The eastern boundary is marine, which in the southern half of the Area follows the coastline 200 m offshore from the southern to northern extremities of the ice-free area of Edmonson Point. From the northern extremity of Edmonson Point, the eastern boundary extends NW across Baia Siena for a distance of 2 km to a position 200 m due east from the coast of the northern extremity of Colline Ippolito. Baia Siena is thus enclosed within the Area. Boundary markers have not been installed because the ice sheet margin and the coast are obvious boundary references.

- *Climate*

No extended meteorological records are available for Edmonson Point, although annual data for McMurdo Station, Scott Base and Cape Hallett suggest the average mean temperature in the Edmonson Point vicinity would be around  $-16^{\circ}\text{C}$ , and the mean annual snow accumulation about 20-50 cm, equivalent to 10-20 cm of water (Bargagli *et al.*, 1997). Short-term data are available for December 1995 – January 1996, collected during the BIOTEX 1 expedition. During this period temperatures ranged from  $-7^{\circ}\text{C}$  to  $10^{\circ}\text{C}$ , with  $0^{\circ}\text{C}$  exceeded every day. Relative humidity was low (15-40% day, 50-80% night), precipitation occasional as light snow and wind speeds mostly low. From late January weather conditions deteriorated, with frequent subzero daytime temperatures, snow-fall and high winds. Data available for summer seasons in 1998-99 and 1999-00 from a weather station installed near the penguin colony suggest prevailing summer winds at Edmonson Point come from the east, southeast and south. Daily average wind speeds were generally in the range of 3-6 knots, with daily maximums usually being of 6-10 knots, occasionally reaching up to 25-35 knots. Daily average air temperatures ranged from around  $-15^{\circ}\text{C}$  in October,  $-6^{\circ}\text{C}$  in November,  $-2.5^{\circ}\text{C}$  in December to  $-1^{\circ}\text{C}$  in January, decreasing to  $-3.5^{\circ}\text{C}$  again in February (Olmastroni, pers. comm., 2000). The highest daily maximum in the two summer periods was recorded as  $2.6^{\circ}\text{C}$  on 25 December 1998. The average air temperature recorded over both summers was approximately  $-4^{\circ}\text{C}$ , while the average wind speed was 4.5 knots. Average daily relative humidity generally ranged between 40-60%.

- *Geology and Soils*

The geology at Edmonson Point is derived from Cenozoic eruptive activity of Mount Melbourne (Melbourne Volcanic Province), part of the McMurdo Volcanic Group (Kyle, 1990), combined with glacial deposits from the marine-based ice sheet that covered much of the Victoria Land coastline during the last glacial maximum (7500 to 25000 years B.P) (Baroni and Orombelli, 1994). The volcanic complex at

Edmonson Point is composed of a large subaerial tuff ring, scoria cones, lava flows, and subaquatic megapillow lava sequences (Wörner and Viereck, 1990). The rocks are mainly of basaltic and/or trachytic composition, and include various additional volcanic products, such as accumulations of tuffs, pumices and debris deposits (Simeoni *et al.*, 1989; Bargagli *et al.*, 1997). The ground surface is composed mainly of dry, coarse-textured volcanic materials with a low proportion of silt and clay (Bargagli *et al.*, 1997). These exposed surfaces, as well as beneath the surfaces of stones and boulders, are often coated with white encrustations or efflorescences of soluble salts. Most of the ground is dark-coloured, with brownish or yellowish patches of scoria and tuffite. Unstable scree is common on hill slopes, which are dry and mostly unvegetated. Valley and basin floors are covered by fine scoria and coarse sand (Bargagli *et al.*, 1999).

- *Geomorphology*

A series of marine deposits are visible on the cusate foreland at the northern extremity of Edmonson Point. The gently sloping raised beaches of the foreland are composed of differing ratios of sands, pebbles and boulders distributed over lava flows (Simeoni *et al.*, 1989). Numerous small crater-like pits, many containing melt-water or ice, can be observed just above the high tide mark in this locality; these are thought to have been formed by extreme tides and the melting of coastal ice accumulations. South of the cusate foreland, volcanic bedrock exposures are common over much of the ground extending up to about 800 m inland from the coast, most evident in the prominent hills of about 120 m in height in the central northern part of Edmonson Point. A series of late- Pleistocene moraines and related tills lie on the western side of these exposures, with bands of Holocene ice-cored moraine, talus and debris slopes adjacent to the glacier ice which extends from Mount Melbourne (Baroni and Orombelli, 1994).

- *Streams and Lakes*

There are six lakes on Edmonson Point, ranging in length up to 350 m, and in area from approximately 1600 m<sup>2</sup> up to 15,000 m<sup>2</sup> (Map 2). Two further lakes occur behind the coastal ridge at Colline Ippolito, the largest of which is approximately 12,500 m<sup>2</sup> (Map 3). In addition, on Edmonson Point there are approximately 22 smaller ponds of diameters of less than 30 m (Broady, 1987). The larger ponds are permanently ice-covered, with peripheral moats forming during the summer. Detailed physico-chemical characteristics and limnology of the lakes of Edmonson Point are reported in Guilizzoni *et al.* (1991). There are numerous streams throughout the Area, some of which are supplied with meltwater from the adjacent ice sheet, while others are fed by lakes and general ice / snow melt. Several stream beds have flood terraces of fine soil covered by pumice-like pebbles of 5-10 mm diameter. Many of the streams and pools are transient, drying up shortly after the late snow patches in their catchments disappear.

- *Plant Biology*

Compared to several other sites in central Victoria Land, Edmonson Point does not have a particularly diverse flora, and there are only a few extensive closed stands of vegetation. Six moss species, one liverwort, and at least 30 lichen species have been recorded within the Area (Broady, 1987; Lewis Smith, 1996, 1999; Lewis Smith pers. comm., 2004; Castello, 2004). Cavacini (pers. comm., 2003) noted that recent analyses have identified at least 120 alga and cyanobacteria species present at Edmonson Point. These are present in a range of forms including algal mats on soil and as epiphytes on mosses, and in a range of habitats such as in lakes, streams and snow, and on moist ornithogenic and raw mineral soils. At the onset of summer, snow melt reveals small stands of algae and moss on valley floors, although much of these lie buried by up to 5 cm of wind-blown and melt-washed fine mineral particles. This community is capable of rapid growth during December, when moisture is available and soil temperatures are relatively high, bringing shoot apices up to a centimetre above the surface as the surface accumulation of sand is washed or blown away. Increased water flow or strong winds can quickly bury these stands, although sufficient light for growth can penetrate 1-2 cm below the surface (Bargagli *et al.*, 1999). The principal moss communities occur on more stable substrata which are not subjected to burial by sand, for example in sheltered depressions or along the margins of ponds and meltwater streams, and seepage areas below late snow beds where moisture is available for several weeks. Some of these are among the most extensive stands found in continental Antarctica, being of up to 3000 m<sup>2</sup>, most notably the stand of *Bryum subrotundifolium* (= *B. argenteum*) several hundred metres west of the main Adélie colony (Map 4). Other, less extensive, notable stands occur near the lake adjacent to the Adélie colony (Map 4), and smaller localized stands of *Ceratodon purpureus* (with relatively thick deposits of dead organic material) being found in a valley in the north of Edmonson Point and in the upper area of the principal stream in the northern ice-free area. Greenfield *et al.* (1985) suggested that, apart from Cape Hallett, no area in the Ross Sea has a comparable abundance of plants, although in 1996 a similarly extensive area colonised almost exclusively by *Bryum subrotundifolium* (= *B. argenteum*) was discovered on Beaufort Island (ASPA No. 105), approximately 280 km to the south of Edmonson Point.

The moss-dominated communities comprise up to seven bryophyte species, several algae and cyanobacteria and, at the drier end of the moisture gradient, several lichens encrusting moribund moss (Lewis Smith, 1999; Bargagli *et al.*, 1999). There are mixed communities or zones of *Bryum subrotundifolium* (= *B. argenteum*), *B. pseudotriquetrum* and *Ceratodon purpureus*. In some wetter sites the liverwort *Cephaloziella varians* occurs amongst *C. purpureus*. Dry, very open, often lichen-encrusted moss communities usually contain *Hennediella heimii*, and often occur in hollows which hold small late snow patches. *Sarconeurum glaciale* occurs in a stable scree above the large lake in the south of the Area (Lewis Smith, 1996). The upper portions of moss colonies are often coated with white encrustations of soluble salts (Bargagli *et al.*, 1999).

The lichen communities are relatively diverse, with 24 species identified and at least six crustose species so far unidentified, although few are abundant (Castello, 2004;

Lewis Smith, pers. comm. 2004). Epilithic lichens are generally sparse and not widespread, being mainly crustose and microfoliose species restricted to rocks used as skua perches and occasionally on stable boulders in scree, moist gullies and temporary seepage areas. Macrolichens are scarce, with *Umbilicaria aprina* and *Usnea sphacelata* found in a few places. The former species is more abundant on the gently sloping intermittently inundated outwash channels of Colline Ippolito, together with *Physcia* spp. and associated with small cushions of *Bryum subrotundifolium* (= *B. argenteum*) (Given, 1985, 1989), *B. pseudotriquetrum* and *Ceratodon purpureus* (Lewis Smith, pers comm. 2004). *Buellia frigida* is the most widespread crustose lichen on the hard lavas, but a distinct community of nitrophilous species occurs on rocks used as skua perches (*Caloplaca*, *Candelariella*, *Rhizoplaca*, *Xanthoria*). In gravelly depressions below late snow beds, moss turves are often colonised by encrusting cyanobacteria and ornithocoprophilic lichens (*Candelaria*, *Candelariella*, *Lecanora*, *Xanthoria*) and, where there is no bird influence, by the white *Leproloma cacuminum* (Lewis Smith, 1996).

Early work on the algal flora at Edmonson Point identified 17 species as Cyanophyta, 10 as Chrysophyta and 15 as Chlorophyta (Broady, 1987). More recent analyses (Cavacini, pers. comm., 2003) have identified 120 alga and cyanobacteria species, which is considerably more than the numbers of species of Cyanophyta (28), Chlorophyta (27), Bacillariophyta (25) and Xanthophyta (5) recorded previously (Cavacini, 1997, 2001; Fumanti *et al.*, 1993, 1994a, 1994b; Alfinito *et al.*, 1998). Broady (1987) observed few areas of algal vegetation on ground surfaces; the most extensive were oscillatoriacean mats in moist depressions in areas of beach sand, which may have been temporary melt ponds prior to when the survey was undertaken. Similar mats were found adjacent to an area of moss with a *Gloeocapsa* sp. as an abundant associate. *Prasiococcus calcarius* was observed in the vicinity of the Adélie penguin colony, both as a small area of rich green crusts on soil and growing on an area of moribund moss cushions. Other epiphytic algae include Oscillatoriaceae, *Nostoc* sp., unicellular chlorophytes including *Pseudococcomyxa simplex*, and the desmid *Actinotaenium cucurbita*. Substantial stream algae were observed with waters containing oscillatoriacean mats over the stream beds, wefts of green filaments attached to the surface of stones (mainly *Binuclearia tectorum* and *Prasiola* spp.), small ribbons of *Prasiola calophylla* on the under-surfaces of stones, and dark brown epilithic crusts of cyanophytes (dominated by *Chamaesiphon subglobosus* and *Nostoc* sp.) coating boulders. Ponds present in beach sand contained *Chlamydomonas* sp. and cf. *Ulothrix* sp., while ponds fertilized by penguin and skua guano contained *Chlamydomonas* sp. and black benthic oscillatoriacean mats. Other ponds also contained rich benthic growths of Oscillatoriaceae, frequently associated with *Nostoc sphaericum*. Other abundant algae were *Aphanothece castagnei*, *Binuclearia tectorum*, *Chamaesiphon subglobosus*, *Chroococcus minutus*, *C. turgidus*, *Luticola muticopsis*, *Pinnularia cymatopleura*, *Prasiola crispa* (particularly associated with penguin colonies and other nitrogen-enriched habitats), *Stauroneis anceps*, various unicellular chlorophytes, and – in the highest conductivity pond in beach sand – cf. *Ulothrix* sp.

Algae and cyanobacteria are locally abundant in moist soils, and filaments and foliose mats of *Phormidium* spp. (dominant on patches of wet ground and in shallow lake bottoms), aggregates of *Nostoc commune* and a population of diatoms have been identified (Wynn-Williams, 1996; Lewis Smith pers. comm., 2004). The fungal species *Arthrobotrys ferox* has been isolated from moss species *Bryum pseudotriquetrum* (= *B. algens*) and *Ceratodon purpureus*. *A. ferox* produces an adhesive secretion which has been observed to capture springtails of the species *Gressittacantha terranova* (about 1.2 mm in length) (Onofri and Tosi, 1992).

## 7. Scientific values

### 7(i) Invertebrate

There is a high diversity of soil nematodes in the moist soils at Edmonson Point when compared to other areas described in Victoria Land. Nematodes found at Edmonson Point include *Eudorylaimus antarcticus*, *Monhysteridae* sp., *Panagrolaimus* sp., *Plectus antarcticus*, *P. frigophilus*, and *Scottinema lyndsayea* (Fрати, 1997; Wall pers. comm., 2000). The latter species, previously only known from the McMurdo Dry Valleys, was found at Edmonson Point in 1995-96 (Fрати, 1997). Less abundant are the springtails, most commonly *Gressittacantha terranova*, which was found under rocks and on soil and mosses in a number of moist microhabitats (Fрати, 1997). Red mites (likely to be either *Stereotydeus* sp. or *Nanorchestes*, although species not identified) are common in aggregations beneath stones in moist habitats, and Collembola, rotifers, tardigrades and a variety of protozoans are also found (Fрати *et al.*, 1996; Lewis Smith, 1996; Wall pers. comm., 2000; Convey pers. comm., 2003).

### 7(ii) Breeding birds

Adélie penguins (*Pygoscelis adeliae*) breed in two groups near the coast in the central and eastern- most part of Edmonson Point, occupying an area of about 9000 m<sup>2</sup> (Map 4). The number of breeding pairs recorded between 1981-2005 is summarised in Table 1, the average number in this period being 2080. In 1994-95 the majority of birds were recorded to arrive around 30-31 October, while the majority of the season's chicks had fledged by 12 February, with fledging complete by 21 February (Franchi *et al.*, 1997). An abandoned nesting site, occupied approximately 2600-3000 years ago, lies about 1 km to the northwest of the current colony, on bedrock adjacent to the cusped foreland (Baroni and Orombelli, 1994).

Table 1. Adélie penguins (breeding pairs) at Edmonson Point 1981-2005 (data Woehler, 1993; Olmastroni, 2005, *pers. comm.*).

Year	No. of breeding pairs	Year	No. of breeding pairs
1981	1300	1995	1935
1984	1802	1996	1824



1987	2491	1997	1961
1989	1792	1999	2005
1991	1316	2001	1988
1994	1960	2003	2588
		2005	2385
		2007	2303
		2010	2112
		2016	2704

Between 2005 and 2010 according to CEMP procedures, three population counts were made at Edmonson Point, the colony consisting of 2385, 2303 and 2112 occupied nests in 2005, 2007 and 2010 respectively.

The average number since the beginning of the research program being 2112. Thus total population seem stable with respect to the average value 2080 from 1994 to 2005.

The colony, in the last count carried out in November 2016, consists of 3066 breeding pairs distributed in 11 under colonies (data sent to the CCAMLR in June 2016).

The population of skua (*Stercorarius maccormicki*) was evaluated in about 100 breeding pairs in the whole area, slightly less do as reported by Pezzo *et al.*, (2001), although sufficiently in line with that reported by Piece *et al.*, (2001) regarding the relationship between skuas and penguins of about 1:20.

The ratio between skua and penguin remained high (1:20) as previously reported by Pezzo *et al.*, (2001). Edmonson Point's skua population nearby Adélie penguin colony remained stable through years consisting of about 130 breeding pairs in 2010 summer season. Also at Edmonson Point North and South 55 and 61 breeding pairs respectively, were counted in 2010 summer season.

A breeding colony of south polar skuas (*Catharacta maccormicki*) within the Area is one of the most numerous in Victoria Land, with over 120 pairs, of which 36 pairs occupy Colline Ippolito (CCAMLR, 1999; Pezzo *et al.*, 2001; Volpi pers. comm. 2005). . Furthermore the Area includes two "club sites", nearby large freshwater ponds, used throughout the breeding seasons by groups of non-breeders ranging between 50 and 70 individuals (Pezzo 2001; Volpi 2005 pers. comm.). Flocks of snow petrels (*Pagodroma nivea*) have been observed flying over the Area, and Wilson's storm petrels (*Oceanites oceanicus*) have been sighted regularly. Neither of these latter two species is known to breed within the Area.

Penguin Nest Camera (NC49):

The System of Digital images PNC49 (Australian Antarctic Division) was installed at Edmonson Point during the 2014-15 antarctic campaign. This tool allows, through the acquisition of images remotely the monitoring of area with about 30 nests of control, external to the APMS area. The Penguin Nest Room, reactivating

autonomously after the winter season, thanks to the solar panel and batteries, has allowed us to observe the first arrival into the reproductive area to the 20/10/2015.

All images were collected and sent to colleagues of the Australian Antarctic Division, to become part of an international database for research on reproductive phenology of the Adelie penguin.

#### *7(iii) Breeding mammals*

At Edmonson Point numerous (>50) Weddell seals (*Leptonychotes weddellii*) regularly breed in the near shore marine environment (on fast ice) within the Area. Females use this area to give birth and raise pups on the fast ice along the coastline of the whole Area. Later in the summer Weddell seals frequently haul out on beaches within the Area.

### **8. Scientific Research**

#### *8(i) CCAMLR Ecosystem Monitoring Programme (CEMP) Studies*

The presence at Edmonson Point of breeding penguin colonies and the absence of krill fisheries within their foraging range make this a critical site for comparative studies and inclusion with other CEMP sites in the ecosystem monitoring network established to meet the objectives of CCAMLR. The purpose of protected area designation is to allow planned research and monitoring to proceed, while avoiding or reducing, to the greatest extent possible, other activities which could interfere with or affect the results of the research and monitoring programme or alter the natural features of the site.

The Adélie penguin is a species of particular interest for CEMP routine monitoring and directed research at this site. For this purpose the Adélie Penguin Monitoring Program, a joint research project between Italian and Australian biologists, has been ongoing at Edmonson Point since 1994-95. An Automated Penguin Monitoring System (APMS) along with on-site observations by researchers, forms the basis of a study of at least 500-600 nests within the northern sector of the colony as part of the CEMP (CCAMLR, 1999; Olmastroni *et al.*, 2000). Fences have been installed to direct penguins over a bridge which registers their weight, identity and crossing direction as they move between the sea and their breeding colony.

Parameters routinely monitored include trends in population size, demography, duration of foraging trips, breeding success, chick fledging weight, chick diet and breeding chronology.

The studies on Adélie penguin also involve population monitoring, experiments with satellite transmitters and temperature-depth recorders to investigate foraging location and duration. Combined with stomach flushing to record the diet of monitored penguins, this programme is developing comprehensive observations of

Adélie penguin feeding ecology (Olmastroni, 2002). Diet data (Olmastroni *et al.*, 2004) confirmed the results of studies from krill distribution in the Ross Sea (Azzali and Kalinowski, 2000; Azzali *et al.*, 2000) and indicate that this colony is located at a transition point in the availability of *E. superba* between northern and more southerly colonies where this species is absent or rare in the diet of penguins (Emison, 1968; Ainley, 2002). These studies also highlighted the importance of fish to the diet of the Adélie penguin, which represented up to 50% of stomach contents in some years.

Local sea ice and weather data contribute to the understanding of possible factors affecting the breeding biology of this species (Olmastroni *et al.*, 2004). Moreover behavioural studies are also part of the research (Pilastro *et al.*, 2001).

Research on the south polar skua colony focuses on breeding biology (Pezzo *et al.*, 2001), population dynamics, biometry, reproductive biology and migratory patterns. Since 1998/99 more than 300 south polar skuas have been banded by metal and coloured rings, which facilitate field research that requires the recognition of individual birds and will allow for identification of birds migrating from the Area.

#### *8(ii) Scientific Research after 2005*

Ecology of marine birds and CCAMLR Ecosystem Monitoring Programme (CEMP) Studies.

The studies on Adélie penguin population involved demographic parameters that were estimated in relation to individual characteristics (sex and age) and to large scale (Ross Sea winter ice extent anomalies and SOI) and local scale (food availability) environmental variables. While large-scale environmental factors affected adult survival, breeding success varied principally according to local variables. Breeding success was particularly low when local stochastic events (storms) occurred at sensitive times of the breeding cycle (immediately after the hatching) (Olmastroni *et al.* 2004; Pezzo *et al.*, 2007; Ballerini *et al.*, 2009). Also changes in fast-ice extent in front of the breeding area influenced the adult breeders transit times between colony and foraging grounds, and females conducted longer foraging trips, dived for longer periods and made more dives than males. The diving parameters were affected neither by the sex nor by the year, but differed between the breeding stages (Nesti *et al.*, 2010). Annual adult survival probability at Edmonson Point (0.85, range 0.76– 0.94) was similar to that estimated from other Adélie penguin populations in which individuals were marked with passive transponders. An annual average survival rate of 0.85 seems to be typical of the species and is consistent with an expected average lifespan of about 11 years (6.6 years after adulthood) (Ballerini *et al.*, 2009).

Some aspects of the breeding biology of the south polar skua, during five seasons are under investigation being the subject of a doctoral thesis that is being carried out at University of Siena (A. Franceschi, Aspetti della Biologia riproduttiva dello Stercorario di McCormick, *Stercorarius maccormicki*).

Related projects to the vegetation:

At Edmonson Point, over the past five years, several research projects on issues related to the vegetation were started.

- long-term monitoring: installation of n. 3 permanent plot for the monitoring of long-term vegetation, permafrost and soil thermal regime (period of the plot installation 2002);
- analysis of the CO<sub>2</sub> streams: the analyzes were carried out using CO<sub>2</sub> portable analyzers (IRGA) by selecting different types of vegetation cover in the vicinity of the long-term monitoring sites;
- during the 2014/2015 campaign, we have fitted manipulation experiments for the study of potential future impacts of climate change. These experiments were made (and are still in progress) along a latitudinal gradient from Finger Point (77 ° S) at Apostrophe Island (73 ° S). For these experiments Edmonson Point is the master site is the site with the largest number of complex experiments and the replicas. In all sites for each experiment it was carried out a plot of treatment accompanied by a control plot (undisturbed).

The types of manipulation are as follows:

- An increase of the temperature using open top chambers (OTC) according to the protocol ITEX (International Tundra EXperiment);
- canopies for the exclusion of the precipitation;
- barriers for redistribution of the snowpack by wind (Snow fences).

In addition to these manipulations related to the physical environment they were implemented manipulations of the regime of water / snow / nutrients. In particular, the additions include: A) the snow; B) liquid water; C) N-NO<sub>3</sub>; D) N-Urea; E) P-PO<sub>4</sub>; F) Guano.

further molecular analyzes are being carried out relatively to the phylogeny and filogrografia of mosses of the genus *Bryum* pan-Antarctic level also using samples of biological material collected at Edmonson Point.

### *8(iii) Other Scientific Activities*

Studies of terrestrial ecology at Edmonson Point were initiated in the 1980s, although this type of research and other forms of science increased in the 1990s, in particular by Italian scientists. Edmonson Point was the location of BIOTEX 1, the first SCAR Biological Investigation of Antarctic Terrestrial Ecosystems (BIOTAS) research expedition, during December 1995 and January 1996. Ten researchers from three countries participated in a variety of scientific projects which included: taxonomic, ecological, physiological and biogeographical studies on cyanobacteria, algae, bryophytes, lichens (including chasmolithic and endolithic communities), nematodes, springtails and mites; studies of soil and freshwater biogeochemistry; microbial metabolic activity and colonisation studies; and investigations into the

photosynthetic responses to ambient and controlled conditions of mosses, lichens and plant pigments that may act as photoprotectants (Bargagli, 1999). While the BIOTAS programme has now formally concluded, it is expected that further studies of this type will be on-going at Edmonson Point.

## 9. Human Activities/Impacts

Edmonson Point was probably first visited on 6 February 1900 when Carsten Borchgrevink landed just north of Mount Melbourne on “a promontory almost free of snow ... about 100 acres in extent” and climbed about 200 m up the slopes (Borchgrevink, 1901: 261). The Wood Bay region was rarely mentioned during the following 70 years, and presumably was visited only infrequently. Activity in the area increased in the 1980s, first with visits by the GANOVEX expeditions (Germany). Botanical research was undertaken in December 1984 (Given, 1985; Greenfield *et. al.*, 1985; Broady, 1987) and in January 1989, at which time the first proposals for special protection of the site were made (Given pers. comm. 2003). Italy established a station in close proximity at Terra Nova Bay in 1986-87 and increased research interest in the site followed.

The modern era of human activity at Edmonson Point has been largely confined to science. The impacts of these activities have not been described, but are believed to be minor and limited to items such as campsites, footprints, markers of various kinds, human wastes, scientific sampling, handling of limited numbers of birds (e.g. installation of devices to track birds, stomach lavage, biometric measurements, etc), and potentially some impacts associated with helicopter access and installation and operation of camp and research facilities at the penguin colony and on the northern cusped foreland. At least one fuel spill of around 500 ml, and other smaller spills, were reported in 1996 as a result of refuelling operations at the generator and fuel store located at the penguin colony (see disturbed sites marked on Map 4). In addition, seaborne litter is occasionally washed onto beaches within the Area. The Restricted Zone at Colline Ippolito has received less human activity than Edmonson Point and impacts in this area are expected to be negligible.

### *9(i) Restricted and managed zones within the Area*

*Restricted Zone:* The ice-free area of Colline Ippolito (1.12 km<sup>2</sup>) approximately 1.5 km north-west of Edmonson Point is designated as a Restricted Zone in order to preserve part of the Area as a reference site for future comparative studies, while the remainder of the terrestrial Area (which is similar in biology, features and character) is more generally available for research programmes and sample collection. The northern, western and southern boundaries of the Restricted Zone are defined as the margins of the permanent ice extending from Mount Melbourne, and are coincident with the boundary of the Area (Maps 1 and 3). The eastern boundary of the Restricted Zone is the mean low water level along the coastline of this ice-free area.

Access to the Restricted Zone is allowed only for compelling scientific reasons or management purposes (such as inspection or review) that cannot be served elsewhere within the Area.

*9(ii) Structures within and near the Area*

*CEMP Site:* A fibreglass cabin for field observation, containing instrumentation and APMS panel, and two Nunsen huts for 4 people were installed by PNRA in 1994/95 to support CEMP research. These structures are located on a rocky knoll at an elevation of 16 m, 80 m from the coast and 40 m south of the northern sub-colony of penguins (Maps 2 and 4). At the beginning of each field season a generator and a number of fuel drums are temporarily stored about 20 m from the camp and removed at the end of each season. Adjacent to the northern penguin sub-colony, fences of metal net (30-50 cm) have been installed to direct penguins over the APMS weigh bridge.

*Other activities:* Approximately 50 plastic cloches were installed at 10 locations throughout the Area in 1995-96 as part of BIOTEX-1 (Maps 2 and 4). A number of additional cloches were installed the previous year at four locations (Wynn-Williams, 1996). It is not precisely known how many of these cloches remain within the area. Temporary camp facilities were installed at the location of the designated camp site for the duration of the BIOTEX-1 programme, which have now been removed.

During the thirtieth Italian Antarctic expedition has been removed much of the fence surrounding the colony D (Map 4) and the underlying part. It 'been completely eliminated the barrier in the valley under the Automated Penguin Monitoring System (APMS), by limiting only to the fence surrounding the APMS. We have so improved and freed the area from several meters of the fence and over 40 iron bolts that were in the ground. (Map 4).

On 28 October 2016, during the Antarctic campaign XXXII, the old field has been reclaimed: were removed two fuel drums and the Nansen Hut located near the apple. Then remains the apple, APMS and outbuildings, the weather station and the Penguin Nest Camera at A,B observation points (Map 4)

The nearest permanent stations are Mario Zucchelli Station at Terra Nova Bay (Italy), Gondwana Station (Germany) and Jang Bogo Station (Republic of Korea) which lie approximately 50, 44 and 43 km south respectively.

*9(iii) Location of other protected areas within close proximity of the Area*

The nearest protected areas to Edmonson Point are the summit of Mount Melbourne (ASPANo. 118), which lies 13 km to the west, and a marine area at Terra Nova Bay (ASPANo. 161), which lies approximately 52 km to the south (Map 1, Inset 2).

## 10. Permit conditions

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority. Conditions for issuing a Permit to enter the Area are that:

- it is issued only for scientific research on the Area, or for compelling scientific reasons that cannot be served elsewhere; or
- it is issued for essential management purposes consistent with plan objectives such as inspection, maintenance or review;
- access to the Restricted Zone is allowed only for compelling scientific reasons or management purposes (such as inspection or review) that cannot be served elsewhere within the Area;
- the actions permitted will not jeopardise the ecological or scientific values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the Permit, or an authorised copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the Permit;
- Permits shall be issued for a stated period.
- The appropriate authority should be notified of any activities/measures undertaken that were not included in the authorised Permit.

### *10(i) Access to and movement within the Area*

Access to the Area shall be by small boat, on foot or by helicopter. Movement over land within the Area shall be on foot or by helicopter. Access to the Area by vehicle is restricted according to the conditions described below.

#### *- Small boat access*

The Edmonson Point part of the Area may be entered at any point where pinnipeds or seabird colonies are not present on or near the beach. Access for purposes other than CEMP research should avoid disturbing pinnipeds and seabirds (Map 1 and 2). There are no special restrictions on landings from the sea, although when accessing the main ice-free area of Edmonson Point visitors shall land at the northern cusped foreland and avoid landing at breeding bird colonies (Map 2).

#### *- Restricted conditions of vehicle access*

Use of vehicles within the Area is prohibited, except at the southern boundary of the Area where they may be used on sea ice to gain access to the shore, from where visitors shall proceed on foot. Thus, vehicle use shall avoid interference with animal feeding routes and the Adélie penguin colony. When using vehicles on sea ice care should be exercised to avoid Weddell seals which may be present: speed should be kept low and seals shall not be approached by vehicle closer than 50 m.

Access over land by vehicles is allowed to the boundary of the Area. Vehicle traffic shall be kept to the minimum necessary for the conduct of permitted activities.

- *Aircraft access and overflight*

All restrictions on aircraft access and overflight stipulated in this plan shall apply during the period 15 October – 20 February inclusive. Aircraft may operate and land within the Area according to strict observance of the following conditions:

- All overflight of the Area for purposes other than access shall be conducted according to the height restrictions imposed in the following table.

**Minimum overflight heights within the Area according to aircraft type**

Aircraft type	Number of Engines	Minimum height above	
		Feet	Metres
Helicopter	1	2461	750
Helicopter	2	3281	1000
Fixed-wing	1 or 2	1476	450
Fixed-wing	4	3281	1000

- Helicopter landing is normally allowed at only three designated sites (Maps 1-4). The landing sites with their coordinates are described as follows:
  - a) shall be used for most purposes, located on the northern cusplate foreland of Edmonson Point (Map 2) (74°19'24"S, 165°07'12"E);
  - b) is allowed in support of the Adélie Penguin Monitoring Programme when necessary for transport of heavy equipment / supplies (Map 2) (74°19'43"S, 165°07'57"E); and
  - c) is allowed for access to the Restricted Zone, located at the northern ice-free area (Colline Ippolito, Map 3) (74°18'50"S, 165°04'29"E).
- In exceptional circumstances, helicopter access may be specifically authorised elsewhere within the Area for the purpose of supporting science or management according to conditions imposed by the Permit on access location(s) and timing. Landing of helicopters at sites of mammals and seabird sites and significant vegetation shall be avoided at all times (Maps 2-4).
- The designated aircraft approach route is from the west of the Area, from over the lower eastern ice slopes of Mount Melbourne (Maps 1-3). Aircraft shall approach the main designated landing site (A) on the cusplate foreland from the north-west over or near Baia Siena (Siena Bay). When appropriate, access to landing site (B) should follow the same route and proceed a further 700 m SE. The departure route is identical in reverse.



- When appropriate, access to landing site (C) should be from the lower eastern ice slopes of Mount Melbourne and proceed directly to the landing site from the south over the land or where this is not feasible over Baia Siena (Siena Bay), avoiding skuas nesting to the north of the landing site.
- Use of smoke grenades to indicate wind direction is prohibited within the Area unless absolutely necessary for safety, and any grenades used should be retrieved.

- *Foot access and movement within the Area*

Movement on land within the Area shall be on foot. Visitors should move carefully so as to minimise disturbance to the breeding birds, soil, geomorphological features and vegetated surfaces, and should walk on rocky terrain or ridges if practical to avoid damage to sensitive plants and the often waterlogged soils.

Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimise trampling effects. Pedestrians that are not undertaking research or management related to the penguins shall not enter the colonies and should maintain a separation distance from the breeding birds of at least 15 m at all times. Care should be exercised to ensure monitoring equipment, fences and other scientific installations are not disturbed.

Pedestrians moving between the helicopter landing sites (A) or (B) to the Adélie colony shall follow the preferred walking routes marked on Maps 2 and 4 or follow a route along the beach.

*10(ii) Activities that are or may be conducted in the Area, including restrictions on time or place*

- The research programme associated with the CCAMLR CEMP;
- Scientific research that will not jeopardise the ecosystem of the Area;
- Essential management activities, including monitoring.

*10(iii) Installation, modification or removal of structures*

No structures are to be erected within the Area except as specified in a Permit. All scientific equipment installed in the Area must be approved by Permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be made of materials that pose minimal risk of contamination to the Area. Removal of specific equipment for which the Permit has expired shall be a condition of the Permit. Permanent structures are prohibited.

*10(iv) Location of field camps*

Semi-permanent camps and temporary camping is permitted within the Area at the primary designated site on the cusplate foreland of Edmonson Point (Map 2).

Camping at the CEMP Research camp (Maps 2 & 4) is permitted only for purposes of the Adélie Penguin Monitoring Programme. When necessary within the Restricted Zone for purposes specified in the Permit, temporary camping is permitted at the designated site (C) (74°18'51"S, 165°04'16"E) approximately 100 m west of helicopter landing site (Map 3).

*10(v) Restrictions on materials and organisms which can be brought into the Area*

No living animals, plant material or microorganisms shall be deliberately introduced into the Area and the precautions listed in 7(ix) below shall be taken against accidental introductions. In view of the presence of breeding bird colonies at Edmonson Point, no poultry products, including products containing uncooked dried eggs, including wastes from such products, shall be released into the Area.

No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted.

Fuel is not to be stored in the Area, unless authorised by Permit for specific scientific or management purposes. Fuel spill clean-up equipment should be made available for use at locations where fuel is being regularly handled. Anything introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of any introduction into the environment is minimised. If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material in situ. The appropriate authority should be notified of anything released or not removed that was not included in the authorised Permit.

*10(vi) Taking or harmful interference with native flora or fauna*

Taking or harmful interference with native flora or fauna is prohibited, except by Permit issued in accordance with Annex II to the Protocol on Environmental Protection to the Antarctic Treaty. Where taking or harmful interference with animals is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard.

*10(vii) Collection or removal of anything not brought into the Area by the Permit holder*

Collection or removal of anything not brought into the Area by the Permit holder shall only be in accordance with a Permit and should be limited to the minimum necessary to meet scientific or management needs. Permits shall not be granted if there is a reasonable concern that the sampling proposed would take, remove or damage such quantities of rock, soil, native flora or fauna that their distribution or abundance on Edmonson Point would be significantly affected. Anything of human origin likely to compromise the values of the Area, which was not brought into the

Area by the Permit Holder or otherwise authorised, may be removed unless the impact of removal is likely to be greater than leaving the material *in situ*: if this is the case the appropriate authority should be notified.

*10(viii) Disposal of waste*

All wastes, except human wastes, shall be removed from the Area. Human wastes shall either be removed from the Area, or incinerated using purpose-designed technologies such as a propane-burning toilet, or in the case of liquid human wastes may be disposed of into the sea.

*10(ix) Measures that are necessary to ensure that the aims and objectives of the Management Plan can continue to be met*

Permits may be granted to enter the Area to carry out monitoring and site inspection activities, which may involve the small-scale collection of samples for analysis or review, or for protective measures.

Any specific long-term monitoring sites shall be appropriately marked.

To help maintain the ecological and scientific values of Edmonson Point special precautions shall be taken against introductions. Of concern are microbial, invertebrate or plant introductions from other Antarctic sites, including stations, or from regions outside Antarctica. All sampling equipment or markers brought into the Area shall be thoroughly cleaned. To the maximum extent practicable, footwear and other equipment used or brought into the Area (including backpacks, carry-bags and tents) shall be thoroughly cleaned before entering the Area.

*10(x) Requirements for reports*

Parties should ensure that the principal holder for each Permit issued submits to the appropriate authority a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas. Parties should maintain a record of such activities and, in the Annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organising the scientific use of the Area.

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## APPENDIX 1

New bibliography and other publications of interest for the research activity at Edmonson Point (Ross Sea)

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## APPENDIX 2

### Permits Issued

During 2006-2011 Italian Antarctic Campaign have been issued the permits for the interference or sampling of following living organisms into the Edmonson Point ASPA N° 165:

<b>2006/2007 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
Pygoscelis adeliae	2000	visual census
“ “	10	tagging
“ “	10	feather sampling
Stercorarius maccormicki	200	visual census

Have been carried out water sampling from lakes. Permit for entry in ASPA 165 have been performed for 40 days in the field camp.

<b>2007/2008 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>

Have been issued permits for entry in ASPA 165 only for meteo station control for 2 times, 3 hours each time

<b>2008/2009 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>

No activity has been performed at Edmonson Point ASPA 165 during 2007/2008 campaign

<b>2009/2010 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
System Pygoscelis adeliae	2000	visual census
“ “ “	18	feathers and blood sampling
Stercorarius maccormicki	120	visual census
“ “ “	10	feathers and blood sampling
Mosses	200 g	manual sampling
Algae	200 g	manual sampling

Have been carried out water sampling, mosses and algae from lakes. Permit for entry in ASPA 165 have been performed during 31 days in the field camp and for 3 hours for other sampling.

<b>2010/2011 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
Mosses	600 g	manual sampling
Algae	400 g	manual sampling
Lichens on rocks and soils	600 g	manual sampling
Colonized rocks and soils by microorganisms and lichens	2 Kg	manual sampling

Sampling and studies activities into the ASPA area have been carried out in 12 different times for a total of 28 hours of work.

### APPENDIX 3

#### Permits issued

During 2011-2016 Italian Antarctic Campaign have been issued the permits for the interference or sampling of following living organisms into the Edmonson Point ASPA N° 165:

<b>2011/2012 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
Mosses	0.005 kg	manual system
Lichens	0.002 kg	manual system

Permit for entry in ASPA 165 have been performed in the field camp 4 times, 3 hours each time and 3 times for meteo activities 1 hour each time. 15 hours in total.

<b>2012/2013 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
Mosses	0.08 kg	manual system
Lichens	0.05 kg	manual system

Have been issued permits for entry in ASPA 165 for research activities and meteo station control. The total time inside the ASPA during the 2012-13 campaigning has been about 27 hours.

<b>2013/2014 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
Lacustrine algae	1 kg	manual system
Mosses	1.2 kg	manual system
Lichene	0.1 kg	manual system
Faeces and guano	how need	manual system
Bivalve fossil	3 species for stratigraphic layer	manual system

Have been issued permits for entry in ASPA 165 only for meteo station control for 2 times, 3 hours each time. The total time inside the ASPA during the 2013-14 campaigning has been about 25 hours.

<b>2014/2015 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
Project on Conservation of a polar mesopredator species susceptible to ecosystem change	3000 Pygoscelis adeliae	visual census
	N° 20 feathers and blood sampling	manual system
	Stercorarius maccormicki 120	visual census
	N°10 feathers and blood sampling	manual system

He was made a field at the ASPA 165 (Edmonson Point) for a period of about 60 days. Have been issued permits for entry in ASPA also for meteo station control for 2 times, 3 hours each time. The total time inside the ASPA during the 2014-15 campaigning has been about 6 hours and 60 days.

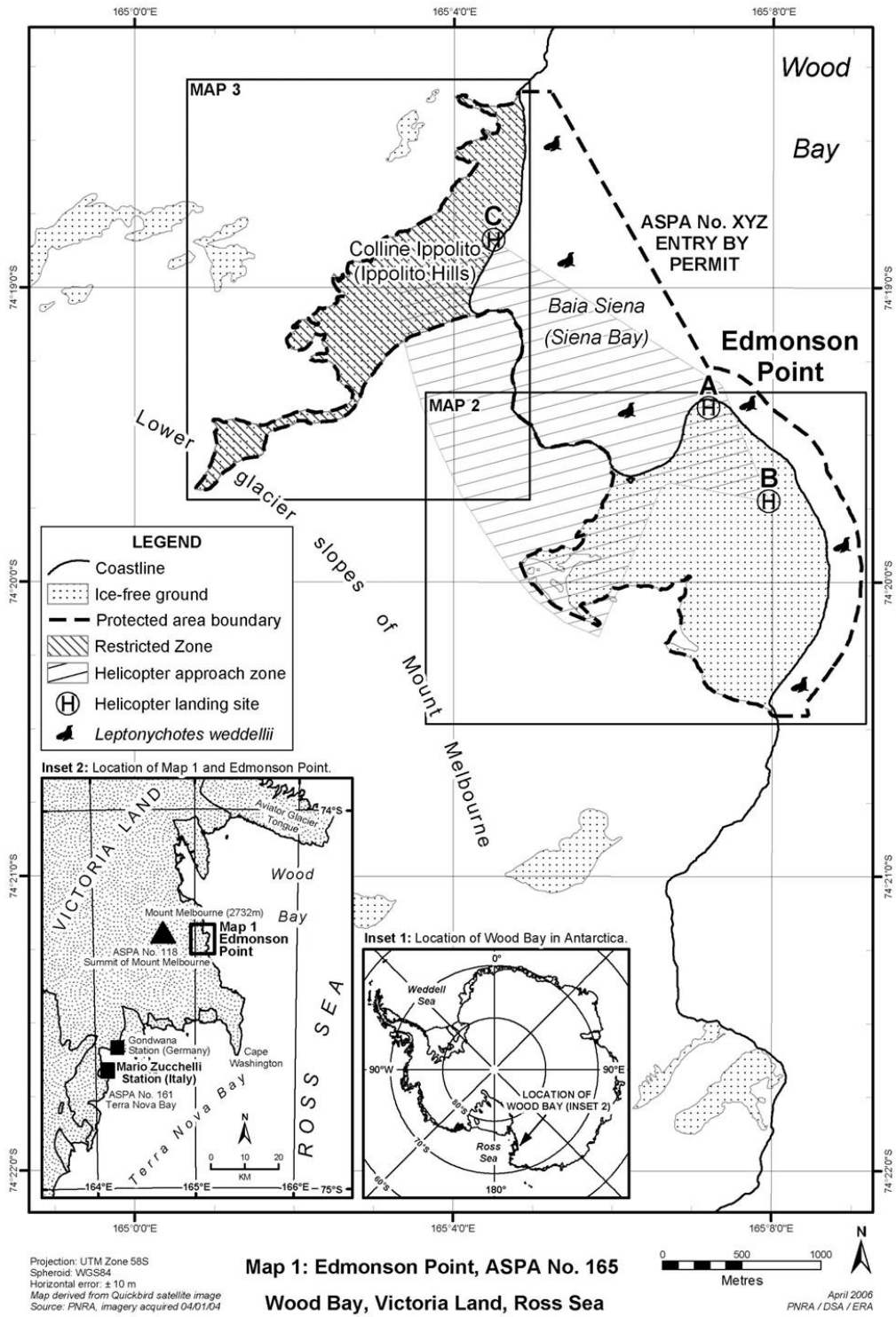
<b>2015/2016 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
surface with biological crust	1.5 kg	using sterile spade

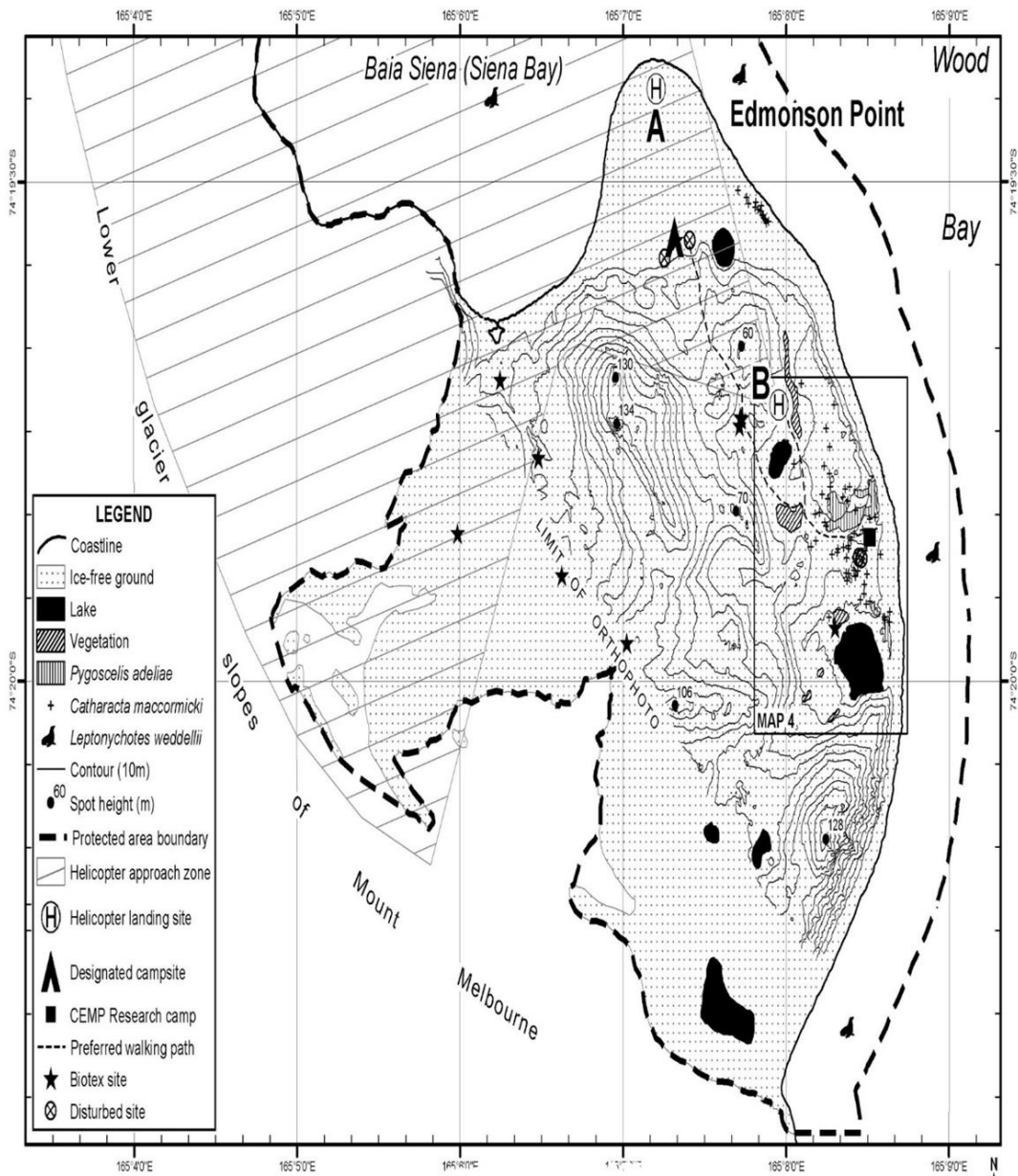
Have been issued permits for entry in ASPA also for meteo station control for 5 times, 3 hours each time. The total time inside the ASPA during the 2015-16 campaigning has been about 21 hours.

<b>2016/2017 campaign</b>		
<i>Organism denomination</i>	<i>Amount N° or Kg</i>	<i>Sampling System</i>
Collection of tephra – No living organism will be sampled		sample by spatula
Algae; Planktonic invertebrates; Fish	5 for species	plankton net, fish line

Have been issued permits for entry in ASPA also for meteo station control for 5 times, 3 hours each time. The total time inside the ASPA during the 2016-17 campaigning has been about 43 hours.

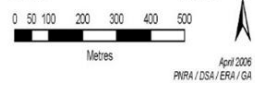
Edmonson Point ASPA 165 Maps.



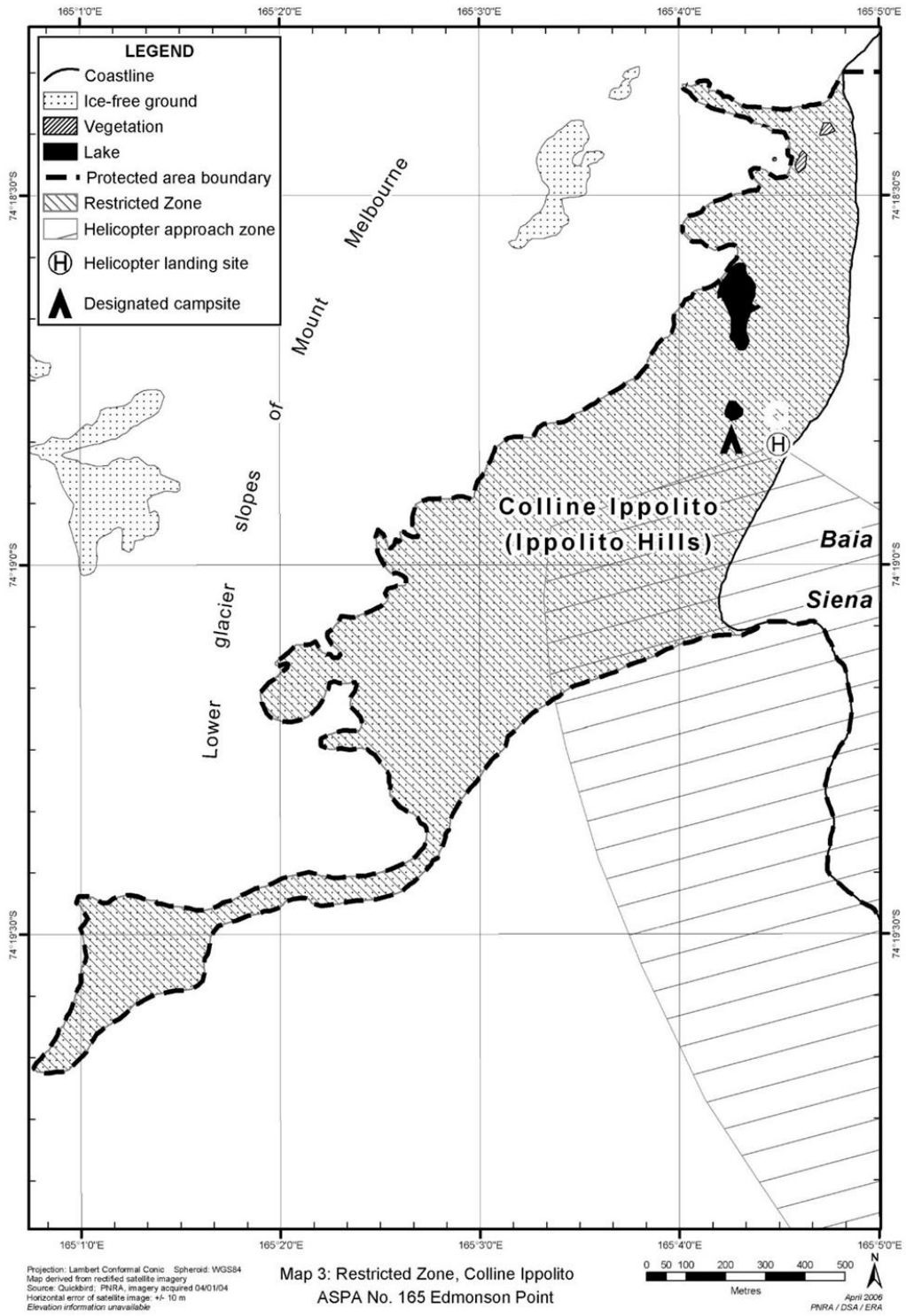


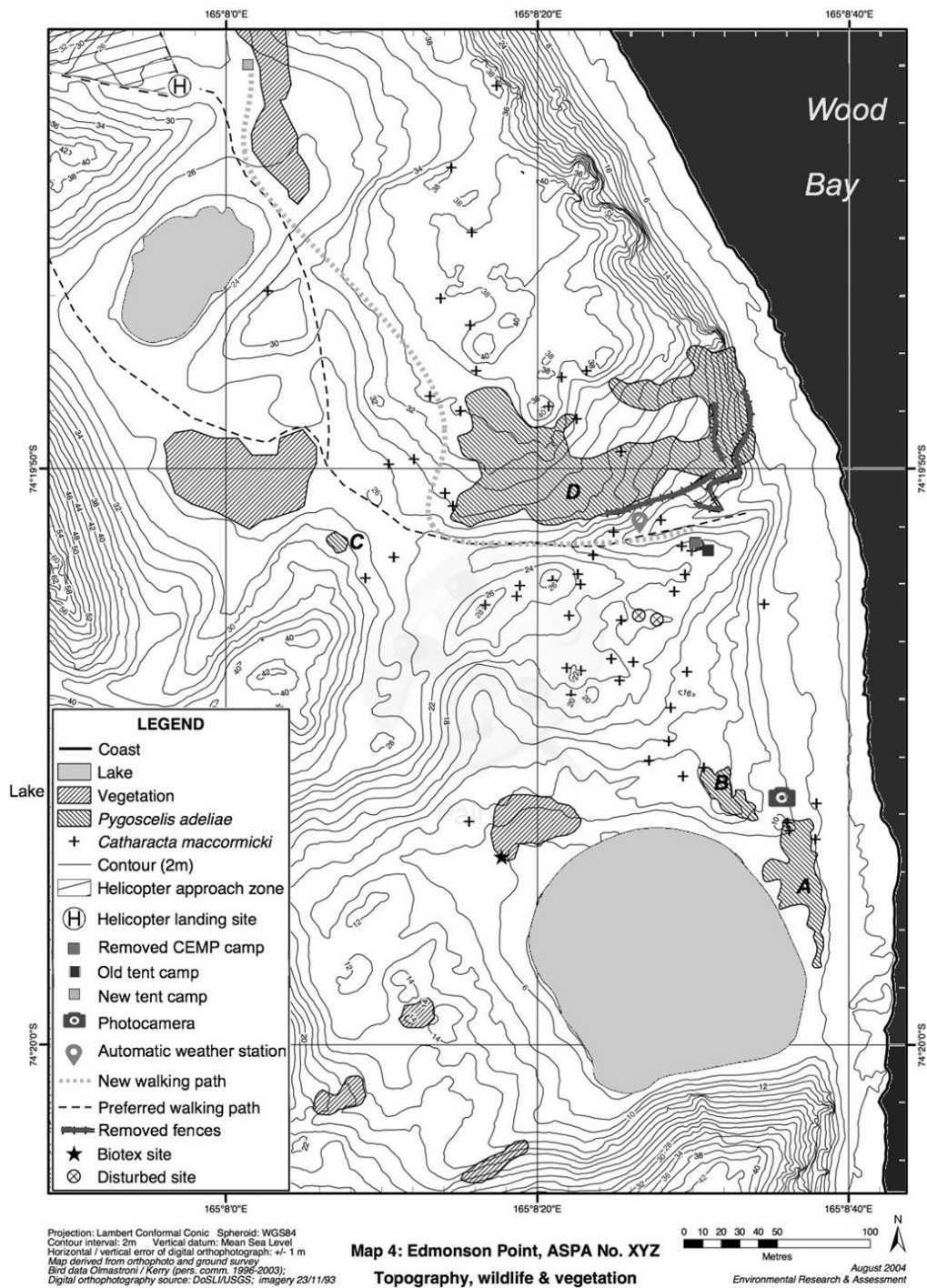
Projection: Lambert Conformal Conic, Spheroid: WGS84  
 Contour interval: 10 m - Vertical datum: Mean Sea Level  
 Horizontal / vertical error of digital orthophotograph: +/- 1 m  
 Map derived from orthorectified, rectified satellite imagery and ground survey  
 Base data: Citradromi / Henry (pers. comm. 1996-2002)  
 Digital orthophotography: source DoS/LUS/GS/GA; imagery 2311193  
 Satellite imagery: Quickbird; source PHRA; imagery 04/01/04

Map 2: Edmonson Point, ASPA No. 165  
 Physical / human features and access guidelines









Measure 8 (2017)

**Antarctic Specially Managed Area No. 5 (Amundsen-Scott South Pole Station, South Pole): Revised Management Plan**

**The Representatives,**

*Recalling* Articles 4, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (“the Protocol”), providing for the designation of Antarctic Specially Managed Areas (“ASMA”) and the approval of Management Plans for those Areas;

*Recalling* Measure 2 (2007), which designated Amundsen-Scott South Pole Station, South Pole as Antarctic Specially Managed Area No. 5;

*Noting* that the Committee for Environmental Protection has endorsed a revised Management Plan for ASMA 5;

*Desiring* to replace the existing Management Plan for ASMA 5 with the revised Management Plan;

**Recommend** to their Governments the following Measure for approval in accordance with Paragraph 1 of Article 6 of Annex V to the Protocol:

That:

1. the revised Management Plan for Antarctic Specially Managed Area No. 5 (Amundsen-Scott South Pole Station, South Pole), which is annexed to this Measure, be approved; and
2. the Management Plan for Antarctic Specially Managed Area No. 5 annexed to Measure 2 (2007) be revoked.

## **Management Plan for Antarctic Specially Managed Area No.5**

### **AMUNDSEN-SCOTT SOUTH POLE STATION, SOUTH POLE**

#### **Introduction**

The Amundsen-Scott South Pole Station (hereafter referred to as South Pole Station), operated by the United States, is located on the polar plateau at an elevation of 2835 m near the geographic South Pole at 90°S. An area of ~26,344 km<sup>2</sup> around the South Pole Station is designated as an Antarctic Specially Managed Area (hereafter referred to as ‘the Area’). The Area has been designated in order to maximize the valuable scientific opportunities at the Pole, protect the near-pristine environment and ensure that all activities, including those to experience the extraordinary qualities of the South Pole, can be conducted safely, environmentally responsibly and without disruption to scientific programs. In order to help achieve the objectives of the Management Plan, the Area has been divided into Scientific, Operations, and Restricted zones. The Scientific Zone is further divided into four sectors: Clean Air, Quiet, Downwind and Dark. The management measures agreed for those areas help coordinate activities and protect the important values of the South Pole.

The Area was originally designated following a proposal by the United States of America and adopted through Measure 2 (2007). The current Management Plan has been comprehensively revised and updated as part of the review process required by the Protocol on Environmental Protection to the Antarctic Treaty (hereafter the Protocol).

The Area is situated within ‘Environment Q – East Antarctic high interior ice sheet’, as defined in the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)). The Area is not classified under the Antarctic Conservation Biogeographic Regions classification (Resolution 6 (2012)).

#### **1. Values to be protected and activities to be managed**

##### *- Environmental and scientific values*

The Area is located in a region of high scientific value and Amundsen-Scott South Pole Station facilitates exceptional scientific research with extensive international collaboration. The unique environmental conditions at the South Pole, including the extremely cold and dry climate, its isolated location high on an ice sheet and being the southern axis point of the Earth, provide ideal conditions to conduct a wide range of scientific observations:

- Astrophysics, atmospheric and geospace sciences – including near-Earth solar wind, magnetosphere, ionosphere, and astronomy and astrophysical studies including cosmic ray and solar physics. The South Pole’s position on the Earth’s axis, the Area’s climatic conditions and remoteness from light pollution facilitate extended astronomical and astrophysical observations of specific stellar objects. Also, the Area’s isolation from sound, vibration, and

electromagnetic interference (EMI) is important for astrophysical research. The location is ideal for high-energy particle astrophysics experiments and detection of extreme energy events using instrument arrays installed into the ice sheet. The geophysically stable location of the Area and the operation of the South Pole Station year-round allow for continuous research of upper atmosphere physics, including solar processes, effects of short term geomagnetic phenomena (auroras, induced electrical currents, and radio wave communications interference), and long term events (relating to the ozone layer, ultraviolet radiation, atmospheric composition, stratospheric winds, weather, and climate). Located far from pollution sources and human influence, the air at the South Pole is considered to be the cleanest on Earth. The Area therefore serves as an important monitoring and research location for global background levels of natural and anthropogenic atmospheric constituents, and also for research into climate change.

- Glaciology – The thick ice sheet contains a natural record of atmospheric constituents, which is researched to understand past changes in the Earth’s atmosphere and climate.
- Seismology – Due to its isolation from sound and vibration, one of Earth’s most important seismic stations is situated in the Area.
- Medical research – The unique community of people living at South Pole Station allows for specialized medical research on small, isolated groups.

- *Historic values*

The Area has significant historic value and two Historic Sites and Monuments (HSMs) have been designated at the South Pole:

- HSM No.1 was designated in 1972 at 90°S to recognise a flag mast erected at the South Pole by the First Argentine Overland Polar Expedition in December 1965. The flag mast is believed now to lie irretrievably buried deep beneath ice within ~500 m from the geographic South Pole, although its exact location is unknown.
- HSM No.80 was designated in 2005 in the vicinity of 90°S to recognise Amundsen’s Tent, which was erected by the Norwegian expedition led by Roald Amundsen on their arrival at the South Pole on 14 December 1911. The Norwegian expedition was the first to reach the South Pole. The tent is believed now to lie irretrievably buried deep beneath ice within several km of the geographic South Pole, although its exact location is unknown.

The United States has established a ‘Ceremonial South Pole’ close to South Pole Station to commemorate the 1957/58 International Geophysical Year (IGY) and all expeditions that have achieved the South Pole.

- *Aesthetic and wilderness values*

As unique points on the rotational axis of the Earth, the Poles have long captured the imagination of geographers, explorers and the general public. The South Pole has attracted exceptional interest because of its unique and challenging qualities, such as the ice-dominated landscape combined with remoteness, high altitude and extreme cold. The South Pole is one of the most challenging environments on Earth for human survival. Many continue to seek out that challenge for diverse reasons, including for adventure, excitement and for personal discovery and achievement. For many, whether making the journey overland or by air, attaining the Pole represents an extraordinary and highly rewarding experience.

In addition, unusual phenomena such as parhelion or sun dogs, sun pillars and mirages may occur with beautiful effects in polar clouds or in suspended ice crystals in the dry, clear atmosphere. The Aurora Australis may illuminate the sky with dramatic arcs and waves of multicolored light at times of darkness, making a most impressive display.

The extreme environmental conditions, the vast ice-bound landscape, the unusual and beautiful atmospheric phenomena, the deep sense of history of human endurance and perseverance, combined with intangible qualities in people's personal experience and relationship with the South Pole, characterize the site as one of exceptionally high aesthetic and wilderness value.

## **2. Aims and objectives**

The aim of this Management Plan is to conserve and protect the environment surrounding the South Pole by managing and coordinating human activities in the Area such that the values of the South Pole are protected and sustained in the long term, especially the unique and outstanding scientific values.

The specific objectives of management in the Area are to:

- Facilitate scientific research while maintaining stewardship of the environment;
- Promote and assist with the planning and coordination of human activities at South Pole to manage actual or potential conflicts among different values (including those of different scientific disciplines), activities and operators;
- Ensure the long-term protection of scientific, historic, aesthetic, wilderness and other values of the Area by minimizing disturbance to or degradation of these values, including disturbance to natural features, and by minimizing the cumulative environmental impacts of human activities;
- Minimize the footprint of all facilities and scientific experiments established in the Area, while allowing for necessary modifications and improvements to these in a manner consistent with the other objectives of the Management Plan;
- Minimize any physical disturbance, release of pollutants, contamination and

wastes produced within the Area, and take all practical steps to contain, treat, remove or remediate these whether produced in the course of normal activities or by accident;

- Promote use of energy systems and modes of transport within the Area that have the least environmental impact, and minimize as far as practicable the use of fossil fuels for the conduct of activities within the Area;
- Improve the understanding of natural processes and human impacts both locally within the Area and globally, including through the conduct of monitoring programs; and
- Encourage communication and co-operation between users of the Area, in particular through dissemination of information on the Area and the provisions that apply;
- Prevent the unintended introduction of species not native to the Area, and minimize as far as practicable the unintended transfer of native species within the Area.

### **3. Management activities**

To achieve the aims and objectives of this Management Plan, the following management activities shall be undertaken:

- Parties with an active interest in the Area should convene as required, and preferably annually, a South Pole Management Group (hereafter the Management Group) to oversee coordination of activities in the Area, including to:
  - facilitate and ensure effective communication among those working in or visiting the Area;
  - provide a forum to anticipate, identify and resolve any actual or potential conflicts in use;
  - help minimize duplication of activities;
  - maintain a record of activities and, where practical, impacts in the Area;
  - develop strategies to detect and address cumulative impacts;
  - disseminate information on the Area, in particular on the activities occurring and the management measures that apply within the Area, including through maintaining this information electronically at <http://www.southpole.aq/>;
  - review past, existing, and future activities and evaluate the effectiveness of management measures and make recommendations on the implementation of this Management Plan.
- National Programs operating within the Area shall maintain copies of the current version of the management plan and supporting documentation in appropriate station and research facilities and make these available to all persons in the Area, as well as electronically at <http://www.southpole.aq/>;
- National Programs operating within the Area and tour operators visiting

should ensure that their personnel (including staff, crew, passengers, scientists and any other visitors) are briefed on, and are aware of, the requirements of this Management Plan, and in particular the General Environmental Guidelines (Appendix A), the Guidelines for the Scientific Zone (Appendix B) and Restricted Zones (Appendix C), and the Guidelines for Non-Governmental Visitors (Appendices D and E) that apply within the Area;

- National Programs operating within the Area and tour operators visiting should ensure that their personnel are briefed on, and are aware of, the risks and requirements for safety in the extreme environment at the South Pole, including in aircraft operations and in medical emergencies;
- Tour operators and any other group or person responsible for planning and / or conducting non-governmental activities within the Area should coordinate their activities with National Programs operating in the Area in advance to ensure they do not pose risks to the values of the Area and that they comply with the requirements of the Management Plan. In particular, advance coordination should be undertaken with the United States Antarctic Program as operator of Amundsen-Scott South Pole Station;
- National Programs operating within the Area should seek to develop best practices with a view to achieving the objectives of the Management Plan, and to exchange freely such knowledge and information;
- Signs and / or markers should be erected where necessary and appropriate to show the location or boundaries of zones, research sites, landing sites or campsites within the Area. Signs and markers shall be secured and maintained in good condition, and removed when no longer necessary;
- Visits shall be made as necessary (no less than once every five years) to evaluate whether the Management Plan is effective and to ensure management measures are adequate. The Management Plan, Code of Conduct and Guidelines shall be revised and updated as necessary; and
- National Programs operating within the Area shall take such steps as are necessary and practical to ensure the requirements of the Management Plan are observed.

#### **4. Period of designation**

Designated for an indefinite period.

#### **5. Maps and Photographs**

Map 1: ASMA No.5 South Pole: Location, topography, ASMA boundary, Scientific Zone and Clean Air Sector.

Map 2: ASMA No.5 South Pole: Management Zones and Sectors.

Map 3: ASMA No.5 Amundsen-Scott South Pole Station: Operations Zone.

Map 4: ASMA No.5 Amundsen-Scott South Pole Station.

Map 5: South Pole Non-Governmental Visitor approach guidelines overview.

Map 6: South Pole Non-Governmental Visitor approach guidelines detail.



- *Important notes on South Pole maps*

The ice sheet and facilities at the South Pole move at a rate of ~10 m per year. As a result, the true positions of features shown on maps and their GPS coordinates change over time. Therefore a Local Grid is used to define all ASMA, Zone and Sector boundaries, which all move with the Local Grid. Local Grid bearings thus remain consistent relative to permanently installed facilities, which move with the ice. Facility positions remain consistent relative to each other and to the ASMA boundaries, although their true positions shift relative to the geographic South Pole. Local Grid north aligns with the Greenwich Meridian (0 Degrees Longitude). ASMA maps are updated on a regular basis and the most current maps are made available at <http://www.southpole.aq/>.

## **6. Description of the Area**

### *6(i) Geographical coordinates, boundary markers and natural features*

- *General description*

The landscape at the South Pole comprises an extensive, gently sloping and featureless ice sheet rising to ~2835 m in elevation. The bedrock of the underlying continental landmass has an elevation of ~135 m above sea level, making the ice sheet at this location approximately 2700 m in thickness. The ice sheet over the Pole extending out to 89°S slopes in a Grid NW direction towards the Weddell Sea, ranging from ~3000 m to ~2650 m. The surface near the pole generally comprises windblown snow or sastrugi, and is otherwise featureless and not crevassed.

- *Boundaries and coordinates*

The boundary of the Area is defined as two semi-circles extending with a radius of 20 km and 150 km respectively around the South Pole Station (Map 1). The larger semi-circle extends 150 km from a point of origin defined as the Grid SW corner of the Atmospheric Research Observatory (ARO) building (~365 m from the geographic South Pole (2017)) and is bounded by the Grid 110° and 340° lines from the ARO building. This large semi-circle comprises the Clean Air Sector (CAS) of the Scientific Zone, which shares the outer boundary of the ASMA.

The smaller semi-circle extends 20 km from a point of origin defined as the center of the circular aluminum tower staircase on the main elevated building of South Pole Station (hereafter the elevated station). The center of this staircase is the common origin of three other management sectors (Quiet, Downwind and Dark) which, together with the CAS, comprise the Scientific Zone within the ASMA. The circular aluminum tower staircase is a readily recognizable feature on the maps and on the ground, and the elevated station is expected to be present in the Area longer than any other structure or landmark.

The boundary of the Area comprises all structures and areas of current and planned research at South Pole Station and an area of sufficient size to meet the objectives of the Scientific Zone. The geographic location of the ASMA shifts by ~10 m per year along with all of the facilities as the ice sheet moves.

- *Climate*

The climate at the South Pole Station is extremely cold, windy and arid. The average annual temperature at the South Pole is -49.4°C (-56°F). The highest temperature recorded at South Pole Station is -12.3°C (9.9°F) (on 25 Dec 2011), and the lowest is -82.8°C (-117.0°F) (June 1982).

The sun reaches a maximum elevation of 23.5° above the horizon at midsummer. Snow reflects much of the sunlight reaching the surface of the Polar Plateau.

Air humidity at the South Pole is close to zero, making the environment an extreme polar desert. Snowfall at the South Pole is minimal, with average annual precipitation being only 86 mm liquid equivalent. Winds are persistent and average between 5-15 knots, mainly originating from a Grid northeast / east direction. Wind-blown snow tends to accumulate around structures, causing deep drifts and burying structures even though actual snowfall is low.

An analysis of surface climatology by Lazzara *et al.* (2012) found no statistically significant change in temperature or pressure at the South Pole over the period 1957–2010, although a significant downward trend was observed for wind speeds, decreasing by 0.28 m / s per decade, as well as for average snow accumulation (1983-2010), decreasing by -2.9 mm / year.

- *Atmospheric sciences*

Pollutants from aircraft and other sources in polar regions can travel hundreds of kilometers, affecting measurements of boundary layer air, measurements of gasses and aerosols in the air column, and measurements of contaminants in the snow, thus requiring an extensive area be kept vacant to maintain a site for research on clean air. The Atmospheric Research Observatory (ARO) is situated upwind ~450 m Grid NE of the elevated station, and lies at the Grid SW corner of the Clean Air Sector (CAS). The CAS extends in a semi-circle from ARO 150 km to the outer boundary of the Scientific Zone and the ASMA, which provides the necessary buffer for ensuring accurate measurements. Most of the atmospheric research is conducted within the CAS, which is situated upwind from the station to help to ensure that the air remains as pristine as possible. The research at ARO is carried out by the United States National Oceanic and Atmospheric Administration's Global Monitoring Division (NOAA/ESRL). Measurements are undertaken to determine long-term trends of important trace gases, aerosols, and solar radiation and to investigate the influence of these gases and aerosols on the Earth's climate (Sheridan *et al.* 2016). Stratospheric ozone depletion is also investigated using balloon-borne instrumentation, and both scientific and operational balloon launches are made from the Balloon Inflation Facility located in the Operations Zone.

- *Astrophysics and Geospace sciences*

Most research projects related to astrophysics and geospace sciences are conducted within the Dark Sector, an area which has been set aside with the aim to reduce light and EMI as far as possible within this area.

The Dark Sector Laboratory is home to the South Pole Telescope (SPT). The SPT can detect Cosmic Microwave Background (CMB) Radiation and one of its main aims is to develop understanding of the expansion of the Universe from the time of the 'Big Bang' by identifying galaxy clusters where CMB radiation has been altered by concentrations of dark matter (Carlstrom *et al.* 2011; Reichardt, de Haan & Bleem 2016). The SPT will form part of the Event Horizon Telescope, an array of telescopes distributed worldwide which will synthesise together an earth-sized telescope. The Dark Sector Laboratory also houses the BICEP detectors, which have been operational since 2006. These experiments aim to detect B-mode polarization, with each generation of BICEP increasing the number of detectors and thus the sensitivity to B-mode polarization (Ade *et al.* 2015).

The Martin A. Pomerantz Observatory (MAPO) is also situated inside the Dark Sector. It houses equipment for several research projects, one being the Small Polarimeter Upgrade for DASI (SPUD), which is also designed to measure B-mode polarization.

The IceCube Laboratory, a neutrino detector, is also located in the Dark Sector. IceCube is a form of telescope comprising over 5100 spherical sensors buried in one cubic kilometre of ice. The experiment was built to investigate neutrino properties and the nature of dark matter. Since operation commenced in 2010, IceCube has observed for the first time the astrophysical high-energy neutrino flux, it has measured the cosmic-ray anisotropy for the first time in the southern hemisphere, it has produced the world's best limits on the spin-dependent cross section for weakly interacting dark matter particles, and it has made the most detailed measurements of the properties of light propagation in Antarctic ice (Aartsen *et al.* 2016, 2017).

The Askaryan Radio Array (ARA) is a novel detector under construction in the Dark Sector which aims to discover extreme energy events using sub-surface radio antenna arrays (Allison *et al.* 2015, 2016).

South Pole is part of the Antarctic Gravity Wave Imaging Network (ANGWIN). The aim of ANGWIN is to collect continent-wide gravity wave measurements. At South Pole, measurements are focused on quantifying the temperature signatures of gravity waves deep within the polar vortex (Mehta *et al.* 2017).

A SuperDARN (Dual Auroral Radar Network) array was established at South Pole in the Operations Zone in 2013, and the array helps fill a gap in studies of auroral physics over the Antarctic (Makarevich, Forsythe & Kellerman 2015).

- *Glaciology*

Snow accumulation has been monitored intermittently at the South Pole since the 1957/58 International Geophysical Year (IGY). An extensive network of measurement locations to monitor long-term snow accumulation around the South Pole was established in 1992 (Mosley-Thompson *et al.* 1999). The network of measurement stakes extends out 20 km in all directions from the Pole; it is essential for the research being conducted on snow accumulation that the stakes and the area around the stakes are not disturbed. Data collected between 1958-97 showed net annual accumulation rates increased over this period (Mosley-Thompson *et al.* 1999), which is in contrast to the more recent results reported by Lazzara *et al.* (2012) for the period 1982-2010 showing a decrease.

Ice core drilling is also conducted at South Pole. SPICECORE, which was drilled during the 2014/15 and 2015/16 seasons, will provide records of stable isotopes, aerosols and atmospheric gases dating back ~40,000 years.

- *Seismology*

Seismological data have been collected at the South Pole since the 1957/58 IGY. Conditions at the South Pole are ideal for investigating earthquakes and the structure of the Earth. The energy levels of vibrations from seismic events travelling through the Earth and the polar ice sheet are recorded by seismometers at the South Pole. Because of its position at the Earth's axis of rotation, measurements at the Pole of the energy generated by major earthquakes are not affected by the rotational forces which influence recordings elsewhere on Earth. The South Pole Remote Earth Science and Seismological Observatory (SPRESSO) is situated ~7.5 km from South Pole Station inside the Quiet Sector. The instruments are buried ~300 m deep in the ice recording vibrations of the Earth. Due to the lack of other vibrations in the area which can generate seismic 'noise', the instruments at South Pole can detect vibrations up to four times quieter than other observatories on earth.

- *Medical research*

Due to its isolated environment South Pole Station is ideal for medical research focusing on evaluations of social behaviour and human physiology. Research at the South Pole on sleep patterns has examined the role of total darkness on sleep quality and mood characteristics. Studies have also been undertaken at the South Pole on the effects of isolation and confinement on depression, fatigue, vigor, and anxiety. This research is important for determining the performance capabilities of people working in isolated environments. Research has also been conducted on high altitude illness (Anderson *et al.* 2011).

- *Historic features*

Two Historic Sites and Monuments (HSM) have been formally designated within the Area (HSM No.1 and HSM No.80), and these are described in Section 6(iv).

A marker surrounded by the flags of the original twelve signatory nations of the Antarctic Treaty, known as the Ceremonial South Pole, has been erected by the United States ~150 m grid north of South Pole Station and lies ~200 m from the geographic South Pole. The Ceremonial South Pole commemorates the 1957/58 IGY as well as all expeditions that have reached the South Pole.

- *Human activities / impacts*

Following attainment of the South Pole by the Amundsen and Scott expeditions in 1911/12, no further visits were made to the South Pole until the 1957/58 IGY when a permanent station was established there by the United States. Amundsen-Scott South Pole Station has had several major upgrades, the most recent being the opening of the elevated station in 2008. The main activity at the South Pole is science. The remoteness, scale and types of science being conducted require significant logistical support, including a major ski-way for large transport aircraft, substantial fuel storage and power generation facilities, and accommodation and scientific laboratories. Further information about structures at the South Pole is provided in Section 6(iii).

Non-Governmental Visitors (NGVs) on expeditions or as tourists comprise the other main activity at the South Pole. Over the five-year period between 2006-11 an average of approximately 190 people per season visited the South Pole on private expeditions. The highest number to date was recorded in 2011/12 with 495 visitors, which is almost double the previous high of 266 recorded in 2010/11. This peak was driven by a surge of interest in the South Pole surrounding the centennial years of Amundsen's and Scott's expeditions. Around 230 NGVs were recorded in 2015/16, close to the level seen immediately prior to the centennials.

Approximately 750,000 liters (198,000 gallons) of diesel fuel is stored in tanks at the South Pole, the volume necessary to maintain safe operations at South Pole Station, which is used for power, aircraft, vehicles and heavy machinery. In the winter of 1989 150,000 liters (40,000 gallons) of this fuel leaked into snow at South Pole and was unrecoverable (Wilkniss 1990), which represents the most substantial single contamination event at South Pole to date. Emissions from diesel generators and engines probably account for the majority of contaminants on a continuous basis, although these are dispersed and diluted by persistent winds generally towards the area Grid SW from the station.

*6(ii) Restricted and managed zones within the area*

This management plan establishes three types of zones within the Area: Operations, Scientific, and Restricted. The management objectives of the different types of zone are set out in Table 1. Maps 1 and 2 show the extent of the Scientific Zone, while Map 3 shows the extent of the Operations Zone and the Restricted Zones.

A new zone or zone type may be considered by the Management Group as the need arises, and those no longer needed may be delisted. Zoning updates should be given

particular consideration at the time of Management Plan reviews.

**Table 1:** Management Zones designated within the Area and their specific objectives.

<b>Management Zones</b>	<b>Specific Zone Objectives</b>	<b>Plan Appendix</b>
Operations Zone	To ensure that science support facilities and related human activities within the Area are contained and managed within a designated area.	-
Scientific Zone	To ensure those planning science or logistics within the Area, and all visitors to the Area, are aware of sites of current or long-term scientific investigation that may be sensitive to disturbance or have sensitive scientific equipment installed, so these may be taken into account during the planning and conduct of activities within the Area. A particular objective of the Scientific Zone is to minimize conflicts between different types of use.	B
Restricted Zone	To restrict access into a particular part of the Area and/or activities within it for a range of reasons, e.g. owing to special scientific values, because of sensitivity, presence of hazards, or to restrict emissions or constructions at a particular site. Access into Restricted Zones should normally be for compelling reasons that cannot be served elsewhere within the Area.	C

The overall policies applying within the zones are outlined in the sections below, while detailed guidelines for the conduct of activities within the Scientific Zone are found in Appendix B and within the Restricted Zones in Appendix C.

- *Operations Zone*

The Operations Zone (Maps 3 and 4) has been established to contain primary human activity in the Area, including science support activities, main station services (e.g. living facilities), ski-way operations, and on-ground support facilities for Non-Governmental Visitors (NGVs).

The boundary of the Operations Zone (Map 3), described clockwise from ARO, extends ~1.85 km Grid SE 110° from ARO, following the southern boundary of the Clean Air Sector. Thence the Operations Zone boundary extends ~3.75 km Grid 243° SW, sharing the boundaries of the Quiet Sector and Downwind Sector. Thence the Operations Zone boundary extends ~1.3 km Grid 202° SSW, following the boundary of the Aircraft Operations Restricted Zone around the Grid southern end of the ski-way. The boundary thence extends ~3.6 km Grid 158° NNE along the Grid western boundary of the Aircraft Operations Restricted Zone, parallel to the ski-way and to

its Grid northern end. The Operations Zone boundary continues in the same direction a further ~1.3 km beyond the Grid northern end of the ski-way to the Clear Air Sector boundary. Thence the Operations Zone boundary follows the Clean Air Sector boundary back to ARO ~1.15 km Grid SE (following the Grid 340° line from ARO). The Operations Zone is ~430 ha in area.

The following provisions should be observed within the Operations Zone:

- Waste minimization and management should be considered in the planning, maintenance and decommissioning of facilities within the Operations Zone;
- Alternative energy sources and energy efficiency should be considered in the planning and maintenance of facilities within the Operations Zone;
- Contingency plans for emergencies in the Operations Zone should be developed as appropriate by the National Program(s) operating in the Area;
- The installation of any new structures or modernization of existing National Program(s) operating in the area should review and coordinate any plans for construction or installations to ensure that any impacts on scientific activities and values are minimized. Any change is subject to environmental assessment as required by Article 8 of the Protocol.
- Specific guidelines for Non-Governmental Visitors (NGVs) within the Operations Zone are described in Appendix D of this management plan.

- *Scientific Zone*

The Scientific Zone has been established to avoid mutual interference and / or conflicts between multiple activities, and in particular to protect scientific research from disturbance that could affect results. The Scientific Zone encompasses the majority of the ASMA, with the outer boundary defined by and coincident with the ASMA boundary (Map 1). The inner boundary of the Scientific Zone is defined by, and coincident with, the boundary of the Operations Zone (Maps 2 and 3).

The Scientific Zone is divided into four Sectors – Clean Air, Quiet, Downwind and Dark – to ensure that scientific activities with particular sensitivity are strategically located so the potential for interference is minimized. Of particular concern are interference from sound, light, vibration, contamination from local sources of pollutants, and visual obstruction. Entry to and activities within the Sectors should not interfere with scientific research.

The boundaries of the Sectors and the specific guidelines and operational policies applying within them are defined in Appendix B.

- *Restricted Zones*

Restricted Zones have been designated at sites where access and / or activities need to be restricted to ensure scientific values are maintained, or for reasons of safety. Access to Restricted Zones is prohibited except by authorized personnel for essential scientific, operational or management purposes. There are six Restricted Zones in the ASMA, all located within or near the Operations Zone (Maps 3 and 4): details of

the boundaries and restrictions applying within the Restricted Zones are provided in Appendix C.

The National Program(s) operating in the Area or expedition leaders from other groups should ensure that all visitors to the Area are informed of the boundaries and purposes of the Restricted Zones and the entry restrictions that apply.

*6(iii) Structures within and near the Area*

The first station at the South Pole was established by the United States in the 1956/57 austral summer for the 1957/58 International Geophysical Year (IGY). A permanent research facility named Amundsen-Scott South Pole Station has been operated at the South Pole continuously by the United States since, although with several major facility replacements and additions. Wind-blown snow accumulation is a perennial problem and without clearance structures can become buried. The first station, now referred to as 'Old Pole', was crushed by the weight of snow and ice and had to be abandoned deep under the surface. More recently, the geodesic dome that replaced 'Old Pole' was removed before it became submerged by ice.

The replacement main building (Map 4), dedicated in 2008, is elevated above ground level in order to minimize snow accumulation, and is referred to as the elevated station. In addition to dining and sleeping accommodation for up to ~150 people, the facilities include a computer laboratory, meeting rooms, lounges, a gym, medical surgery, emergency power plant, and a hydroponic greenhouse. The elevated station has a floor area of ~6000 m<sup>2</sup> (65,000 ft<sup>2</sup>). Fuel storage and power generators to support station operations are located in the nearby sub-surface fuel arches.

In the summer South Pole Station accommodates up to a maximum of ~150 scientists and support personnel, while during winter this reduces to ~45 to maintain the station and run experiments. If required, up to ~18 additional personnel can be housed in the nearby 'hypertats' (Map 4). The station is completely isolated between mid-February and late-October, when air and overland support to the Pole are generally not undertaken because conditions are so extreme.

Other structures at the South Pole include the Atmospheric Research Observatory (ARO), located ~450 m Grid NE from the elevated station, air operations facilities and passenger terminal, fuel tanks, antennae, 'Summer camp' buildings, and maintenance offices. Three principal science buildings are located in the Dark Sector, including the IceCube Neutrino Observatory, the Dark Sector Laboratory which houses the South Pole Telescope (SPT), and the Martin A. Pomerantz Observatory (MAPO) where a range of astrophysics and geospace science projects are undertaken.

Two Automatic Weather Stations (AWS) are situated in the Clean Air Sector ~110 km from ARO. AWS 'Henry' is located at Grid north (-89.001° S, -0.391° W) and AWS 'Nico' is located Grid east (-89.0° S, 90.024° E). The AWS were installed in



1993; maintenance access is made by small aircraft, with the most recent in January 2015 when tower heights were increased to account for snow accumulation.

All permanent facilities at the South Pole have been constructed by the United States Antarctic Program. Temporary camp facilities are erected in the summer by Non-Governmental Visitors (NGVs) to the South Pole, and these are located ~1 km Grid north from the elevated station in an area that does not conflict with science or support operations. A second NGV camp typically used by vehicle expeditions is located outside of the Area just over 20 km Grid NW of the South Pole. Each summer, a small temporary building is usually placed by USAP near the aircraft parking area close to the Ceremonial South Pole for use by NGVs as a shelter and for science interpretation.

#### *6(iv) Location of other protected areas within the Area*

There are no Antarctic Specially Protected Areas within or near the ASMA.

Two Historic Sites and Monuments have been designated within the Area:

- **Historic Site and Monument No. 1 (HSM No. 1)**, located at the South Pole 90°S: Flag mast erected in December 1965 at the South Geographical Pole by the First Argentine Overland Polar Expedition. The precise location or continued existence of the flag mast is not known.
- **Historic Site and Monument No. 80 (HSM No. 80)**, located in the vicinity of the South Pole 90°S: Amundsen's tent. The tent was erected at 90°S by the Norwegian group of explorers led by Roald Amundsen on their arrival at the South Pole on 14 December 1911. The tent is assumed to have become buried deep under ice in the vicinity of the South Pole, although the precise location is not known.

## **7. General Code of Conduct**

### *7(i) Access to and movement within the Area*

Air access to the Area is usually made by ski-equipped fixed-wing aircraft, and visits made by helicopter are rare. Overland access to the Area is made by vehicle, on ski or on foot. For safety reasons, all visitors to the Area should give prior notification of their visit to the National Program(s) operating in the Area. In particular, prior permission is required from the United States Antarctic Program for use of the ski-way. Additional requirements are detailed below for access to the Area by aircraft. Coordination with National Program(s) operating in the Area does not imply any liability of those National Program(s) for any accident or injury incurred at any time during the expedition.

Access to the Area both by air and overland should avoid the Clean Air Sector of the Scientific Zone (Map 1). Access to the Restricted Zones within the Area is generally prohibited except by authorized personnel as detailed below and in Appendix C.

- *Aircraft access and overflight*

The ski-way and associated infrastructure have been established and are maintained by the National Program(s) operating in the Area and are essential to the operations and safety of personnel in the Area. Use of the ski-way and associated infrastructure is therefore restricted to the National Program(s) operating in the Area unless prior permission has been granted by those National Program(s) for aircraft access by other visitors. The entire ski-way and associated aircraft taxi, fuelling and parking areas lie within the Aircraft Operations Restricted Zone (Appendix C), where access is restricted according to the provisions set out below.

Use of wheeled aircraft on the ski-way is prohibited.

All pilots visiting the Area should refer to the latest version of the Antarctic Flight Information Manual (AFIM) for specific details regarding access to the area via aircraft and requirements for prior approval for ski-way use.

Specific restrictions on aircraft access to and overflight within the Clean Air Sector are detailed in the Guidelines for the Scientific Zone (Appendix B).

- *Aircraft access and overflight by National Programs*

- National Program(s) intending to access the Area by aircraft, including for overflight, should coordinate with the National Program(s) operating in the area to ensure there will be no conflicts with ongoing activities.
- Advance planning and communication, consistent with the Antarctic Treaty's Information Exchange requirements, with confirmation at least 24 hours prior to arrival, is necessary to avoid conflicts.
- Pilots approaching the ski-way should notify Amundsen-Scott South Pole Station Communications Center (COMMs) at least 30 minutes prior to landing at the South Pole to allow time to clear the ski-way, and should confirm again their approach 10 minutes before landing.

- *Aircraft access and overflight by other expeditions*

- Approval of ski-way use for an activity not associated with a National Program does not need to include a full safety review of an expedition or its flight plan, and does not imply any liability of those National Program(s) responsible for operating the ski-way for any accident or injury incurred at any time during the expedition.
- Non-Governmental Visitors (NGVs) seeking prior approval to access the Area by aircraft or use the ski-way should refer to the requirements and procedures for approval in the AFIM and contact the appropriate National Authorities.

- *Ski-way access and crossing*

- The ski-way and associated aircraft taxi, refuelling and parking areas are located entirely within the Aircraft Operations Restricted Zone (Appendix C and Map 3) where access is prohibited except by authorized personnel;
- Pilots, logistics personnel, and passengers on aircraft are authorized to move to and from aircraft as necessary and in accordance with operational procedures within the Aircraft Operations Restricted Zone;
- Station personnel and Non-Governmental Visitors are authorized to cross the aircraft taxi area at the Grid northern end of the ski-way at the designated crossing point, located where red beacon lights are installed on the road between the elevated station and Dark Sector science buildings (Map 4);
- Crossing the aircraft taxi area is prohibited when the red beacon lights are flashing, warning that aircraft movements in the vicinity are imminent;
- The ski-way should only be crossed in other areas as absolutely necessary, or as authorized, or in an emergency.

- *Vehicle access and use*

- Vehicles should stay on marked trails to the maximum extent practicable and observe the requirements of the ARO 'No Vehicle' and ARO 'Meteorological Tower' Restricted Zones (Appendix C);
- Vehicles should not be driven within 50 m of the geographic South Pole;
- Vehicles should avoid the Clean Air and Quiet Sectors except as required for essential scientific, operational and management purposes and observe the Guidelines for the Scientific Zone (Appendix B).

- *Pedestrian access and movement within the Area*

- Pedestrians should stay on marked trails to the maximum extent practicable;
- Pedestrians should avoid the Clean Air and Quiet Sectors except as required for essential scientific, operational and management purposes and observe the Guidelines for the Scientific Zone (Appendix B).

- *Access to buildings and facilities*

Access to buildings and facilities in the Area operated by National Program(s) should be made only with permission from the responsible Program. For restrictions on access to specific structures and their surrounding areas, see the Guidelines for the Scientific Zone (Appendix B) and for Restricted Zones (Appendix C).

*7(ii) Activities that may be conducted in the Area*

All activities in the Area should be conducted in a manner that is in accordance with the requirements of this Management Plan and will preserve the values of the Area to the greatest extent practicable.

Parachute operations from aircraft over or near the ski-way or other infrastructure in the Area should not be conducted unless specific written authorization is provided in advance by the United States Antarctic Program, which operates South Pole Station and the ski-way.

*7(iii) Installation, modification, or removal of structures*

Care should be exercised when locating and establishing installations to minimize the risk of mutual interference between different scientific activities, or between science and operations activities, and of their impact on the environment. In particular, installation, modification or removal of structures within the Area should be planned taking into account the different objectives of the Scientific Zone Sectors to help ensure that the potential for conflicts is minimized.

Consideration should be given to maximizing the use of existing facilities before new facilities are constructed, and the footprint of all installations should be kept to the minimum practicable. In general, permanent or semi-permanent structures primarily needed for station logistics and operations should be installed within the Operations Zone, unless they are small in size and pose no significant threat to the values of the Area (e.g. an Automatic Weather Station (AWS) or a small radio repeater with minimal associated infrastructure).

All installations should be maintained while operational and removed when no longer necessary. Installations should be identified by the National Program responsible, name of the principal investigator and year of installation. The types of installations and their coordinates should be recorded by the responsible National Program in a facilities database, with this information made available as necessary.

National Programs should exchange information through the Management Group on proposals for new installations in advance of their construction, with the aim of coordinating activities and minimizing the need for new or potentially disruptive or duplicative installations.

*7(iv) Field camps*

Non-Governmental Visitors (NGVs) to the South Pole should camp at the designated field camp site located within the Operations Zone ~1 km Grid north from the elevated station (Maps 3 and 4).

A small field camp is occasionally established to support NGVs travelling to the South Pole by vehicle, which is located ~300-400 m outside of the boundary of the ASMA, just over 20 km Grid NW from the South Pole.

Field camps shall be maintained while operational and removed when no longer necessary.

*7(v) Taking or harmful interference with native flora or fauna*

Not applicable.

*7(vi) Restrictions on materials and organisms that may be brought into the Area*

Long-term research to establish global baselines and trends for atmospheric trace gases and pollutants is being carried out using highly sensitive instruments at ARO. It is important that air sampled remains as pristine as possible. For this reason, those chemicals listed in Table B.1 of the guidelines for the Clean Air Sector (Appendix B), or products and equipment that contain or emit them, are prohibited within the CAS and at ARO. All visitors to the South Pole should, to the maximum extent practicable, seek to avoid bringing those chemicals listed in Table B.1 into the Area.

*7(vii) Collection or removal of material found in the Area*

Collection and use of snow and ice for water supplies essential to support National Programs or Non-Governmental Visitor (NGV) expeditionary activities is permitted. It is prohibited to damage, remove or destroy any historic artifacts listed as Historic Sites and Monuments under Article 8.4 of Annex V to the Protocol (see Section 6(iv) for a list of designated sites within the Area). All other material found within the Area should only be collected or removed for essential scientific, educational or management purposes and should be limited to the minimum necessary for those needs. Any meteorites taken are to be collected and curated according to accepted scientific standards, and made available for scientific purposes. Material of human origin likely to compromise the values of the Area should be removed unless the impact of removal is likely to be greater than leaving the material in place. If this is the case the appropriate authority should be notified.

*7(viii) Waste management*

- For the National Program(s) operating in the Area: All waste shall be removed from the Area except human and domestic liquid wastes which may be deposited into deep sewer bulbs beneath the ice surface, or disposed of by other methods in accordance with Annex III of the Protocol;
- For other expeditions to the Area: All wastes, including all human and domestic liquid wastes, shall be removed from the Area.

*7(ix) Requirements for reports*

Reports of activities in the Area should be maintained by the Management Group to the maximum extent practicable, and made available to all Parties.

In accordance with Article 10 of Annex V to the Protocol, arrangements shall be made for collection and exchange of reports of inspection visits and on any significant changes or damage within the Area.

Tour operators should record their visits to the Area, including the number of visitors, dates, and incidents in the Area, and submit these data in accordance with the procedures for reporting on expeditions adopted by the Antarctic Treaty Parties and the International Association for Antarctica Tour Operators (IAATO).

## **8. Provisions for the Exchange of Information in Advance of Proposed Activities**

In addition to the normal exchange of information by means of the annual national reports to the Parties of the Antarctic Treaty, Scientific Committee on Antarctic Research (SCAR), and Council of Managers of National Antarctic Programs (COMNAP), Parties operating in the Area should exchange information in advance through the Management Group. All National Programs intending to visit or conduct research in the ASMA should contact the National Program(s) operating in the Area sufficiently in advance of the activity to allow for coordination of planned activities with ongoing activities in the Area.

All visitors intending to use the skiway are required to provide advance notification to the United States Antarctic Program, as detailed in Section 7(i) of this Management Plan.

Tour operators and other Non-Governmental Visitors to the Area shall provide advance notification of their visit schedules to National Program(s) operating in the Area.

## **9. Supporting Documentation**

### *- Electronic information*

The Management Group has established a website (<http://www.southpole.aq>) for the purpose of providing additional information and supporting documentation on the environment, science and activities at South Pole, including up-to-date management documents, maps, descriptions and policies.

Because of the steady ice movement at the South Pole there is a need for regular map updates, and the most recent versions are made available at [www.southpole.aq/maps](http://www.southpole.aq/maps).

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## **APPENDIX A:**

### ***General Environmental Guidelines for the South Pole***

*The South Pole has unique properties that make it an ideal location for certain types of scientific research. For example, its position remote from human influence makes it ideal for monitoring global background levels of atmospheric constituents. Isolation from light pollution, electromagnetic interference (EMI), sound and vibration, is important for astrophysical research, with the latter two being especially valuable for seismological observations. The thick ice sheet contains a natural record of atmospheric constituents that can be analysed to interpret past climate, and is also an ideal medium for installation of sensitive instruments to detect sub-atomic particles. The position on the Earth's axis of rotation is advantageous for many atmospheric and space science studies. It is important that guidelines are followed so that these qualities may be protected to the fullest extent practicable so that the productivity of the research can be maximized.*

#### **Before you travel to the Area:**

- Ensure that your planned activities follow the requirements of the Code of Conduct in the Management Plan, the Environmental Guidelines in Appendix A, the specific guidelines that apply within the Scientific Zone (Appendix B), guidelines for Restricted Zones (Appendix C), and the guidelines for Non-Governmental Visitors in Appendices D and E.
- Plan all activities such as scientific experiments, installation of equipment, travel, camps, fuel handling, and waste management, with the aim of minimizing environmental impacts.
- Ensure that all equipment, supplies and packaging are planned so as to avoid to the maximum extent practicable those compounds listed in Table B.1, Appendix B, as prohibited within the Clean Air Sector (CAS) and at the Atmospheric Research Observatory (ARO).
- Ensure that all equipment, supplies and packaging are planned so as to minimize the amount of waste generated when at South Pole.

#### **Travel and activities within the Area:**

- Where practicable, keep to designated or established tracks, and be aware of the site-specific guidelines in Appendices B and C, and in particular avoid the Clean Air and Quiet Sectors and the Restricted Zones, where prior authorization is required for access.
- Vehicles should avoid the ARO 'No Vehicles' and ARO 'Meteorological Tower' Restricted Zones (Appendix C).
- Observe the designated crossing point and beacon warnings on the road between the elevated station and the Dark Sector science buildings.
- Where practicable, vehicles should be parked over a secondary containment unit or a drip tray.
- The ski-way should be marked so it is clearly visible from the air and markers used should be well-secured and durable.



**Field camps: location and set up**

- Non-Governmental Visitors should use the designated campsite within the Operations Zone when camping within the Area.
- The footprint of the designated campsite should be the minimum size practicable.
- Ensure that equipment and supplies are properly secured at all times to avoid dispersion by wind.

**Use of materials and energy:**

- Everything taken into the Area should generally be removed to the maximum extent practicable.
- Activities that could result in the dispersal of foreign materials should be avoided (e.g. use of flares) or should be conducted inside a building or tent (e.g. when cutting, sawing or unpacking materials).
- Explosives should not be used within the Area, unless approved by a National Program for use in support of essential scientific or management purposes.
- Where possible, ensure that nothing is left frozen into snow or ice that may ablate out and cause later contamination.
- Use energy systems and modes of travel within the Area that have the least environmental impact as far as practicable, and minimize the use of fossil fuels.

**Fuel and chemicals:**

- Steps should be taken to prevent the accidental release of fuel or chemicals. For example, regular checks should be made to ensure all fuel valve positions are correctly set, and fuel line couplings are sealed and secure.
- Ensure that spill kits and secondary containment units appropriate to the volume of the substance are available when using chemicals or fuels. Those working with chemicals and fuels should be familiar with their use and with appropriate spill response procedures.
- Chemical and fuel containers should be securely positioned and sealed, particularly when stored outside.
- All fuel drums should be stored with secondary containment.
- Fuel cans with spouts should be used when refuelling generators or vehicles.
- Vehicle oil changes should be carried out with adequate provision for containment and preferably inside.
- Generators and vehicles should be refuelled over drip trays with absorbent spill pads when outside.

**Waste and spills:**

- Clean up any spills and / or releases to the maximum extent possible and report the location(s) including coordinates, to the appropriate National Program.

## **APPENDIX B**

### ***Guidelines for the Scientific Zone***

*The Scientific Zone encompasses the majority of the ASMA and is divided into four Sectors – Clean Air, Quiet, Downwind and Dark (Maps 1-4). The Clean Air Sector (CAS) ensures a near-pristine air- and snow-sampling environment for atmospheric and climate systems research. The Quiet Sector is an area where noise and equipment activities are limited to minimize vibration effects on seismological and other vibration-sensitive research. The Downwind Sector provides an area free from obstructions for balloon launches, aircraft operations, and other ‘downwind’ activities. The Dark Sector aims to provide an area of reduced light pollution and low electromagnetic noise to help facilitate astronomy and astrophysical research. Following are descriptions of the objectives of and special guidelines for activities in each sector of the Scientific Zone.*

#### **Clean Air Sector**

The Clean Air Sector (CAS) is established to preserve the unique conditions that are required for atmospheric research at the South Pole Station. The Earth’s atmosphere near the South Pole is remote from worldwide human influence, and a predominant northerly (Grid) wind means the Atmospheric Research Observatory (ARO) is situated upwind of all other facilities more than 90% of the time. These natural conditions allow for nearly continuous measurement of important trace constituents of the atmosphere in a location remote from anthropogenic inputs. The air sampled at the South Pole is representative of the background atmosphere of the planet and may be characterized as the ‘cleanest air on Earth’.

#### **- *Geographic boundaries of the Clean Air Sector***

The Clean Air Sector is a wedge-shaped area extending 150 km upwind (grid northeast) of the Atmospheric Research Observatory (ARO) at South Pole Station and the ski-way (Maps 1 to 4). Overland and air access to the CAS are restricted to maintain the scientific value of the Sector. The Clean Air Sector is defined by the following boundaries:

- A line extending 150 km (81 nautical miles) Grid 340° from the SW corner of the ARO building.
- A line extending 150 km (81 nautical miles) Grid 110° from the SW corner of ARO building.
- A semi-circular arc connecting the above two lines, extending ~340 km and maintaining a constant distance of 150 km (81 nautical miles) from the SW corner of the ARO building.

The United States National Oceanic and Atmospheric Administration (NOAA) has conducted many hours of aircraft air pollutant measurements and data show that plumes can be traced for hundreds of miles in stable air. To protect measurements at the ARO and in the snow within the Clean Air Sector it was recommended that aircraft fly above 2000 m (6000 ft) to remain above the boundary layer air and to

limit deposition of particles and gas at the snow surface. The 150 km radius was selected as a reasonable buffer distance, although Arctic studies suggest that twice that distance is justifiable.

- *Aircraft overflight and landing restrictions in the Clean Air Sector*

- Aircraft overflight below 2000 m (~6000 ft) and landings within the Clean Air Sector are prohibited except for essential scientific, operational or management purposes (e.g. aviation authority checks (e.g. United States Federal Aviation Authority), scientific missions, aerial photography, emergency flight paths etc.), which must be approved in advance in consultation with the National Program(s) operating within the Area.
- Pilots of any aircraft entering the Clean Air Sector are requested to fly in such a manner that will help to minimize potential contamination (e.g. avoid steep ascents, avoid repeat circling, take the most direct practicable route etc.).

- *Overland access restrictions to and within the Clean Air Sector*

- Activities, structures, and instrumentation located within the Clean Air Sector should not interfere with projects already established, except as specifically authorized by the appropriate National Authority.
- Personnel accessing ARO should follow the marked trail from South Pole Station and observe the requirements of the ARO 'No Vehicle' and ARO 'Meteorological Tower' Restricted Zones (see Appendix C).
- Access to CAS is allowed for scientific purposes such as snow / air sampling. Access may be allowed for occasional or periodic measurement of properties such as snow depth and accumulation, provided this is coordinated in advance to avoid potential conflicts and will not compromise research being carried out within the Sector requiring clean conditions.
- Access to CAS is allowed for snow / trail maintenance, such as occasional excavation of the Met Tower and ARO.
- Access to CAS is allowed for occasional cleaning and maintenance of ski-way visibility markers located along 353° east of grid north (Table D.1).
- All overland access within the CAS should undertake travel and operate in such a manner that will help to minimize potential contamination (e.g. avoid leaving vehicles or machinery running when not necessary, take the most direct practicable route, refuel vehicles outside of the CAS etc.).
- The National Program(s) operating in the Area should document all pedestrian / surface vehicle excursions into the Clean Air Sector.

- *Additional guidelines for the Clean Air Sector and within ARO*

- Access to the roof of the ARO building is restricted. Please contact the United States Antarctic Program (USAP) if access is required for your project. Users of the roof area must note all roof excursions in the Clean Air Sector Log. Structures, objects, etc. are not allowed on the roof of the ARO building in a location that would interfere with air sampling intakes or at a height

exceeding 1.3 m (4 ft) above the roof surface, due to interference with the current solar and terrestrial radiation instruments. Do not obstruct the roof hatches with equipment or materials.

- Access to the orange and white meteorological tower and to the snow surface near the tower is restricted. Objects and activity on the tower and on the snow surface in its vicinity (particularly within a distance of approximately three times the tower's height) can interfere with measurements conducted from the tower. Please contact the USAP if access is required.
- Structures should not be placed in a manner that they could cause drifting upwind of, under, or near the ARO building.
- All instrumentation within ARO and the Clean Air Sector must meet the criteria set for current instrumentation as determined by the appropriate National Authority.
- Due to the electromagnetic (EM) sensitivity of solar and thermal atmospheric radiation measurements being conducted at and nearby ARO, the use of EM transmitters near ARO is prohibited except for infrequent but necessary use of handheld radios.
- Any individual or organization wishing to establish an experiment within ARO and/or the Clean Air Sector must coordinate with the National Program(s) operating in the area.

### Restricted Chemicals

The use of chemicals listed in Table B.1, or of products and equipment that contain or emit them, is prohibited at ARO and in the CAS (this includes the area beneath the building, the roof of the building, and near the orange and white NOAA meteorological tower, which lies within a Restricted Zone (see Appendix C)). Please contact the National Program(s) operating in the area for help in finding alternatives to their use.

Table B.1 is a partial list of specific chemical substances being monitored at the ARO Clean Air facilities, and may vary over time. The atmospheric concentrations of most are being measured to a precision of parts per trillion, and the measurements are particularly susceptible to contamination from local sources.

**Table B.1:** Prohibited chemicals at ARO and in the CAS.

Class	Formula	Description	Name	Use
Chlorofluoro-carbons (CFCs)	CCl <sub>3</sub> F	trichlorofluoromethane	CFC-11	Refrigerants, solvents, foam blowing agents, aerosol propellants, and heat exchange medium (no longer manufactured in the U.S.)
	CCl <sub>2</sub> F <sub>2</sub>	dichlorodifluoromethane	CFC-12	
	CCl <sub>2</sub> FCCl <sub>3</sub>	trichlorotrifluoroethane	CFC-113	
	IF <sub>2</sub>			

Class	Formula	Description	Name	Use
Hydrochlorofluoro-carbons (HCFCs)	CHCl <sub>2</sub> F	dichlorofluoromethane	HCFC-21	Refrigerants, solvents, foam blowing agents, aerosol propellants, and heat exchange medium (HCFCs are found in the "blueboard" at South Pole)
	CHClF <sub>2</sub>	chlorodifluoromethane	HCFC-22	
	CF <sub>3</sub> CHCl	chlorotetrafluoroethane	HCFC-124	
	F CCl <sub>2</sub> FCH	dichlorofluoroethane	HCFC-141b	
	3 CClF <sub>2</sub> CH	chlorodifluoroethane	HCFC-142b	
3				
Hydrofluoro-carbons (HFCs)	CF <sub>3</sub> CH <sub>2</sub>	tetrafluoroethane	HFC-134a	Refrigerants, foam blowing agents, and aerosol propellants
	F CH <sub>3</sub> CHF	difluoroethane	HFC-152a	
Halons	CBrClF <sub>2</sub>	bromochlorodifluoromethane	halon-1211	Fire suppression and extinguishing systems (no longer manufactured in the U.S.)
	CBrF <sub>3</sub>	bromotrifluoromethane	halon-1301	
Chlorocarbons	CH <sub>3</sub> Cl	chloromethane	methyl chloride	Solvents, cleaning agents, degreasing agents, and in other less common applications
	CH <sub>2</sub> Cl <sub>2</sub>	dichloromethane	methylene chloride	
	CHCl <sub>3</sub>	trichloromethane	chloroform	
	CCl <sub>4</sub>	tetrachloromethane	carbon tetrachloride	
	CH <sub>3</sub> CCl <sub>3</sub>	trichloroethane	methyl chloroform	
C <sub>2</sub> Cl <sub>4</sub>	tetrachloroethene	perchloroethene		
Bromocarbons	CH <sub>3</sub> Br	bromomethane	methyl bromide	
	CH <sub>2</sub> Br <sub>2</sub>	dibromomethane	methylene bromide	
	CHBr <sub>3</sub>	tribromomethane	bromoform	
Idocarbons	CH <sub>3</sub> I	iodomethane	methyl iodide	
Others	N <sub>2</sub> O	nitrous oxide		Oxidizer
	SF <sub>6</sub>	sulfur hexafluoride		Electric transformers

### Quiet Sector

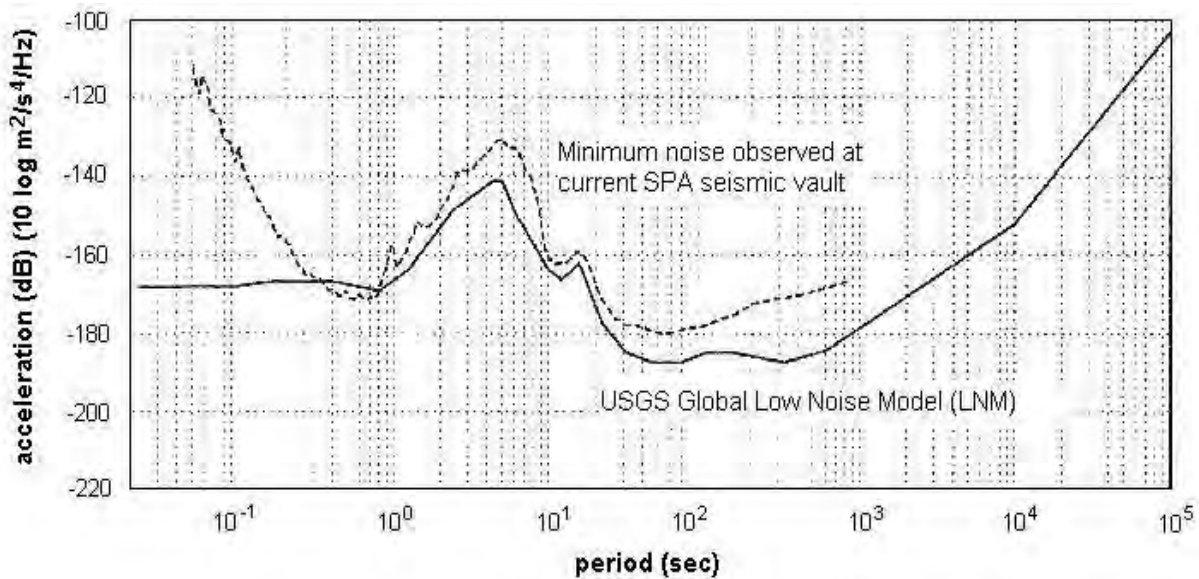
Sound noise and mechanical equipment activities are limited within the Quiet Sector to minimize vibration effects on seismological and other vibration-sensitive research. The South Pole Remote Earth Science and Seismological Observatory (SPRESSO) was established by the USAP ~7.5 km Grid SE of South Pole Station to provide a remote laboratory for experiments that require a vibration-quiet environment. Seismographic facilities have operated continuously at the South Pole since the 1957/58 International Geophysical Year (IGY).

- *Geographic Boundaries of the Quiet Sector*

The outer boundary of the Quiet Sector is defined by and coincident with the Scientific Zone and ASMA boundary, 20 km from the elevated station (Map 2). The inner boundaries of the Quiet Sector are defined by the Grid 110° line from ARO (shared by the Clean Air Sector) and by the Grid 185° line from the Quiet Sector origin (shared by the Downwind Sector), and by the boundary of the Operations Zone.

- *Guidelines for the Quiet Sector*

The Quiet Sector is reserved for scientific experiments that require quiet conditions or can operate under stringent quiet conditions. The Quiet Sector has the lowest measured values of seismic noise anywhere on the Earth at periods less than 1 sec. Guidelines for installations and operations within the Quiet Sector are as follows: Activities, structures, and instrumentation located within the Quiet Sector should not produce seismic vibrations at levels greater than the United States Geological Survey (USGS) low noise model (LNM) at periods greater than 1 sec. At periods less than 1 second, levels should not be greater than 12 dB below the LNM (Figure B.1);



**Figure B.1.** Noise thresholds for the Quiet Sector. The lowest noise levels achievable at the SPA seismic vault (in 2000) and the USGS LNM based upon quietest noise conditions globally. The seismic band of interest is from 80 Hz to tidal frequencies (<0.001 MHz).

- Structures that potentially may be buffeted by wind, producing extraneous detectable vibrations, should be located below the snow surface;
- All instrumentation located in SPRESSO shall meet the quiet criterion for seismological instrumentation established by National Program(s) operating in the Area;
- All instrumentation located in SPRESSO shall be remotely operable from

- South Pole Station, particularly during the austral winter;
- Individuals or organizations wishing to establish an experiment within the Quiet Sector shall coordinate in advance with the National Program(s) operating in the Area;
- Transit of motorized vehicles within or across the Quiet Sector for purposes other than support of science or management related to SPRESSO or in the event of an emergency is prohibited except as follows:
  - Access to the Quiet Sector is allowed for trail maintenance, such as when a hard-packed route to SPRESSO is required. This typically requires several passes using heavy equipment to knock down drifts caused by windstorms;
  - Access to the Quiet Sector may be allowed for occasional or periodic measurement of properties such as snow depth and accumulation, provided this is coordinated in advance to avoid potential conflicts and will not compromise seismological and other vibration-sensitive research being carried out within the Sector;
  - Access to the Quiet Sector is allowed for occasional cleaning and maintenance of ski-way visibility markers located along 113° east of grid north (Table D.1).
  - All overland access within the Quiet Sector should undertake travel and operate in such a manner that will help to minimize potential noise and vibration (e.g. avoid leaving vehicles or machinery running when not necessary, take the most direct practicable route, use the lightest vehicle practicable to meet objectives etc.), and vehicles should avoid operating within 100 m of the SPRESSO facility to the maximum extent practicable.
  - National Program(s) operating in the Area may enter the Quiet Sector to remove scientific equipment that is no longer in use, if it will not interfere with other scientific research.
- The National Program(s) operating in the area shall document all travel into the Quiet Sector.

### **Downwind Sector**

The Downwind Sector was established to provide an area free from obstructions for balloon launches, aircraft operations, and other activities. Both scientific and operations activities are allowed in the Downwind Sector.

#### *- Geographic Boundaries of the Downwind Sector*

The outer boundary of the Downwind Sector is defined by and coincident with the Scientific Zone and ASMA boundary, 20 km from the elevated station (Map 2). The inner boundaries of the Downwind Sector are defined by the Grid 185° (shared by the Quiet Sector) and Grid 230° (shared by the Dark Sector) lines from the Downwind Sector origin, and by the boundaries of the Operations Zone and Air Operations Restricted Zone associated with the ski-way.

#### *- Guidelines for the Downwind Sector*

- Activities in the Downwind Sector should not require any maintenance (e.g. snow removal) and should not otherwise obstruct scientific balloon launches or aircraft operations.

### **Dark Sector**

The Dark Sector was established to preserve the conditions of low light pollution and low electromagnetic interference (EMI) at South Pole Station that are important to facilitate many types of astrophysical, astronomical, and aeronautical research.

#### - *Geographic Boundaries of the Dark Sector*

The outer boundary of the Dark Sector is defined by and coincident with the Scientific Zone and ASMA boundary, 20 km from the elevated station (Map 2). The inner boundaries of the Dark Sector are defined by the Grid 230° line from the Dark Sector origin (shared by the Downwind Sector) and by the Grid 340° line from ARO (shared by the Clean Air Sector), and the boundaries of the Operations Zone and Air Operations Restricted Zone associated with the ski-way.

#### - *Guidelines for the Dark Sector*

- Science activities in the Dark Sector are restricted to experiments that do not emit light or EMI above levels approved by the National Program(s) operating in the Area.
- Telescopes and other scientific instruments that are light- and / or EMI-sensitive should be located in the Dark Sector.
- Activities both within and outside of the Dark Sector that emit EMI or have potential to obstruct the viewing horizon should take into account their potential to affect scientific values in the Dark Sector. In particular, Electromagnetic Compatibility (EMC) assessments should be undertaken as necessary in advance of the activity to minimize conflicts between uses, including between operational sources of EMI and scientific instruments, and to minimize impacts on science within the Dark Sector whilst allowing for essential operational needs. This applies also to scientific or operational projects operating from aircraft or satellite platforms that require active radio frequency (RF) emissions (e.g. imaging radars such as Synthetic Aperture Radar etc.) or light-emitting instruments (e.g. LiDAR).
- To help protect sensitive scientific observations within the Dark Sector from unnecessary EMI, pilots of any aircraft entering the Dark Sector are requested to minimize, to the extent that is safe and practicable, operational radio frequency (RF) emissions (e.g. navigation radars or other active nav aids, altimeters, radar sounders, ice radars, radio communications etc.) while flying within the Sector.



## APPENDIX C

### *Guidelines for Restricted Zones*

Six sites within the Area are designated Restricted Zones (Maps 3 and 4), which are defined by boundaries and access policies as follows:

#### **Aircraft Operations Restricted Zone:**

- *Description:* An area of ~60 ha within the Operations Zone that includes the ski-way, aircraft taxi, refuelling and aircraft parking areas (Maps 3 and 4).
- *Boundary:* The boundary is defined as the perimeter of the aircraft operational areas as shown on Map 4.
- *Access requirements:* Access to the zone is prohibited except by authorized personnel, with access policies applying specifically to pilots, logistics personnel and aircraft passengers and more generally to all other personnel at South Pole detailed in Section 7(i) of this Management Plan.

#### **Old Pole Station Restricted Zone:**

- *Description:* An area of ~70 ha within the Dark Sector of the Scientific Zone that includes the former 1957 South Pole station site and the immediate surrounding area up to ~300 – 500 m (Maps 3 and 4).
- *Boundary:* Clockwise from the SE corner of the zone, the boundary extends Grid NW 1.2 km into the Dark Sector from the Operations Zone, extending past and immediately Grid NE of the Dark Sector Laboratory. Thence the boundary proceeds 1 m Grid NE to a point 200 m from the Clean Air Sector, thence extends for 750 m parallel to and 200 m from the Clean Air Sector to the Operations Zone. The boundary thence shares the Operations Zone boundary for a distance of 440 m Grid SW to the SE corner of the zone.
- *Access requirements:* Access to the Old Pole Station Restricted Zone is prohibited except by authorized personnel for essential scientific, operational or management purposes. While remediation work has been undertaken at the site, there remain possible subsurface hazards such as voids or structures that should be avoided.

#### **ARO ‘No Vehicle’ Restricted Zone:**

- *Description:* A semi-circular area of 0.5 ha within the Operations Zone extending 50 m (150 ft) downwind (Grid SW) of the SW corner of the ARO building (Map 4).
- *Boundary:* Defined as the perimeter of the semi-circle described above. Part of the southeastern boundary is shared by the Antenna Field Restricted Zone.
- *Access requirements:* Vehicle access is prohibited without prior

authorization by NOAA and the United States Antarctic Program. All vehicles approaching ARO should use the marked trail and park at the 'turnaround' at the edge of the Restricted Zone where a sign states "No Vehicles Beyond This Point". The purpose of the Restricted Zone is to avoid vehicle emissions close to the ARO facility where sensitive atmospheric monitoring instruments are installed.

**ARO 'Meteorological Tower' Restricted Zone:**

- *Description:* A circular area of 0.13 ha within the Operations Zone surrounding the ARO Meteorological Tower extending 20 m (~66 ft) from the center of the facility (Map 4).
- *Boundary:* Defined as the perimeter of a 20 m circle surrounding the ARO Meteorological Tower.
- *Access requirements:* Vehicle and pedestrian access is prohibited without prior authorization by NOAA and the United States Antarctic Program. Vehicles and pedestrians should avoid the Grid NW half of the Restricted Zone to prevent disturbance to the snow surface in this area, where albedo is being monitored.

**Antenna Field Restricted Zone:**

- *Description:* An area within the Operations Zone of ~25 ha located Grid SE of the road to ARO (Map 4).
- *Boundary:* Clockwise from ARO, the northeastern boundary shares the Grid 110° boundary of the CAS for ~550 m from ARO, thence extends 300 m Grid due south, thence 550 m Grid due west, thence 440 m Grid NW towards but 20 m short of the ARO road, and thence 200 m eastward to the ARO 'No Vehicle' Restricted Zone, and shares this boundary a further ~50 m to the CAS.
- *Access requirements:* Access to the zone is prohibited except by personnel authorized by the National Program(s) operating in the Area. Personnel operating within the zone should avoid disturbing the area where stakes are installed to measure snow accumulation (Map 4), and should be aware of other sensitive scientific or antenna infrastructure.

**Communications Restricted Zone:**

- *Description:* An area within the Operations Zone of ~9.5 ha, the center of which is located ~1 km Grid SW of the elevated station (Map 4).
- *Boundary:* Defined as a rectangle of width ~185 m and of length 510 m.
- *Access requirements:* Access to the zone is prohibited except by personnel authorized by the National Program(s) operating in the Area.

**APPENDIX D**

***General Guidelines for Non-Governmental Visitors to the South Pole***

The South Pole receives a number of visitors associated with Non-Governmental expeditions each austral summer, most of whom are supported by private companies that provide transportation, guides and other logistics. Guidelines have been established to improve coordination between the National Program(s) operating in the Area and Non-Governmental Visitors (NGVs) to the South Pole. The purpose of this Appendix is to inform NGVs about on-site resources, expectations, and hazards at the South Pole, while Appendix E provides specific guidance on overland approach routes.

All visitors to the South Pole shall comply with the Protocol on Environmental Protection to the Antarctic Treaty and with their respective national policies governing activities in Antarctica.

- For the purpose of this management plan, ‘Non-Governmental Visitors’ includes all individuals or organizations that are not sponsored by a National Antarctic Program.
- Amundsen-Scott South Pole Station is operated by the United States Antarctic Program (USAP), which is not authorized to provide support for NGVs except in an emergency.
- NGVs approaching overland should be aware of ski-way visibility markers located at various distances from the geographic South Pole in four directions around the station (Table D.1). All markers are four feet high by eight feet wide, except the 1 mile markers which are eight feet by eight feet, and mounted four feet off the snow surface.

*Table D.1 Visibility markers located around South Pole Station.*

Direction (° E of grid N)	Marker 1		Marker 2		Marker 3		Marker 4		Marker 5		Marker 6	
	miles	km	miles	km	miles	km	miles	km	miles	km	miles	km
113	0.5	0.8	1	1.6	1.5	2.6	2	3.2	-		-	
204	0.5	0.8	1	1.6	1.5	2.6	2	3.2	3	4.8	4	6.4
270	0.75	1.2	1	1.6	2	3.2	3	4.8	-		-	
353	0.5	0.8	1	1.6	1.5	2.6	2	3.2	-		-	

- NGVs that intend to fly aircraft into the Area or land on the ski-way shall obtain prior approval to do so from the National Program(s) that operates the ski-way and associated air traffic control. If prior approval is granted, NGV pilots should refer to and follow guidance in the Antarctic Flight Information Manual (AFIM) and information provided by the National Program(s) operating in the Area.
- NGVs shall not conduct a parachute operation from an aircraft and no pilot in command of an NGV aircraft may allow a parachute operation to be conducted from that aircraft over or near the ski-way or other infrastructure in the Area,

unless specific written authorization is provided in advance by the National Program(s) that operates the ski-way and associated air traffic control.

- No access to email, telephones, or radios will be provided except as authorized by the appropriate National Program.
- The ideal timeframe for visits to the South Pole Station is on Sunday from 13:00 to 17:00 South Pole Station Time [00:00 to 04:00 GMT/UTC]. This time period is recommended to minimize disruption to station science and operations. Services and access to the station at other times are highly unlikely.
- NGVs are required to be self-sufficient in their provision of transport, camping, food, communications and any other support required by their expedition.
- Within the Operations Zone, NGVs should keep within the designated NGV camping and parking areas (Map 4), or the area immediately surrounding the Ceremonial South Pole and geographic South Pole markers and to move between these sites by a direct line or by following the designated vehicle route, unless otherwise authorized by the National Program(s) operating in the area. The reason for this provision is to ensure hazardous sites such as the Old Pole Station and Aircraft Operations Restricted Zones and areas of scientific research with highly sensitive instrumentation are avoided, as well as to ensure safety in other areas where heavy vehicles or machinery may be operating, often in conditions of poor visibility.
- The designated NGV camping area within the Operations Zone has been selected for the following reasons: it is located near the NGV aircraft parking areas, it is close to medical or other emergency services (if needed), it does not usually interfere with vehicle traffic or USAP aircraft operations, and it is away from most hazardous areas, communications facilities and sensitive scientific instrumentation.
- To avoid disruption of official USAP activities, all South Pole Station buildings and operation and science areas are off limits to NGV personnel except when guided by an individual designated by the USAP or when within the aforementioned areas.
- In the event of an aircraft or medical emergency in the Area, NGVs shall notify Amundsen-Scott South Pole Station Communications Center (COMMS) immediately. Station staff shall notify the on-site U.S. National Science Foundation (NSF) Representative and other personnel as necessary.
- Amundsen-Scott South Pole Station staff shall record NGV arrivals and departures, and make this information available to Antarctic Treaty Party members upon request.

## **APPENDIX E**

### ***Guidelines for Non-Governmental Visitor Overland Approach to the South Pole***

#### **No approach to the South Pole through the Clean Air Sector**

- The Clean Air Sector extends 150 km Grid NE from the South Pole, its point of origin being the Grid SW corner of the Atmospheric Research Observatory (ARO) building at Amundsen-Scott South Pole Station. The Sector lies between a line extending Grid 340° and a line extending Grid 110° from ARO, which equates approximately to the area lying between W020° and E110° (clockwise).
- Do not approach the South Pole through the Clean Air Sector (see maps).

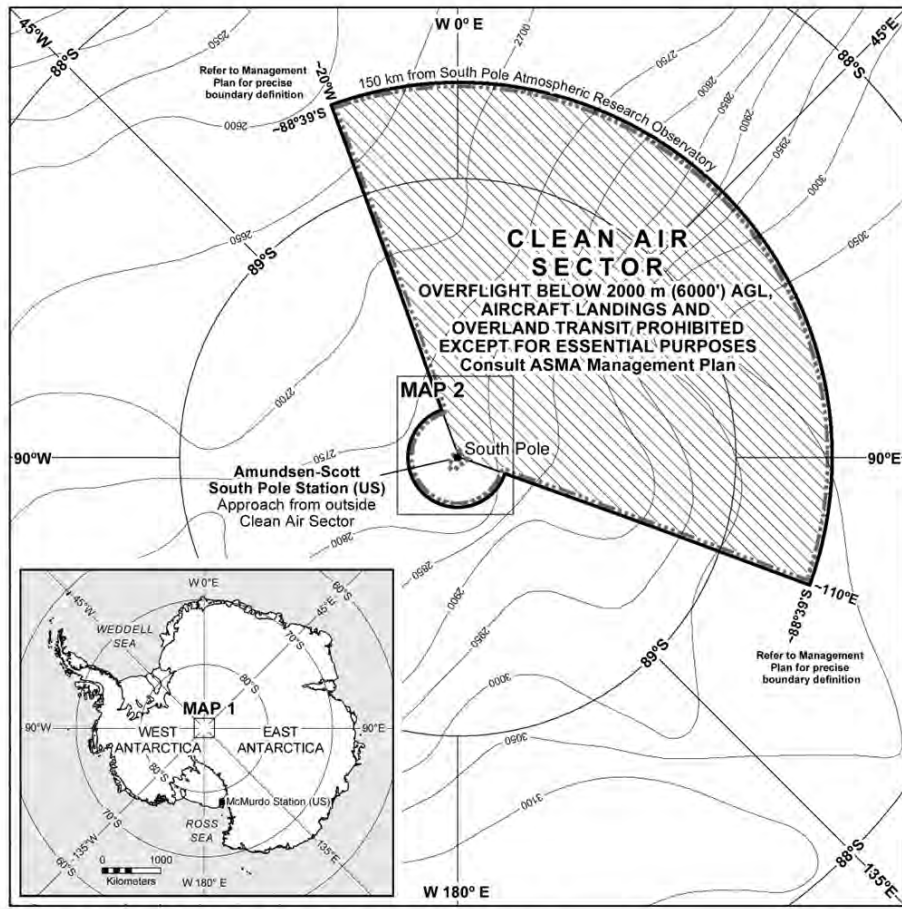
#### **Approach from Grid northwest – west (Ronne Ice Shelf / Hercules Inlet etc.)**

- The Grid northwest and west approach to South Pole lies between W020° and W110°.
- When approaching from this region, on reaching the ASMA boundary at 20 km from the South Pole, proceed directly to ‘West Waypoint’ at S89° 59.0' W016° 00.0', where a sign is located. Do not enter the Clean Air Sector (see maps).
- Call Amundsen-Scott South Pole Station at least 24 hours in advance of your anticipated arrival at the South Pole to advise of your position and plans. Be prepared to wait and camp if necessary until advised that it is safe to proceed.
- On reaching ‘West Waypoint’, proceed on the marked trail (bamboo canes and flags) 0.88 km to the non-governmental visitor campsite and thence 1 km to the South Pole (2016), taking care not to cross into the Clean Air Sector, the boundary of which is marked by flags.

#### **Approach from Grid south – southwest (McMurdo / Ross Ice Shelf)**

- The Grid south and southwest approach to South Pole lies between E110° and W110°.
- When approaching from this region, on reaching the ASMA boundary at 20 km from the South Pole, proceed directly to the ‘Pole Turn 1 Waypoint’ at S89° 55.29' W132° 00.0' where a sign is located, following the South Pole Traverse route on the W132° meridian as far as practicable. Do not enter the Quiet Sector (see maps).
- Call Amundsen-Scott South Pole Station at least 24 hours in advance of your anticipated arrival at the South Pole to advise of your position and plans.
- On reaching ‘Pole Turn 1 Waypoint’, which is 8.8 km from the South Pole (2016), again Stop & Call Amundsen-Scott South Pole Station before proceeding further. Be prepared to camp at ‘Pole Turn 1 Waypoint’ until advised by Amundsen-Scott South Pole Station it is safe to proceed. This is to ensure safety because the approach route lies close to the skiway.

- From ‘Pole Turn 1 Waypoint’ proceed 5.2 km on the South Pole Traverse route to the skiway threshold where a sign is located at the Grid south end of the skiway.
- From the skiway threshold, proceed parallel to and along the Grid west side of the skiway (i.e. the left side on approach towards the Pole) for 4 km, maintaining a distance of at least 30 m from the line of flags marking the edge of the skiway. Proceed to the road between the elevated station and Dark Sector science buildings, where a red beacon light is installed at the designated crossing point of the aircraft taxi area at the Grid north end of the skiway (see Map 6).
- Do not enter onto the skiway other than at the designated crossing point or in an emergency.
- Do not cross the aircraft taxi area at the end of the skiway if the red beacon light is flashing.
- When safe to do so, cross the aircraft taxi area at the designated crossing point and proceed towards the South Pole markers and onward to the non-governmental visitor campsite.



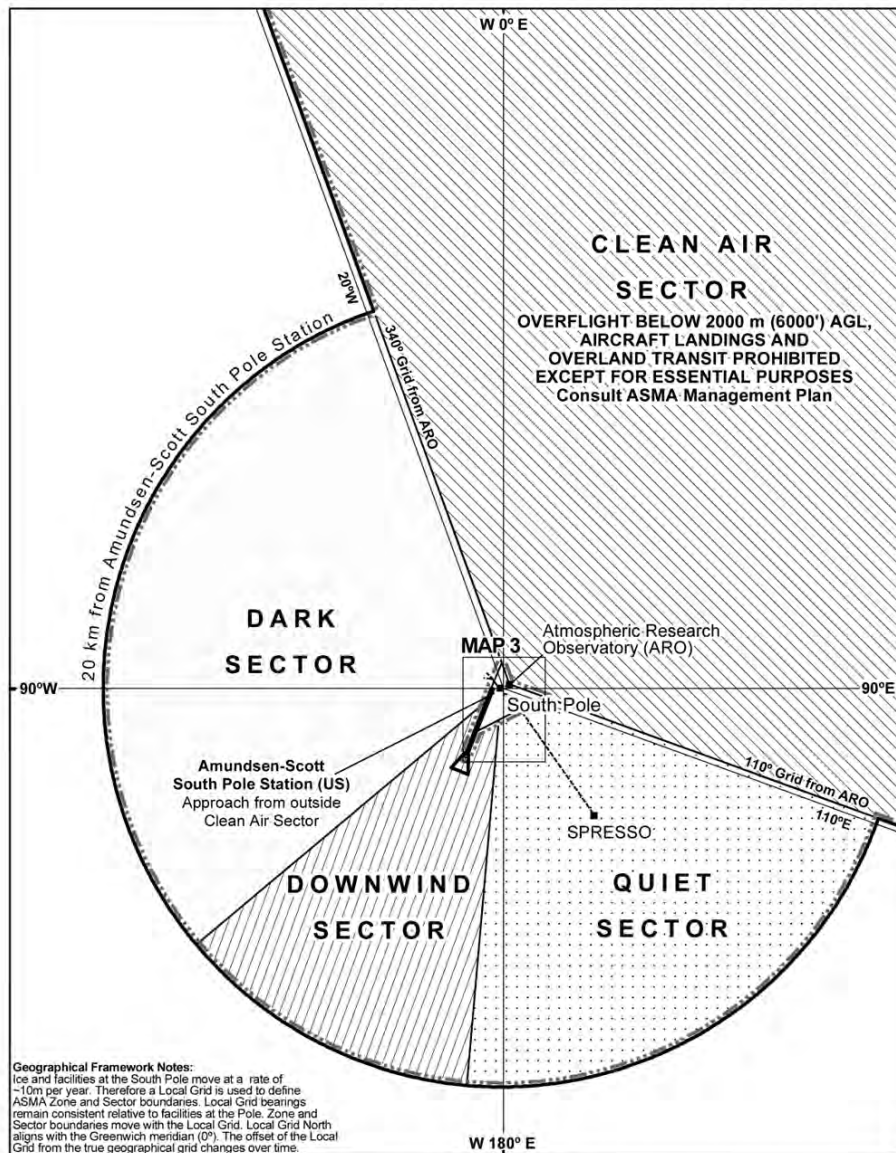
**Map 1: ASMA No. 5 - South Pole - Location and topography**

23 Mar 2017 (Map ID: 10069 010 07)  
 United States Antarctic Program  
 Environmental Research & Assessment



- Contour (50 m)
- ASMA Boundary
- Clean Air Sector
- Permanent ice
- Scientific Zone
- Station building

Projection: Polar Stereographic;  
 Spheroid and horizontal datum: WGS84;  
 Data source: Coast & topography: SCAR ADD (v. 8 - 2012);  
 ASMA boundary, Zones & Sectors: ERA (Feb 2017).

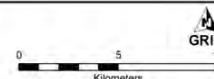


**Map 2: ASMA No. 5 - South Pole - Management Zones and Sectors**

23 Mar 2017 (Map ID: 10069 D11.10)  
United States Antarctic Program  
Environmental Research & Assessment

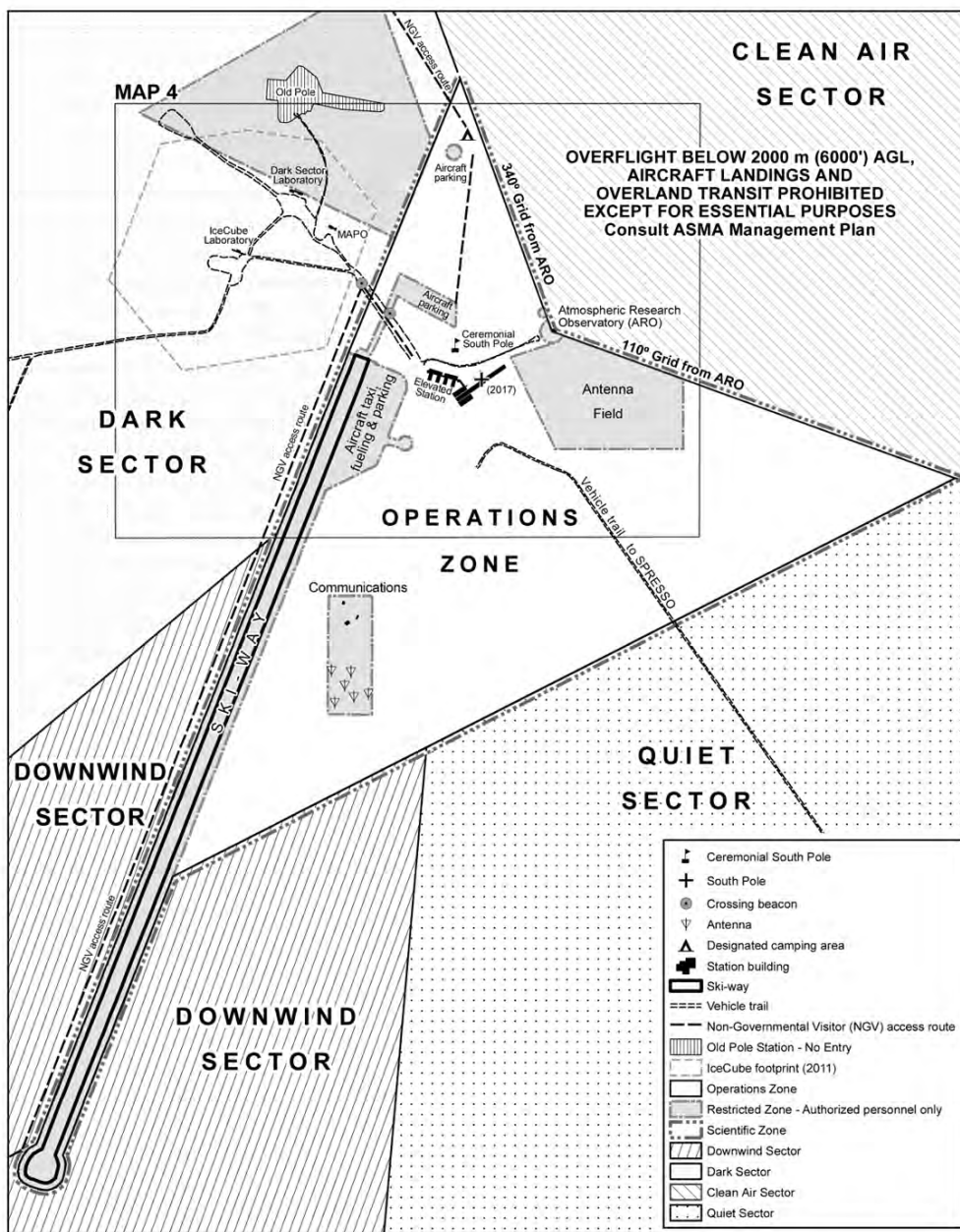


- ASMA Boundary
- Operations Zone
- Scientific Zone
- Downwind Sector
- Dark Sector
- Clean Air Sector
- Quiet Sector
- Station building
- Ski-way
- Skiway threshold
- Vehicle trail



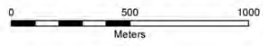
Projection: Polar Stereographic;  
Spheroid and horizontal datum: WGS84;  
Data source: Infrastructure: ASC CAD Survey (2016/17);  
ASMA boundary, Zones & Sectors: ERA (Feb 2017).



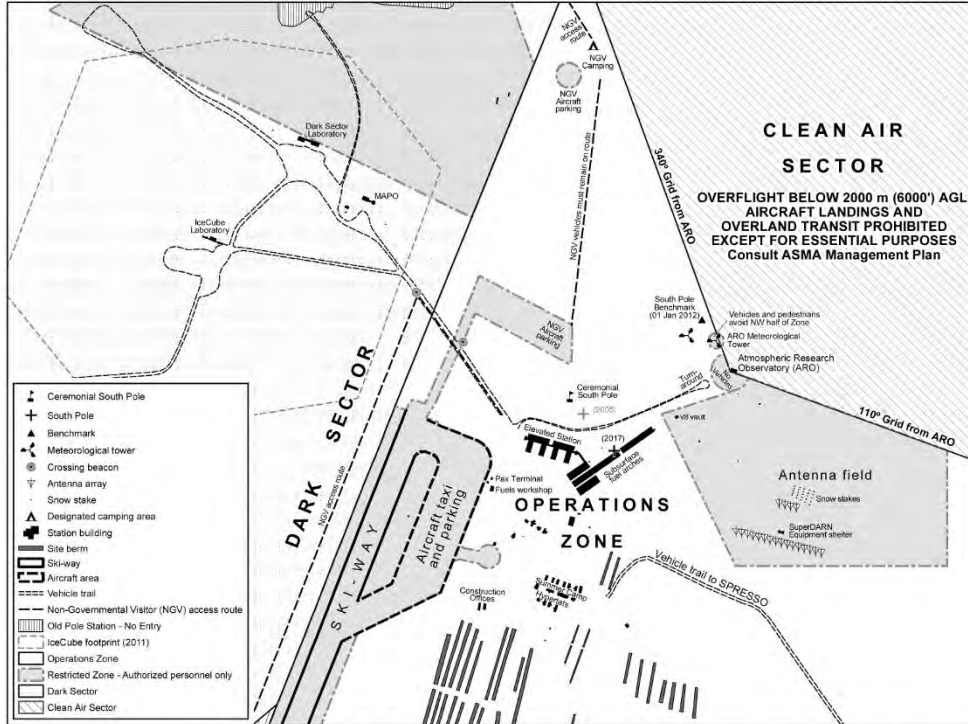


**Map 3: ASMA No. 5 - Amundsen-Scott South Pole Station - Operations Zone**

03 Apr 2017 (Map ID: 10069.013.12)  
 United States Antarctic Program  
 Environmental Research & Assessment



Projection: Polar Stereographic;  
 Spheroid and horizontal datum: WGS84;  
 Data source: Infrastructure: ASC CAD Survey (2016/17);  
 Zones & Sectors: ERA (Feb 2017).



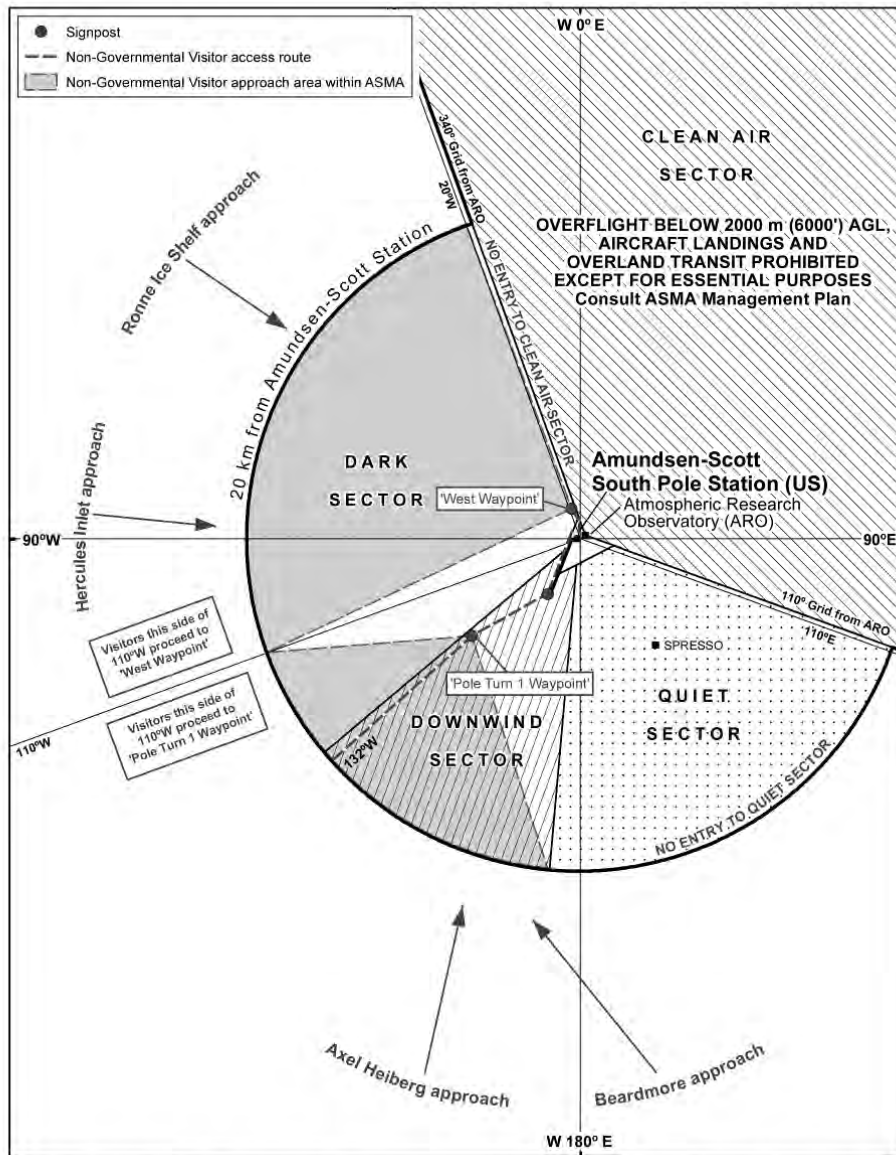
Map 4: ASMA No. 5 - Amundsen-Scott South Pole Station

03 Apr 2017 (Map ID: 10069 014 15)  
 United States Antarctic Program  
 Environmental Research & Assessment

0 100 200 300 400 500  
 Meters



Projection: Polar Stereographic;  
 Spheroid and horizontal datum: WGS84;  
 Data source: Infrastructure: ASC CAD Survey (2016/17);  
 Zones & Sectors: ERA (Feb 2017).



**Map 5: South Pole Non-Governmental Visitor approach routes & guidelines overview**

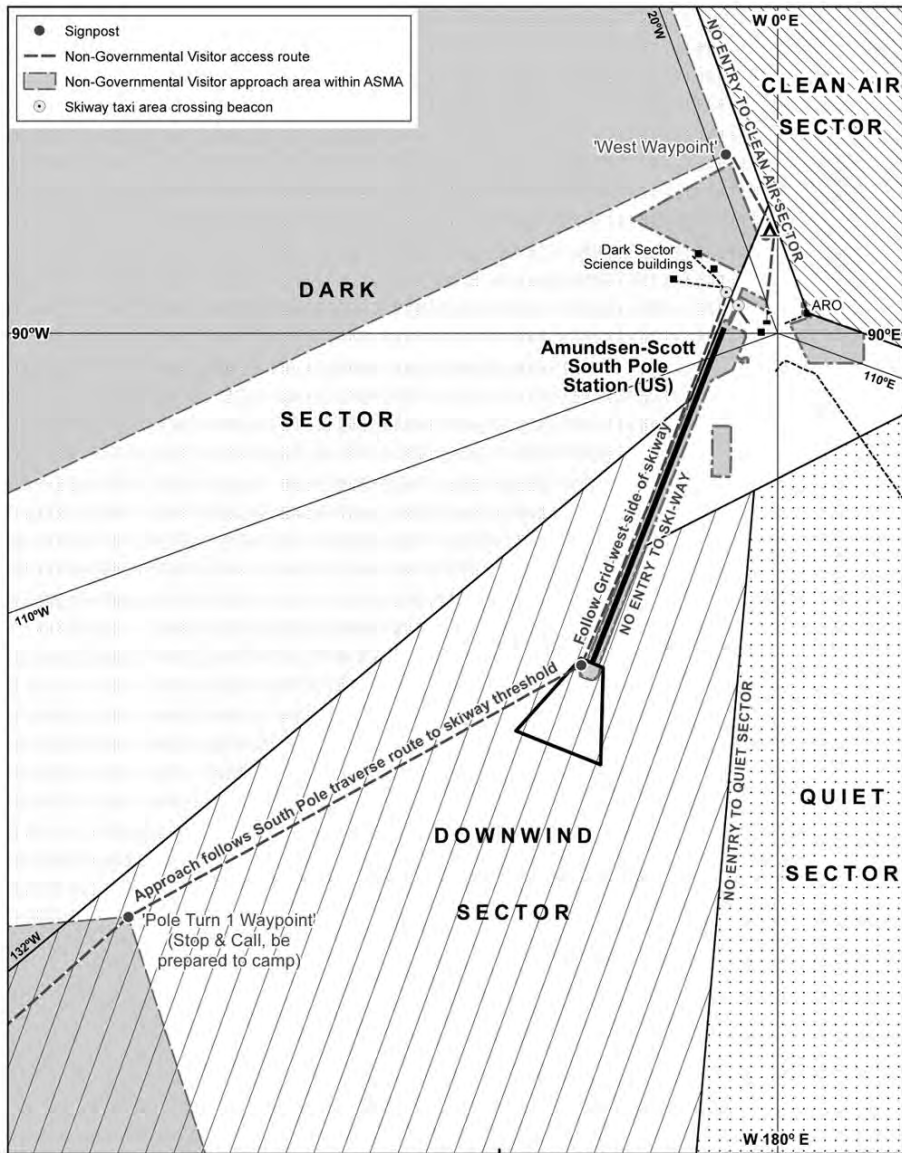
23 May 2017 (Map ID: 10069 008 10)  
 United States Antarctic Program  
 Environmental Research & Assessment



- ASMA Boundary
- Operations Zone
- Downwind Sector
- Dark Sector
- Clean Air Sector
- Quiet Sector
- Station building
- Ski-way



Projection: Polar Stereographic;  
 Spheroid and horizontal datum: WGS84;  
 Data source: Infrastructure: ASC CAD Survey (2016/17);  
 ASMA boundary, Zones & Sectors, NGV access guidance: ERA (Feb 2017).

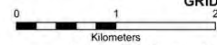


**Map 6: ASMA No. 5 - South Pole Non-Governmental Visitor approach guidelines**

03 Apr 2017 (Map ID: 10069.007.11)  
 United States Antarctic Program  
 Environmental Research & Assessment



- |                 |                  |                  |                         |
|-----------------|------------------|------------------|-------------------------|
| Operations Zone | Clean Air Sector | Ski-way          | Station building        |
| Restricted Zone | Quiet Sector     | Skiway threshold | Designated camping area |
| Downwind Sector | Hazardous Zone   | Vehicle trail    | Ceremonial South Pole   |
| Dark Sector     |                  |                  |                         |



Projection: Polar Stereographic;  
 Spheroid and horizontal datum: WGS84;  
 Data source: ASMA boundary, Zones & Sectors,  
 NGV access guidance: ERA (Feb 2017);  
 Infrastructure: ASC CAD Survey (2016/17).

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