Management Plan for

Antarctic Specially Protected Area No. 126

BYERS PENINSULA, LIVINGSTON ISLAND,

SOUTH SHETLAND ISLANDS

Introduction

The primary reason for the designation of Byers Peninsula (latitude 62°34'35" S, longitude 61°13'07" W), Livingston Island, South Shetland Islands, as an Antarctic Specially Protected Area (ASPA) is to protect the terrestrial and lacustrine habitats within the Area.

Byers Peninsula was originally designated as Specially Protected Area (SPA) No. 10 through Recommendation IV-10 in 1966. This area included the ice-free ground west of the western margin of the permanent ice sheet on Livingston Island, below Rotch Dome, as well as Window Island about 500 m off the northwest coast and five small ice-free areas on the south coast immediately to the east of Byers Peninsula. Values protected under the original designation included the diversity of plant and animal life, many invertebrates, a substantial population of southern elephant seals (*Mirounga leonina*), small colonies of Antarctic fur seals (*Arctocephalus gazella*), and the outstanding scientific values associated with such a large variety of plants and animals within a relatively small area.

Designation as an SPA was terminated through Recommendation VIII-2 and redesignation as a Site of Special Scientific Interest (SSSI) was made through Recommendation VIII-4 (1975, SSSI No. 6). The new designation as an SSSI more specifically sought to protect four smaller ice-free sites on the peninsula of Jurassic and Cretaceous sedimentary and fossiliferous strata, considered of outstanding scientific value for study of the former link between Antarctica and other southern continents. Following a proposal by Chile and the United Kingdom, the SSSI was subsequently extended through Recommendation XVI-5 (1991) to include boundaries similar to those of the original SPA: i.e. the entire ice-free ground of Byers Peninsula west of the margin of the permanent Livingston Island ice sheet, including the littoral zone, but excluding Window Island and the five southern coastal sites originally included, as well as excluding all offshore islets and rocks. Recommendation XVI-5 noted that in addition to the special geological value, the Area was also of considerable biological and archaeological importance.

While the particular status of designation and boundaries have changed from time to time, Byers Peninsula has in effect been under special protection for most of the modern era of scientific activity in the region. Recent activities within the Area have been almost exclusively for scientific research. Most visits and sampling within the Area, since original designation in 1966, have been subject to Permit conditions, and some areas (e.g. Ray Promontory) have been rarely visited. During the International Polar Year, Byers Peninsula was established as an 'International Antarctic Reference Site for Terrestrial, Freshwater and Coastal Ecosystems' (Quesada et al 2009). During this period baseline data relating to terrestrial, limnetic and coastal ecosystems was established, including permafrost characteristics, geomorphology, vegetation extent, limnetic diversity and functioning, marine mammal and bird diversity, microbiology, and coastal marine invertebrate diversity. The archaeological values of Byers Peninsula have been described as unique in possessing the greatest concentration of historical sites in Antarctica, namely the remains of refuges, together with contemporary artefacts and shipwrecks of early nineteenth century sealing expeditions (see Map 2).

Byers Peninsula 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 its numerous lakes, freshwater ponds and streams, (c) is of great ecological importance and represents the most significant limnological site in the region, (d) is vulnerable to human interference, in particular, due to the oligotrophic nature of the lakes

which are highly sensitive to pollution and (e) is of great scientific interest across a range of disciplines. While some of these quality criteria are represented in other ASPAs in the region, Byers Peninsula is unique in possessing a high number of different criteria within one area. While Byers Peninsula is protected primarily for its outstanding environmental values (specifically its biological diversity and terrestrial and lake ecosystems) the Area contains a combination of other values including scientific (i.e. for terrestrial biology, limnology, ornithology, palaeolimnology, geomorphology and geology), historic (artefacts and refuge remains of early sealers), wilderness (e.g. Ray Promontory) and on-going scientific values that may benefit from the Area's protection.

The ice-free ground of Byers Peninsula is surrounded on three sides by ocean and the Rotch Dome glacier to the east. The Area has been designated to protect values found within the ice-free ground on Byers Peninsula. To fulfil this objective a portion of Rotch Dome has been included within the ASPA to ensure newly exposed ice-free ground, (resulting from any retreat of Rotch Dome), will be within the boundaries of the ASPA. In addition, the northwestern Rotch Dome including adjacent de-glaciated ground and Ray Promontory have been designated as restricted zones to allow microbiological studies that required higher quarantine standards than considered necessary within the rest of the Area. The Area (84.7 km^2) is considered to be of sufficient size to provide adequate protection of the values described below.

1. Description of values to be protected

The Management Plan attached to Measure 1 (2002) noted values considered important as reasons for special protection of the Area. The values recorded in the original Management Plans are reaffirmed. These values are set out as follows:

- The described terrestrial flora and fauna is of exceptional diversity, with one of the broadest representations of species known in the maritime Antarctic. For example, sparse but diverse flora of calcicolous and calcifuge plants and cyanobacteria are associated with the lavas and basalts, respectively, and several rare cryptogams and the two native vascular plants (*Deschampsia antarctica* and *Colobanthus quitensis*) occur at several sites.
- With over 60 lakes, numerous freshwater pools and a great variety of often extensive streams, it is the most significant limnological site in the South Shetland Islands – and perhaps the Antarctica Peninsula region – and also one which has not been subjected to significant levels of human disturbance.
- *Parochlus steinenii* (the only native winged insect in Antarctica) is of limited distribution in the South Shetland Islands. The only other native dipteral, the wingless midge *Belgica antarctica*, has a very restricted distribution on the Antarctic Peninsula. Both species are abundant at several of the lakes and pools on Byers Peninsula.
- Unusually extensive cyanobacterial mats dominated by *Phormidium* sp.and other species, particularly on the upper levels of the central Byers Peninsula plateau, are the best examples so far described in the maritime Antarctic.
- The breeding avifauna within the Area is diverse, including two species of penguin [chinstrap (*Pygoscelis antarctica)* and gentoo (*P. papua*)], Antarctic tern (*Sterna vittata*), Wilson's storm petrels (*Oceanites oceanicus*), cape petrels (*Daption capense*), kelp gulls (*Larus dominicanus*), southern giant petrels (*Macronectes giganteus*), black-bellied storm petrels (*Fregetta tropica*), blue-eyed cormorants (*Phalacrocorax atriceps*), brown skuas (*Catharacta loennbergi*), and sheathbills (*Chionis alba*).
- The lakes and their sediments constitute one of the most important archives for study of the Holocene palaeoenvironment in the Antarctic Peninsula region, as well as for establishing a regional Holocene tephrachronology.
- Well-preserved sub-fossil whale bones are present in raised beaches, which are important for radiocarbon dating of beach deposits.
- The ice-free sites on the peninsula with exposed Jurassic and Cretaceous sedimentary and fossiliferous strata, are considered of outstanding scientific value for study of the former link between Antarctica and other southern continents.

2. Aims and objectives

Management at Byers Peninsula aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance;
- allow scientific research on the terrestrial and lacustrine ecosystems, marine mammals, avifauna, coastal ecosystems and geology;
- allow other scientific research within the Area provided it is for compelling reasons which cannot be served elsewhere;
- allow archaeological research and measures for artefact protection, while protecting historic artefacts present within the Area from unnecessary destruction, disturbance, or removal;
- prevent or minimise the introduction to the Area of alien plants, animals and microbes;
- minimise the possibility of the introduction of pathogens which may cause disease in fauna within the Area; and
- 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:

- A map showing the location of the Area and stating the special restrictions that apply, shall be displayed prominently at Base Juan Carlos I (Spain) and St. Kliment Ochridski Station (Bulgaria) on Hurd Peninsula, where copies of this management plan shall be made available.
- Markers, signs, fences or other structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition.
- 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.

Byers Peninsula has been described as extremely sensitive to human impact (Tejedo et al 2009). The Area was designated as an ASPA to protect a diverse range of values present within the Area. As a result, it attracts scientists (representing a diverse range of disciplines) and archaeologists from a number of Treaty nations. The high number of people present in the Area at peak times (mid-summer) means there is potential for the environmental values of the area to be negatively impacted upon by human activities, for example by potentially increasing (i) the size and number of camping location, (ii) the trampling of vegetation, (iii) the disturbance of native wildlife (iv) the generation of waste and (v) the need for fuel storage. Consequently, when making plans for field work within the Area, Parties are **strongly encouraged** to liaise with other nations likely to be operating in the Area that season and co-ordinate activities to keep environmental impacts to an absolute minimum (e.g. fewer than c. 12 people in the Area at any one time). As a minimum standard, the cumulative environmental impact created by all Treaty nations operating in the Area in any one season should be less than minor or transitory.

All Parties are strongly encouraged to use the established International Field Camp (located on South Beaches, 62º39'49.7" S, 61º05'59.8' W), to reduce the creation of new camping sites that would increase levels of human impacts within the Area. Two melon huts are found within the camp (one set up for scientific research, the other for domestic activities; both huts are managed by Spain). The melon huts are available to all Treaty Parties, should they wish to use them. Parties should liaise with Spain to co-ordinate access to the melon huts.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: Byers Peninsula ASPA No. 126 in relation to the South Shetland Islands, showing the location of Base Juan Carlos I (Spain) and St. Kliment Ochridski Station (Bulgaria), and showing the location of protected areas within 75 km of the Area. Inset: the location of Livingston Island along the Antarctica Peninsula.

Map 2: Byers Peninsula ASPA No. 126 topographic map. Map specifications: Projection UTM Zone 20S; Spheroid: WGS 1984; Datum: Mean Sea Level. Horizontal accuracy of control: ±0.05 m. Vertical contour interval 50 m.

6. Description of the Area

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

BOUNDARIES

The Area encompasses:

- Byers Peninsula and all ice-free ground and ice sheet west of longitude 60°53`45`` W, including Clark Nunatak and Rowe Point;
- the near-shore marine environment extending 10 m offshore from the low tide water line; and
- Demon Island and Sprite Island, adjacent to the southern shoreline of Devils Point, but excluding all other offshore islets, including Rugged Island, and rocks (Map 2).

The linear eastern boundary follows longitude 60°53`45`` W to ensure newly exposed ice-free ground resulting from the retreat of Rotch Dome, which may contain scientifically useful opportunities and new habitats for colonization studies, will be within the boundaries of the ASPA.

No boundary markers are in place.

GENERAL DESCRIPTION

Byers Peninsula (between latitudes 62°34'35" and 62°40'35" S and longitudes 60°53`45``" and 61°13'07" W, 84.7 km^2) is situated at the west end of Livingston Island, the second-largest of the South Shetland Islands (Map 1). The ice-free area on the peninsula has a central west-east extent of about 9 km and a NW-SE extent of 18.2 km, and is the largest ice-free area in the South Shetland Islands. The peninsula is generally of low, gently rolling relief, although there are a number of prominent hills ranging in altitude between 80 – 265 m (Map 2). The interior is dominated by a series of extensive platforms at altitudes of up to 105 m, interrupted by isolated volcanic plugs such as Chester Cone (188 m) and Negro Hill (143 m) (Thomson and López-Martínez 1996). There is an abundance of rounded, flat landforms resulting from marine, glacial and periglacial erosional processes. The most rugged terrain occurs on Ray Promontory, a ridge forming the northwest-trending axis of the roughly 'Y'-shaped peninsula. Precipitous cliffs surround the coastline at the northern end of Ray Promontory with Start Hill (265 m) at the NW extremity being the highest point on the peninsula.

The coast of Byers Peninsula has a total length of 71 km (Map 2). Although of generally low relief, the coast is irregular and often rugged, with numerous headlands, cliffs, offshore islets, rocks and shoals. Byers Peninsula is also notable for its broad beaches, prominent features on all three coasts (Robbery Beaches in the north, President Beaches in the west, and South Beaches). The South Beaches are the most extensive; extending 12 km along the coast and up to almost 0.9 km in width, these are the largest in the South Shetland Islands (Thomson and López-Martínez 1996). For a detailed description of the geology and biology of the Area see Annex 1.

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. Using this model, Byers Peninsula is predominantly Environment Domain G (Antarctic Peninsula off-shore islands geologic), which is described as "*a very small terrestrial environment focused around the Antarctic Peninsula and associated offshore islands such as Deception Island. At 966 km^2 it is by far the smallest environment within the classification. The environment consists entirely of ice-free land cover and contains a combination of three geological units - sedimentary (2%), intrusive (24%), and volcanic (28%). Climatically the environment is the warmest in the classification with an average air temperature of only -3.29°C, has the smallest seasonal range at -8.82°C, and receives the highest level of solar radiation at 10.64 MJ/m2/day. The average wind speed within the environment is moderate, at 13.86 m/sec. The environment is moderately*

sloping with an average slope of 13.41°. Well-known locations the environment covers include parts of ice free areas on South Shetland Islands such as Fildes Peninsula on King George Island, and small points on the Antarctic Peninsula along Davis Coast'. The scarcity of Environment 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, 114, 125, 128, 140, 145, 149, 150, and 152 and ASMAs 1 and 4.

The permanent ice of Rotch Dome comes under Environment Domain E, which is described as "*a moderately sized ice sheet environment focussed around the Antarctic Peninsula as far south as latitude 73°S. The size of the environment (173,130 km^2) is moderate when compared with other environments. The environment consists entirely of ice sheet and contains no mapped geology. Climatically the environment is warm when compared across the continent and is the warmest of the environments that contain only ice sheet. Environment E is ranked ninth warmest in average air temperature (-14.06 °C), fourth smallest in seasonal range (-15.04 °C), and seventh in the amount of solar radiation (9.85 MJ/m^2/day). The average wind speed within the environment is low ranking, 17th out of 21 environments (10.28 m/s). The environment is a moderately sloping environment with an average slope of 15.01°. Well-known locations the environment covers include the glacierised parts of South Orkney, South Shetland (including Deception), Snow Hill, Brabant, Anvers, Adelaide and Alexander Islands as well as the Antarctic Peninsula north of 73°S*'. Other protected areas containing Domain E include ASPAs 113, 114, 117, 126, 128, 129, 133, 134, 139, 147, 149, 152 and ASMAs 1 and 4.

6(ii) Access to the Area

- Access shall be by helicopter or 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 beach around the Area, landing is possible at many locations. Nevertheless, if possible, landing of cargo and scientific equipment should be close to the International Field Camp located at Southern Beaches (62º39'49.7" S, 61º05'59.8' W; see 6(*iii*) for further details).
- A designated helicopter landing site is located at 62º39'36.4" S, 61º05'48.5' W, to the east of the International Field Camp.
- Under exceptional circumstances necessary for purposes consistent with the objectives of the Management Plan, helicopters may land elsewhere within the Area, although landings should, where practicable, be made on ridge and raised beach crests.
- No helicopter lands shall be made within the restricted zones [see section 6(*v*)].
- Helicopters should avoid sites where there are concentrations of birds (e.g. Devils Point, Lair Point and Robbery Beaches) or well-developed vegetation (e.g. large stands of mosses near President and South Beaches).
- To avoid disturbance of wildlife, aircraft should avoid landing within an over-flight restriction zone extending ¼ nautical mile (c. 460 m) inland from the coast during the period 1 October – 30 April inclusive (see Map 2). The only exception to this is the designated helicopter landing site at 62º39'36.4" S, 61º05'48.5'W.
- Within the over-flight restriction zone 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). In particular, aircraft should maintain a vertical height of 2000 ft (~ 610 m) AGL and cross the coastline at right angles where possible. 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 coastal zone.
- 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

An International Field Camp is located at South Beaches, at 62º39'49.7" S, 61º05'59.8' W. It is comprised of two fibreglass 'melon huts'. It is maintained by the Spanish Polar Programme and is available for use by all Parties. The locations of 19th Century sealers remains, including refuges and caves used for shelter are given in Smith and Simpson (1987) (see Map 2). Several cairns marking sites used for topographical survey are also present within the Area, predominantly on high points.

The nearest scientific research stations are 30 km east at Hurd Peninsula, Livingston Island [Base Juan Carlos I (Spain) and St Kliment Ochridski (Bulgaria)].

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

The nearest protected areas to Byers Peninsula are: Cape Shirreff (ASPA No. 149) which lies about 20 km to the northeast, Deception Island (ASMA No. 4), Port Foster and other parts of Deception Island (ASPAs No. 140, 145) which are approximately 40 km SSE and 'Chile Bay' (Discovery Bay) (ASPA No. 144), which is about 70 km to the east at Greenwich Island (Map 1).

6(v) Restricted and managed zones within the Area

Some zones on Byers Peninsula are thought to have been visited only very rarely, or never. New metagenomic techniques are predicted to allow future identification of microbial biodiversity (bacteria, fungi and viruses) to an unprecedented level, allowing many fundamental questions regarding microbial dispersal and distribution to be answered. Restricted zones have been designated that are of scientific importance to Antarctic microbiology and greater restriction is placed on access with the aim of preventing microbial or other contamination by human activity:

- In keeping with this aim, within the restricted zones sterile protective over-clothing shall be worn. The protective clothing shall be put on immediately prior to entering the restricted zones. Spare boots, previously cleaned using a biocide then sealed in plastic bags, shall be unwrapped and put on just before entering the restricted zones. If accessing the restricted zones by boat, protective clothing shall be put on immediately upon landing.
- To the greatest extent possible, all sampling equipment, scientific apparatus and markers brought into the restricted zones shall have been sterilized, and maintained in a sterile condition, before being used within the Area. Sterilization should be by an accepted method, including UV radiation, autoclaving or by surface sterilisation using 70% ethanol or a commercially available biocide (e.g. Virkon®).
- General equipment includes harnesses, crampons, climbing equipment, ice axes, walking poles, ski equipment, temporary route markers, pulks, sledges, camera and video equipment, rucksacks, sledge boxes and all other personal equipment. To the maximum extent practicable, all equipment used or brought into the restricted zones shall have been thoroughly cleaned and sterilized at the originating Antarctic station or ship. Equipment shall have been maintained in this condition before entering the restricted zones, preferably by sealing in sterile plastic bags or other clean containers.
- Scientists from disciplines other than microbiology are permitted to enter the restricted areas, but shall adhere to the quarantine measures detailed above.
- Camping within the restricted zones is not permitted.
- Helicopter landings within the restricted zones are not permitted.
- If access to the restricted zones is required for research or for emergency reasons, a detailed record of where visitation occurred (preferably using GPS technology) and the specific activities, should be submitted to the appropriate national authority and included in the Exchange of Information Annual Report, preferably through the Electronic Information Exchange System (EIES).

The restricted zones are:

1. North-western Rotch Dome and adjacent deglaciated ground. The restricted zone includes all land and ice sheet within an area bordered to the east by longitude 60º53'45"W, to the west by longitude

60°58'48" W, to the south by latitude 62°38'30"S, and the northern boundary follows the coastline (see Map 2).

2. Ray Promontory. The restricted zone includes all land and permanent ice northwest of a straight line crossing the Promontory from 62°37`S, 61°08`W (marked by a small coastal lake) to 62°36`S, 61°06`W. Within the Ray Promontory restricted zone, access to archaeological remains located on the coast is permitted without the need for quarantine precautions required elsewhere within the restricted zone. Access to inland areas beyond the coastal archaeological remains is not permitted without quarantine measures, detailed in this section, in place. Preferably, access to the archaeological remains shall be from the sea using small boats. Access to the archaeological remains on foot is also permitted without the need for the additional quarantine measures, by following the coastline from the unrestricted area of the Byers Peninsula ASPA to the southeast. Access to the archaeological remains shall be solely for archaeological investigations, authorised by the appropriate national authority.

7. Terms and conditions for entry permits

Entry into the Area is prohibited except in accordance with a Permit issued by an appropriate national authority.

7(i) General permit conditions

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

- it is issued only for scientific study of the ecosystem, geology, palaeontology or archaeology of the Area, or for compelling scientific reasons that cannot be served elsewhere; or
- it is issued for essential management purposes consistent with management plan objectives such as inspection, maintenance or review;
- the actions permitted will not jeopardise the ecological, geological, historical or scientific values of the Area;
- the sampling proposed will not take, remove or damage such quantities of soil, rock, native flora or fauna that their distribution or abundance on Byers Peninsula would be significantly affected;
- 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; and
- 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 unless under exceptional circumstances when helicopter may be used.
- All movement shall be undertaken carefully so as to minimise disturbance to archaeological remains, animals, soils, geomorphological features and vegetated surfaces, walking on rocky terrain or ridges if practical to avoid damage to sensitive plants, patterned ground and 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. Where possible, existing tracks should be used to transit the area (Map 2). If no track exists, care should be taken to avoid creation of new tracks. Research has shown that vegetation on Byers Peninsula can recover if fewer than 200 transits are made over it in a single season (Tejedo et al 2009). Pedestrian routes over vegetated ground should therefore be chosen depending on the forecasted number of transits (i.e. number of people × transits per day × number of days). When the number of transits on the same track is

expected to be less than 200 in the same season, the track should be clearly identified and transits always made along the track. When the number is expected to be larger than 200 in a season, then the route should not be fixed along a single track, but transits should be done across a wide belt (i.e. multiple tracks, each with fewer than 200 transits), to diffuse the impact and allow quicker recovery of trampled vegetation.

- Conditions for use of helicopters within the Area are described in section 6(*ii*)
- 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.

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

- Compelling scientific research which cannot be undertaken elsewhere and that will not jeopardise the ecosystem or values of the Area or interfere with existing scientific studies.
- Archaeological research.
- 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

In order to minimise the area of ground within the ASPA impacted by camping activities, camps should be within the immediate vicinity of the International Field Camp (62º39'49.7" S, 61º05'59.8" W). When necessary for purposes specified in the Permit, temporary camping beyond the International Field Camp 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. Camping within 50 m of any sealers` refuge or shelter is prohibited. Previously used campsites should be re-used where practical, unless the guidance above suggests that they were inappropriately located. Camping within the restricted zones is not permitted.

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

The deliberate introduction of animals, plant material, microorganisms and non-sterile soil into the Area shall not be permitted. 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). In view of the presence of breeding bird colonies on Byers Peninsula, 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 or 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, archaeological or management needs.

Unless specifically authorized by permit, visitors to the Area are prohibited from interfering with or from handling, taking or damaging any historic anthropogenic material meeting the criteria in Resolution 5 (2001). Similarly, relocation or removal of artefacts for the purposes of preservation, protection or to re-establish historical accuracy is allowable only by permit. The appropriate national authority shall be informed of the location and nature of any newly identified anthropogenic materials.

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, including all solid human waste, 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 as the near-shore reefs will prevent dispersal, but shall be removed from the Area. No human waste shall be disposed of inland as the oligotrophic characteristics of the lakes and other water-bodies on the plateau can be compromised by even a small quantity of human waste, including urine.

7(x) 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 collection of data and/or a small number of samples for analysis or review;
- erect or maintain signposts, structures or scientific equipment; or
- carry out protective measures.

Any specific sites of long-term monitoring shall be appropriately marked on site and on maps of the Area. A GPS position should be obtained for lodgement with the Antarctic Data Directory System through the appropriate national authority.

To help maintain the ecological and scientific values of the Area, visitors shall take special precautions against introductions. Of particular concern are microbial, animal or vegetation introductions sourced from soils from other Antarctic sites, including stations, or from regions outside Antarctica. To the maximum extent practicable, visitors shall ensure that footwear, clothing and any equipment – particularly camping and sampling equipment – is thoroughly cleaned before entering the Area. Poultry products and other introduced avian products, which may be a vector of avian diseases, shall not be released into the Area.

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 appended to Resolution 2 (1998)][available from the website of the Secretariat of the Antarctic Treaty 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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Annex 1

Supporting information

CLIMATE

No extended meteorological records are available for Byers Peninsula before 2001, but the climate is expected to be similar to that at Base Juan Carlos I, Hurd Peninsula (recorded since 1988). Conditions there indicate a mean annual temperature of below 0 ºC, with temperatures less than 0 ºC for at least several months each summer and a relatively high precipitation rate estimated at about 800 mm yr^{-1}, much of which falls as rain in summer (Ellis-Evans 1996). The peninsula is snow-covered for much of the year, but is usually completely snow-free by the end of the summer. The peninsula is exposed to weather from the Drake Passage in the north and northwest, the directions from which winds prevail, and Bransfield Strait to the south. The climate is polar maritime, with a permanently high relative humidity (about 90%), cloud covered skies for most of the time, frequent fogs and regular precipitation events. Mean temperature in summer is 1.1 º C, but occasionally can be higher than 5 ºC. Exceptionally summer temperature has reached 9 ºC. Minimum average temperature is close to 0 ºC. In winter, temperatures can be lower than -26 ºC, although the average value is -6 ºC and maximum temperatures in winter can be close to 0 ºC. Mean radiation in summer is 14,000 KJ m^{-2}, reaching 30,000 KJ m^{-2} on sunny days close to the solstice. Winds are high and average speed is 24 km h^{-1}, with frequent storms with winds over 140 Km h^{-1}. The predominant winds are from SW and NE.

GEOLOGY

The bedrock of Byers Peninsula is composed of Upper Jurassic to Lower Cretaceous marine sedimentary, volcanic and volcaniclastic rocks, intruded by igneous bodies (see Smellie *et al* 1980; Crame *et al* 1993, Hathway and Lomas 1998). The rocks represent part of a Mesozoic-Cenozoic magmatic arc complex which is exposed throughout the whole of the Antarctic Peninsula region, although most extensively on the Byers Peninsula (Hathway and Lomas 1998). The elevated interior region of the eastern half of the peninsula – surrounded to the north and south by Holocene beach deposits – is dominated by Lower Cretaceous non-marine tuffs, volcanic breccias, conglomerates, sandstones and minor mudstones, with intrusions in several places by volcanic plugs and sills. The western half of the peninsula, and extending NW half-way along Ray Promontory, is predominantly Upper Jurassic-Lower Cretaceous marine mudstones, with sandstones and conglomerates, with frequent intrusions of volcanic sills, plugs and other igneous bodies. The NW half of Ray Promontory comprises mainly volcanic breccias of the same age. Mudstones, sandstones, conglomerates and pyroclastic rocks are the most common lithologies found on the peninsula. Expanses of Holocene beach gravels and alluvium are found in coastal areas, particularly on South Beaches and the eastern half of Robbery Beaches, with less-extensive deposits on President Beaches.

The Area is of high geological value because "the sedimentary and igneous rocks exposed at Byers Peninsula constitute the most complete record of the Jurassic-Early Cretaceous period in the northern part of the Pacific flank of the magmatic arc complex, and they have proved a key succession for the study of marine molluscan faunas (e.g. Crame 1984, 1995, Crame and Kelly 1995) and non-marine floras (e.g. Hernandez and Azcárte 1971, Philippe *et al* 1995)" (Hathway and Lomas 1998).

GEOMORPHOLOGY AND SOILS

Much of the terrain consists of lithosols, essentially a layer of shattered rock, with permafrost widespread below an active layer of 30-70 cm depth (Thom 1978, Ellis-Evans 1996, Serrano *et al* 1996). Stone fields (consisting of silty fines with dispersed boulders and surficial clasts), gelifluction lobes, polygonal ground (both in flooded and dry areas), stone stripes and circles and other periglacial landforms dominate the surface morphology of the upper platforms where bedrock outcrop is absent (Serrano at al 1996). Debris and mud-flows are observed in several localities. Beneath some of the moss and grass communities there is a 10-20

cm deep layer of organic matter although, because vegetation is sparse over most of Byers Peninsula, there are no deep accumulations of peat (Bonner and Smith 1985). Ornithogenic soils are present especially in the Devils Point vicinity and on a number of knolls along President Beaches (Ellis-Evans 1996).

Parts of the interior of the peninsula have been shaped by coastal processes with a series of raised beaches ranging from 3 to 54 m in altitude, some of which are over 1 km wide. A radiocarbon date for the highest beach deposits suggests that Byers Peninsula was largely free of permanent ice by 9700 yr B.P., while the lowest beach deposits are dated at 300 yr B.P (John and Sugden 1971, Sugden and John 1973). Lake sediment analyses, however, suggest a more recent general deglaciation of central Byers Peninsula of around 4000-5000 yr B.P. and radiocarbon dates in the locality need to be interpreted cautiously (Björck *et al* 1991a, b). In several places sub-fossil whalebones are embedded in the raised beaches, occasionally as almost entire skeletons. Radiocarbon dates of skeletal material from about 10 m a.s.l. on South Beaches suggest an age of between 2000 and 2400 yr B.P. (Hansom 1979). Pre-Holocene surfaces of Byers Peninsula exhibit clear evidence of a glacial landscape, despite the gentle landforms. Today only three small residual glaciers (comprising less then 0.5 km^2) remain on Ray Promontory. The pre-existing glacially modified landforms, have been subsequently overprinted by fluvial and periglacial processes, and moraines and other glacial deposits are scarce (Martinez de Pison *et al* 1996).

STREAMS AND LAKES

Byers Peninsula is perhaps the most significant limnological site in the South Shetland Islands/Antarctic Peninsula region, with over 60 lakes, numerous freshwater pools (differentiated from lakes in that they freeze to the bottom in winter) and a dense and varied stream network. The gentle terrain favours water retention and waterlogged soils are common in the summer. The water capacity of the thin soils is limited, however, and many of the channels are frequently dry, with flow often intermittent except during periods of substantial snow melt or where they drain glaciers (Lopez-Martinez *et al* 1996). Most of the streams drain seasonal snowfields and are often no more than 5-10 cm in depth (Ellis-Evans 1996) although snow accumulation in some narrow gorges can reach over 2 m height, and result in ice dams blocking the lake outlet. The larger streams are up to 4.5 km in length, up to 20 m in width and 30-50 cm in depth in the lower reaches during periods of flow. Streams that drain to the west often have sizeable gorges (Lopez-Martinez *et al* 1996) and gullies up to 30 m in depth have been cut into the uppermost, and largest, of the raised marine platforms (Ellis-Evans 1996). Above the Holocene raised beaches the valleys are gentle, with widths of up to several hundred metres.

Lakes are especially abundant on the higher platforms (i.e. at the heads of basins) and on the Holocene raised beaches near the coast. Midge Lake is the largest at 587 $\times$ 112 m, and deepest with a maximum depth of 9.0 m. The inland lakes are all nutrient-poor and highly transparent, with extensive sediments in deeper water overlain by a dense aquatic moss carpet [*Drepanocladus longifolius (=D. aduncus*)]. In some lakes, such as Chester Cone Lake about 500 m to the south of Midge Lake, or Limnopolar lake, stands of aquatic moss are found growing at one to several metres in depth and cover most of the lake bottom, which is the habitat for *Parochlus* larvae (Bonner and Smith 1985). Large masses of this moss are sometimes washed up along parts of the shoreline. The lakes are generally frozen to a depth of 1.0 - 1.5 m for 9 - 11 months of the year and overlain by snow, although surfaces of some of the higher lakes remain frozen year-round (Ellis-Evans 1996, Lopez-Martinez *et al* 1996). On the upper levels of the central plateau many small, shallow, slow-flowing streams flow between lakes and drain onto large flat areas of saturated lithosol covered with thick cyanobacterial mats of *Phormidium* sp. These mats are more extensive than in any other maritime Antarctic site thus far described and reflect the unique geomorphology and relatively high annual precipitation of the Area. With spring melt there is considerable flush through most lakes, but outflow from many lakes may cease late in the season as seasonal snowmelt decreases. Most lakes contain some crustaceans such as the copepods *Boeckella poppei* and the fairy shrimp *Branchinecta gainii*. Some of the streams also contain substantial growths of cyanobacterial and green filamentous algae, along with diatoms and copepods. A number of relatively saline lakes of lagoonal origin occur close to the shore, particularly on President Beaches. Where these are used as southern elephant seal (*Mirounga leonina*) wallows these lakes have been highly organically enriched. Those coastal shallow lakes and pools located behind the first raised beach often have abundant algal mats and crustaceans, including the copepods *B. poppei* and *Parabroteas sorsi*, and occasionally the fairy shrimp *Br. gainii*. Some of these water bodies have high biological diversity, with newly described species of diatoms (van der Vijver 2010), oligochaete (Rodriguez and Rico, 2009) and ciliate protozoa (Petz et al 2008).

VEGETATION

Although much of Byers Peninsula lacks abundant vegetation, especially inland (see Lindsay 1971), the sparse communities contain a diverse flora, with at least 56 lichen species, 29 mosses, 5 hepatics and 2 phanerogams having been identified as present within the Area. Numerous unidentified lichens and mosses have also been collected. This suggests the Area contains one of the most diverse representations of terrestrial flora known in the maritime Antarctic. A number of the species are rare in this part of the maritime Antarctic. For example, of the bryophytes, *Anthelia juratzkana*, *Brachythecium austroglareosum*, *Chorisodontium aciphyllum*, *Ditrichum hyalinum*, *Herzogobryum teres*, *Hypnum revolutum*, *Notoligotrichum trichodon*, *Pachyglossa dissitifolia*, *Platydictya jungermannioides*, *Sanionia* cf. *plicata*, *Schistidium occultum*, *Syntrichia filaris* and *Syntrichia saxicola* are considered rare. For *A. juratzkana*, *D. hyalinum*, *N. trichodon* and *S. plicata*, their furthest-south record is on Byers Peninsula. Of the lichen flora, *Himantormia lugubris*, *Ochrolechia parella*, *Peltigera didactyla* and *Pleopsidium chlorophanum* are considered rare.

Vegetation development is much greater on the south coast than on the north. Commonly found on the higher, drier raised beaches in the south is an open community dominated by abundant *Polytrichastrum alpinum* (=*Polytrichum alpinum*), *Polytrichum piliferum* (=*Polytrichum antarcticum*), *P. juniperinum*, *Ceratodon purpureus*, and the moss *Pohlia nutans* and several crustose lichens are frequent. Some large stands of mosses occur near President and South Beaches, where extensive snowdrifts often accumulate at the base of slopes rising behind the raised beaches, providing an ample source of melt water in the summer. These moss stands are dominated mainly by *Sanionia uncinata* (=*Drepanocladus uncinatus*), which locally forms continuous carpets of several hectares. The vegetation composition is more diverse than on the higher, drier areas. Inland, wet valley floors have stands of *Brachythecium austro-salebrosum*, *Campylium polygamum*, *Sanionia uncinata*, *Warnstorfia laculosa* (=*Calliergidium austro-stramineum*), and *W. sarmentosa* (=*Calliergon sarmentosum*). In contrast, moss carpets are almost non-existent within 250 m of the northern coast, replaced by scant growth of *Sanionia* in hollows between raised beaches of up to 12 m in altitude. Lichens, principally of the genera *Acarospora*, *Buellia*, *Caloplaca*, *Verrucaria* and *Xanthoria*, are present on the lower (2-5 m) raised beach crests, with *Sphaerophorus*, *Stereocaulon* and *Usnea* becoming the more dominant lichens with increasing altitude (Lindsay 1971).

On better drained ash slopes *Bryum* spp., *Dicranoweisia* spp., *Ditrichum* spp., *Pohlia* spp., *Schistidium* spp., and *Tortula* spp. are common as isolated cushions and turves with various liverworts, lichens (notably the pink *Placopsis contortuplicata* and black foliose *Leptogium puberulum*), and the cyanobacterium *Nostoc commune*. *P. contortuplicata* occurs in inland and upland habitats lacking in nitrogen, and is typical of substrata with some degree of disturbance such as solifluction; it is often the only plant to colonise the small rock fragments of stone stripes and frost-heave polygons (Lindsay 1971). It is usually found growing alone, though rarely with species of *Andreaea* and *Usnea*. *N. commune* covers extensive saturated areas on level or gently sloping, gravelly boulder clay from altitudes of between 60-150 m, forming discrete rosettes of about 5 cm in diameter 10-20 cm apart (Lindsay 1971). Scattered, almost spherical, cushions of *Andreaea*, *Dicranoweisia*, and *Ditrichum* are found on the driest soils. In wet, bird- and seal-influenced areas the green foliose alga *Prasiola crispa* is sometimes abundant.

Rock surfaces on Byers Peninsula are mostly friable, but locally colonised by lichens, especially near the coast. Volcanic plugs are composed of harder, more stable rock and are densely covered by lichens and occasional mosses. Usnea Plug is remarkable for its luxuriant growth of *Himantormia lugubris* and *Usnea aurantiaco-atra* (=*U. fasciata*). More generally, *H. lugubris* and *U. aurantiaco-atra* are the dominant lichen species on inland exposed montane surfaces, growing with the moss *Andreaea gainii* over much of the exposed rock with up to 80% cover of the substratum (Lindsay 1971). In sheltered pockets harbouring small accumulations of mineral soil, the liverworts *Barbilophozia hatcheri* and *Cephaloziella varians* (= *C. exiliflora*) are often found, but more frequently intermixed with cushions of *Bryum*, *Ceratodon*, *Dicranoweisia*, *Pohlia*, *Sanionia*, *Schistidium*, and *Tortula*. *Sanionia* and *Warnstorfia* form small stands, possibly correlated with the absence of large snow patches and associated melt streams. *Polytrichastrum alpinum* forms small inconspicuous cushions in hollows, but it may merge with *Andreaea gainii* cushions in favourable situations (Lindsay 1971).

Crustose lichens are mainly species of *Buellia*, *Lecanora*, *Lecedella*, *Lecidea*, *Placopsis* and *Rhizocarpon* growing on rock, with species of *Cladonia* and *Stereocaulon* growing on mosses, particularly *Andreaea*

(Lindsay 1971). On the south coast moss carpets are commonly colonised by epiphytic lichens, such as *Leptogium puberulum, Peltigera rufescens*, *Psoroma* spp., together with *Coclocaulon aculeata* and *C. epiphorella*. On sea cliffs *Caloplaca* and *Verrucaria* spp. dominate on lower surfaces exposed to salt spray up to about 5 m, with nitrophilous species, such as *Caloplaca regalis, Haematomma erythromma,*and *Xanthoria elegans* often dominant at higher altitudes where seabirds are frequently nesting. Elsewhere on dry cliff surfaces a *Ramalina terebrata* - crustose lichen community is common. A variety of ornithocoprophilous lichens, such as *Catillaria corymbosa, Lecania brialmontii*, and species of *Buellia, Haematomma, Lecanora,* and *Physcia* occur on rocks near concentrations of breeding birds, along with the foliose lichens *Mastodia tessellata, Xanthoria elegans* and *X. candelaria* which are usually dominant on dry boulders.

Antarctic hairgrass (*Deschampsia antarctica*) is common in several localities, mainly on the south coast, and occasionally forms closed swards (e.g. at Sealer Hill); Antarctic pearlwort (*Colobanthus quitensis*) is sometimes associated. Both plants are quite abundant in southern gullies with a steep north-facing slope, forming large, occasionally pure stands with thick carpets of *Brachythecium* and *Sanionia*, although they are rarely found above 50 m in altitude (Lindsay 1971). An open community of predominantly *Deschampsia* and *Polytrichum piliferum* extends for several kilometres on the sandy, dry, flat raised beaches on South Beaches. A unique growth-form of the grass, forming isolated mounds 25 cm high and up to 2 m across, occurs on the beach near Sealer Hill. *Deschampsia* has been reported at only one locality on the north coast (Lair Point), where it forms small stunted tufts (Lindsay 1971).

INVERTEBRATES

The microinvertebrate fauna on Byers Peninsula thus far described comprises 25 taxa (Usher and Edwards 1986, Richard *et al* 1994, Block and Stary 1996, Convey *et al* 1996, Rodriguez and Rico, 2008): six Collembola (*Cryptopygus antarcticus, Cryptopygus badasa, Friesea grisea, Friesea woyciechowskii, Isotoma* (*Folsomotoma*) *octooculata* (=*Parisotoma octooculata*) and *Tullbergia mixta*; one mesostigmatid mite (*Gamasellus racovitzai*), five cryptostigmatid mites (*Alaskozetes antarcticus, Edwardzetes dentifer, Globoppia loxolineata* (=*Oppia loxolineata*), *Halozetes belgicae* and *Magellozetes antarcticus*); nine prostigmatid mites (*Bakerdania antarcticus, Ereynetes macquariensis, Eupodes minutus, Eupodes parvus grahamensis, Nanorchestes berryi, Nanorchestes nivalis, Pretriophtydeus tilbrooki, Rhagidia gerlachei, Rhagidia leechi,* and *Stereotydeus villosus*); two Dipterans (*Belgica antarctica* and *Parochlus steinenii*), and two oligochaetes (*Lumbricillus healyae* and *Lumbricillus sp*.).

Larvae of the wingless midge *Belgica antarctica* occur in limited numbers in moist moss, especially carpets of *Sanionia*, although it is of very restricted distribution on Byers Peninsula (found especially near Cerro Negro) and may be near its northern geographical limit. The winged midge *Parochlus steinenii* and its larvae inhabit the margins of inland lakes and pools, notably Midge Lake and another near Usnea Plug, and are also found amongst the stones of many stream beds (Bonner and Smith 1985, Richard *et al* 1994, Ellis-Evans pers comm 1999). During warm calm weather, swarms of adults may be seen above lake margins.

The diversity of the arthropod community described at Byers Peninsula is greater than at any other documented Antarctic site (Convey *et al* 1996). Various studies (Usher and Edwards 1986, Richard *et al* 1994, Convey *et al* 1996) have demonstrated that the arthropod population composition on Byers Peninsula varies significantly with habitat over a small area. *Tullbergia mixta* has been observed in relatively large numbers; it appears to be limited in Antarctic distribution to the South Shetland Islands (Usher and Edwards 1986). Locally, the greatest diversity is likely to be observed in communities dominated by moss cushions such as *Andreaea* spp. (Usher and Edwards 1986). Further sampling is required to establish populations and diversities with greater reliability. While further sampling at other sites may yet reveal the communities described at Byers Peninsula to be typical of similar habitats in the region, available data on the microfauna confirm the biological importance of the Area.

MICROORGANISMS

An analysis of soil samples collected from Byers Peninsula yielded several nematophagous fungi: in soil colonised by *Deschampsia* were found *Acrostalagmus goniodes, A. obovatus, Cephalosporium balanoides* and *Dactylaria gracilis,* while in *Colobanthus*-dominated soil was found *Cephalosporium balanoides* and

Dactylella gephyropaga (Gray and Smith 1984). The basidiomycete *Omphalina antarctica* is often abundant on moist stands of the moss *Sanionia uncinata* (Bonner and Smith 1985).

Some of the water bodies have high microbial biodiversity including the largest viral genetic diversity found in Antarctic lakes (López-Bueno et al 2009)

BREEDING BIRDS

The avifauna of Byers Peninsula is diverse, although breeding colonies are generally not large. Two species of penguin, the chinstrap (*Pygoscelis antarctica*) and the gentoo (*P. papua*), breed in the Area.

Adélie penguins (*P. adeliae*) have not been observed to breed on Byers Peninsula or its offshore islets. In the South Shetlands Islands, Adélie penguins only breeds on King George Island where the populations are declining (Carlini et al. 2009).

The principal chinstrap penguin colony is at Devils Point, where a rough estimate of about 3000 pairs was made in 1987; a more accurate count made in 1965 indicated about 5300 pairs in four discrete colonies, of which almost 95% were nesting on Demon Island, 100 m to the south of Devils Point (Croxall and Kirkwood 1979; Woehler 1993). Two colonies of about 25 chinstrap penguin pairs surrounded by a colony of gentoo penguins can be found on the President Beaches close to Devils Point. Small chinstrap penguin colonies have been reported on the northern coast, e.g. on Robbery Beaches (50 pairs in 1958; Woehler 1993), but no breeding pairs were reported there in a 1987 survey. In other locations, Lair Point contained 156 pairs in 1966, declining to 25 pairs in 1987 (Woehler 1993). In a recent visit to the area (January 2009) 20 pairs were counted (Barbosa pers.com).

Gentoo penguins breed at several colonies on Devils Point, with approximately 750 pairs recorded in 1965 (Croxall and Kirkwood 1979, Woehler 1993). Currently three colonies of about 3000 pairs in total can be found (Barbosa pers.com). On the northern coast, a rookery of three colonies with 900 pairs in total is located in Robbery Beaches (Woehler 1993). In a visit to Lair Point in January 2009, about 1200 pairs were counted. Woehler (1993) gives no data on gentoo penguins at this location.

Recent estimations of population size for some species of flying birds were obtained from a survey conducted in December 2008 and January 2009 (Gil-Delgado et al. 2010). The Antarctic tern (*Sterna vittata*) population was estimated at 1873 breeding pairs. Two hundred and thirty eight pairs of southern giant petrels *(Macronectes giganticus)* and 15 pairs of brown skua (*Catharacta lonnbergi*) nest locally. A detailed survey of other breeding birds was conducted in 1965 (White 1965). The most populous breeding species recorded then, with approximately 1760 pairs, was the Antarctic tern (*Sterna vittata*), followed by 1315 pairs of Wilson's storm petrels (*Oceanites oceanicus*), approximately 570 pairs of cape petrels (*Daption capense*), 449 pairs of kelp gulls (*Larus dominicanus*), 216 pairs of southern giant petrels, 95 pairs of black-bellied storm petrels (*Fregetta tropica*), 47 pairs of blue-eyed cormorants (*Phalacrocorax atriceps*) (including those on nearshore islets), 39 pairs of brown skuas, and 3 pairs of sheathbills (*Chionis alba*). In addition, prions (*Pachytilla* sp.) and snow petrels (*Pagodroma nivea*) have been seen on the peninsula but their breeding presence has not been confirmed. The census of burrowing and scree-nesting birds is considered an underestimate (White pers. comm. 1999). The majority of the birds nest in close proximity to the coast, principally in the west and south.

Recently some vagrant waders, probably white-rumped sandpipers (*Calidris fuscicollis*) have been seen frequently foraging in some streams in the southern beaches (Quesada pers. comm. 2009).

BREEDING MAMMALS

Large groups of southern elephant seals (*Mirounga leonina*) breed on the Byers Peninsula coast, with a total of over 2500 individuals reported on South Beaches (Torres *et al*. 1981), which is one of the largest populations of this species recorded in the South Shetland Islands. A estimation made in 2008-2009 showed a population ranging from 4700 to 6300 individuals (Gil-Delgado et al. 2010). Large numbers haul out in wallows and along beaches in summer. Weddell (*Leptonychotes weddellii*), crabeater (*Lobodon carcinophagous*) and leopard (*Hydrurga leptonyx*) seals may be seen around the shorelines. Antarctic fur seals (*Arctocephalus gazella*) were once very abundant on Byers Peninsula (see below), but have not

substantially recolonised the Area in high numbers in spite of the recent rapid population expansion in other parts of the maritime Antarctic.

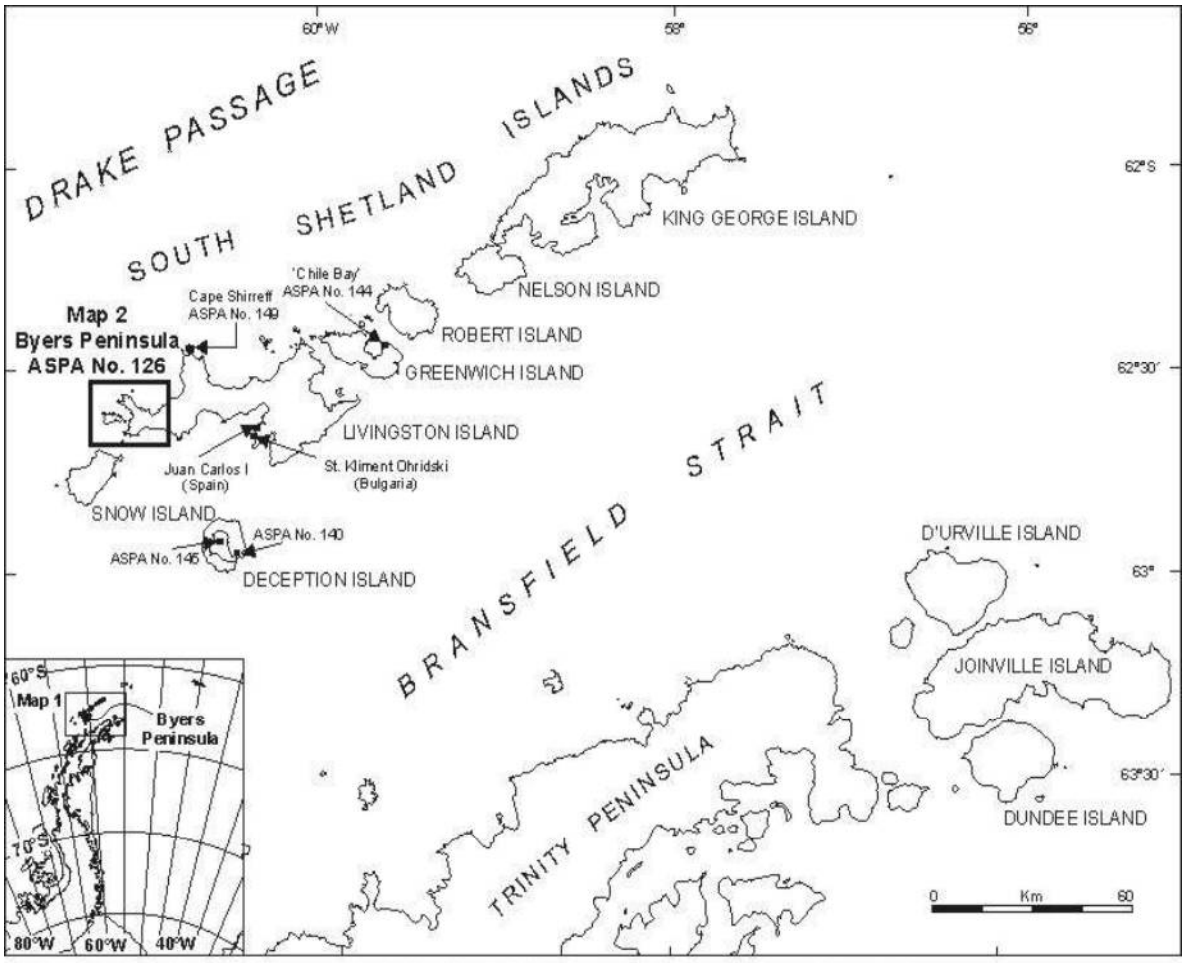
HISTORICAL FEATURES

Following discovery of the South Shetland Islands in 1819, intensive sealing at Byers Peninsula between 1820 and 1824 exterminated almost all local Antarctic fur seals and southern elephant seals (Smith and Simpson 1987). During this period there was a summer population of up to 200 American and British sealers living ashore in dry-stone refuges and caves around Byers Peninsula (Smith and Simpson 1987). Evidence of their occupation remains in their many refuges, some of which still contain artefacts (clothing, implements, structural materials, etc.). Several sealing vessels were wrecked near Byers Peninsula and timbers from these ships may be found along the shores. Byers Peninsula has the greatest concentration of early 19th Century sealers' refuges and associated relics in the Antarctic and these are vulnerable to disturbance and/or removal.

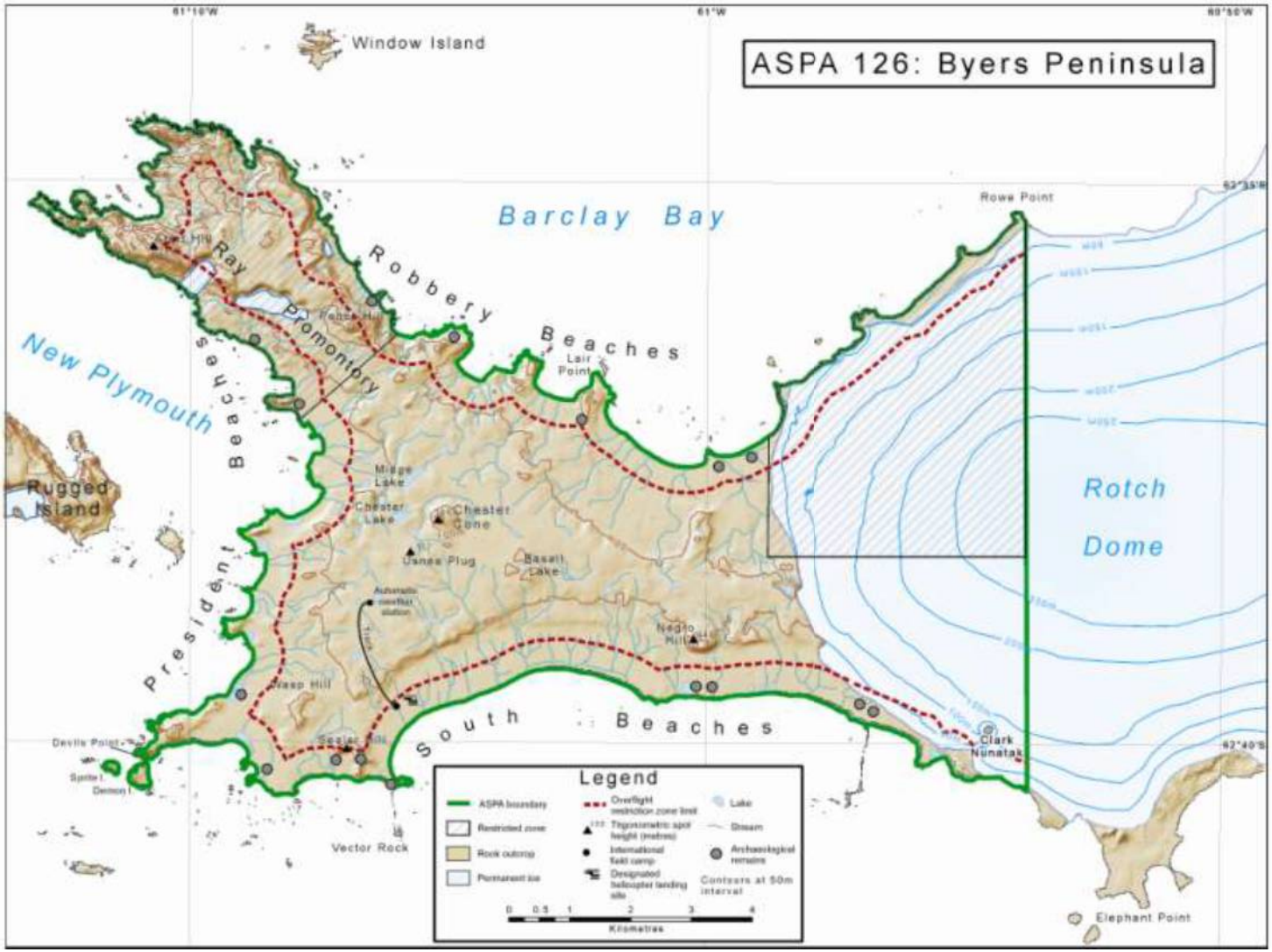
Elephant seal numbers, and to some extent fur seal numbers, recovered after 1860, but were again decimated by a second sealing cycle extending to the first decade of the twentieth century.

HUMAN ACTIVITIES/IMPACTS

The modern era of human activity at Byers Peninsula 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, sea-borne litter washed onto beaches (e.g. from fishing vessels) and from human wastes and scientific sampling. Several wooden stake markers and a plastic fishing float were observed in the southwest of the Area in a brief visit made in February 2001 (Harris 2001). In summer 2009-2010, a beach litter survey was undertaken (Rodriguez-Pertierra pers. comm.). The highest proportion of litter on beaches (averaged over beach length) was found in Robbery Beach (64%) followed by President Beach (28%) and beaches to the southwest of the Area (8%). This is likely to be related to their exposure to the Drake Passage (Torres and Jorquera, 1994). The majority of the litter found on the three beaches was wood (78% by number of items) and plastic (19%) whereas metal, glass and cloth were found more rarely (less than 1%). Several pieces of timber were found, some of them quite large (several meters in length). The plastic items were highly diverse, with bottles, ropes and tape the most numerous items. Floats and glass bottles were also found on the beaches.



Map 1. Byers Peninsula, ASPA No. 126, Livingston Island, South Shetland Islands, location map.
Inset: location of Byers Peninsula on the Antarctic Peninsula



Map 2. ASPA 126: Byers Peninsula topographic map.

Management Plan For
Antarctic Specially Protected Area No. 131
CANADA GLACIER, LAKE FRYXELL, TAYLOR VALLEY, VICTORIA LAND

1. Description of values to be protected

In 1985, an area of approximately 1 km^2 between the east side of Canada Glacier and Lake Fryxell was designated in Recommendation XIII-8 (1985) as SSSI No. 12, following a proposal by New Zealand on the grounds that it contained some of the richest plant growth (bryophytes and algae) in the McMurdo Dry Valleys. The Area is designated primarily to protect the site's scientific and ecological values.

The boundaries of the Area were increased by Measure 3 (1997) to include biologically rich areas that were previously excluded. The Area was redesignated by Decision 1 (2002) as Antarctic Specially Protected Area (ASPA) No. 131. and a revised Management Plan was adopted through Measure 1 (2006).

The Area comprises sloping ice-free ground with summer ponds and small meltwater streams draining from Canada Glacier towards Lake Fryxell. Most of the plant growth occurs in a wet area (referred to as 'the flush') close to the glacier in the central part of the Area. The composition and distribution of the moss, lichen, cyanobacteria, bacteria and algae communities in the Area are correlated closely with the water regime. Thus, hydrology and water quality are important to the values of the site.

The Area has been well-studied and documented, which adds to its scientific value. The vegetation communities, particularly the bryophytes, are vulnerable to disturbance by trampling and sampling. Damaged areas may be slow to recover. Sites damaged at known times in the past have been identified, which are valuable in that they provide one of the few areas in the McMurdo Dry Valleys where the long-term effects of disturbance, and recovery rates, can be measured.

The Area is of regional significance and remains of exceptional scientific value for ecological investigations. Increasing pressure from scientific, logistic and tourist activities in the region coupled with the vulnerability of the Area to disturbance through trampling, sampling, pollution or introduction of non-native species mean the values of the Area continue to require on-going protection.

2. Aims and objectives

Management of Canada Glacier 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 on the ecosystem and elements of the ecosystem while ensuring protection from over-sampling;

- allow other scientific research in the Area provided it is for compelling reasons which cannot be served elsewhere;
- prevent or minimise the introduction to the Area of alien plants, animals and microbes; and
- allow visits for management purposes in support of the aims of the management plan.

3. Management activities

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

- Copies of this Management Plan, including maps of the Area, shall be made available at adjacent operational research stations and all of the research hut facilities located in the Taylor Valley that are within 20 km of the Area.
- Signs illustrating the location and boundaries of the Area, with clear statements of entry restrictions, shall be placed at appropriate locations on the boundary of the Area to help avoid inadvertent entry.
- 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.
- The Area shall be visited as necessary, and no less than once every five years, to assess whether it continues to serve the purposes for which it was designated and to ensure that management activities are adequate.
- National Antarctic Programmes operating in the Area shall consult together with a view to ensuring the above management activities are implemented.

4. Period of designation

Designated for an indefinite period.

5. Maps

Map A: Canada Glacier, Lake Fryxell, Taylor Valley, Regional Topographic Map.
Map specifications: Projection - Lambert conformal conic. Standard parallels - 1st 79° 18' 00" S; 2nd 76° 42' 00"S. Central Meridian - 162° 30' 00" E. Latitude of Origin - 78° 01' 16.2106" S. Spheroid - WGS84.

Map B: Canada Glacier, Lake Fryxell, Taylor Valley, Vegetation Density Map.
Map specifications are the same as those for Map A. Contours are derived from combining orthophotograph and Landsat images. Precise areas of moist ground associated with the flush are subject to variation seasonally and inter-annually.

6. Description of the Area

6(i) Geographical coordinates, boundary markers and natural features
Canada Glacier is situated in the Taylor Valley, in the McMurdo Dry Valleys. The designated Area encompasses most of the glacier forefront area on the east side of the lower Canada Glacier, on the north shore of Lake Fryxell (77° 37' S, 163° 03' E: Map A). It comprises gently to moderately sloping ice-free ground at an elevation of 20 m to 220 m with seasonal melt water ponds and streams draining Canada Glacier into Lake Fryxell.

The southern boundary of the Area is defined as the shoreline of Lake Fryxell, to the water's edge. This boundary extends northeast for approximately 1 km along the shoreline from where Canada Glacier meets Lake Fryxell (77° 37.20` S, 163° 3.64` E) to the southeast corner of the boundary which is marked with a cairn (77° 36.83' S, 163° 4.88' E) adjacent to a small island in Lake Fryxell. The island was once a part of a small peninsula extending into Lake Fryxell but recent lake level rise has turned it into an island (Map B). The peninsula was once marked by a large split rock surrounded by a circle of rocks which was a benchmark for the 1985 NZ survey of the original SSSI, but is no longer visible. A wooden post marking the Dry Valley Drilling Project Site 7 (1973) is still visible on the island.

A moraine ridge extending upslope from the southeast corner of the boundary in a northerly direction defines the eastern boundary of the Area. A cairn (77° 36.68' S, 163° 4.40' E) is located on a knoll on this ridge 450 m from the southeast corner of the boundary. The ridge dips sharply before joining the featureless slope of the main Taylor Valley wall. The northeast boundary corner of the Area is in this dip and is marked by a cairn (77° 36.43' S, 163° 3.73' E).

From the northeast boundary cairn, the northern boundary slopes gently upwards and west for 1.7 km to Canada Glacier, to the point where the stream flows from the glacier and snow field, through a conspicuously narrow gap in the moraine (77° 36.42` S, 162° 59.69` E).

The western boundary follows the glacier edge for about 1 km, down a slope of lateral moraine of fairly even gradient to the southwest corner of the boundary where the glacier meets the lake shore (77° 37.20` S, 163° 3.64` E).

The flush area at Canada Glacier is believed to be the largest high density area of vegetation in the McMurdo Dry Valleys (Map B). The summer water flow, in conjunction with the microtopography, has the greatest influence in determining where mosses, lichens, cyanobacteria, bacteria and algae grow. The glacier face also provides protection from destructive winds which could blow the mosses away in their freeze dry state and from abrasion from wind borne dust.

The flush is located close to the glacier edge. There are two main vegetated areas, separated to the north and south by a small, shallow pond (Map B). The flush area is gently sloping and very moist in summer with areas of wet ground, numerous small ponds and rivulets. The slopes above this area are drier, but vegetation colonises several small stream channels which extend parallel to the glacier from the upper boundary of the Area down to the flush. Undulating moraines assist accumulation of persistent snow patches on this slope, which may also provide moisture for plant growth. Stream channels, and associated vegetation, become less obvious with distance from the glacier (Map B). These slopes and the central flush are drained to the southeast by Canada Stream. Hydrological data collected from this stream

measured the average discharge rate of Canada Stream when it was flowing as 26.41 L/s [min = 0.0 L/s and max = 190.4 L/s] from November 2009 to February 2010. The average water temperature over this time was 3.96 °C [min = -0.1 °C and max = 11.73 °C] (http://www.mcmlter.org/).

Four moss species have been identified from the flush area: *Bryum argenteum* (previously referred to as *Bryum subrotundifolium)* and *Hennediella heimii* (previously referred to as *Pottia heimii)* dominate, with rare occurrences of *Bryum pseudotriquetrum* and *Syntrichia sarconeurum* (formerly known as *Sarconeurum glaciale*). *B. argenteum* occurs mainly in areas of flowing water and seepage. Where water is flowing, a high proportion of this moss has epiphytic *Nostoc* communities associated with it. Towards the edges of the flowing water zones or on higher ground, *Hennediella heimii* dominates. Sporophytes of *Hennediella heimii* are found at this location and may be the most southerly recorded fruiting location for a moss.

Lichen growth in the Area is inconspicuous, but the epilithic lichens, *Carbonea vorticosa, Sarcogyne privigna*, *Lecanora expectans, Rhizoplaca melanophthalma* and *Caloplaca citrina* may be found in a small area near the outflow of the pond near Canada Glacier. Chasmoendolithic lichens also occur in many boulders throughout the flush area.

Over 37 species of freshwater algae and cyanobacteria have been described at the site. The upper part of Canada Stream superficially appears sparse but encrusting communities dominated by cyanobacterium grow on the sides and undersides of stones and boulders. The green alga *Prasiola calophylla* and cyanobacterium *Chamaesiphon subglobosus* have been observed only in this upper part of the stream. *Prasiola calophylla,* growing in dense green ribbons beneath stones in the stream, is generally only apparent when stones are overturned. Cyanobacterial mats, comprising a diverse assemblage of species (including *Oscillatoria, Pseudanabaena, Leptolyngbya, Phormidium, Gloeocapsa, Calothrix* and *Nostoc*) are extensive in the middle and lower reaches of the stream and more diverse than those in the upper stream. Mucilaginous colonies of *Nostoc commune* dominate standing water in the central flush and grow epiphytically on mosses in the wetted margins of water courses, while cyanobacterial mats cover much of the mineral fines and gravels in flowing sections. The filamentous green alga *Binuclearia* is found streaming out in the flow in the middle reaches of the stream. The lower stream is similar in floral composition to the upper, although the algae *Tribonema elegans* and *Binuclearia* have been reported as abundant, but *Prasiola calophylla* is absent. *Tribonema elegans* is rarely encountered in this region of Antarctica.

Invertebrates from six phyla have been described in the Area: the three main groups are Rotifera, Nematoda and Tardigrada, with Protozoa, Platyhelminthes, and Arthropoda also present.

The Canada flush vegetation has been described as profuse but lacking in diversity, when compared to other botanically rich sites in Antarctica. This may be attributable at least in part to the oligotrophic nature of the site. Water flowing through the stream is similar to glacial ice melt, with conductivity in December 2010 of close to 30 μS cm^{-1} from the point where it left the glacier to the delta where it enters the lake. The prevalence of nitrogen fixing cyanobacteria (*Nostoc* and *Calothrix* species) further supports the view of a low nutrient status.

Based on the Environmental Domain Analysis for Antarctica (Resolution 3 (2008)), Canada Glacier is located within Environment S *McMurdo South Victoria Land geologic*.

Evidence of past human activity is noticeable within the Area. Within the flush area, damage to the vegetation including paths and footprints and sites of experimental removal of core samples and larger clumps from moss turfs are visible. A number of old markers are also present in the flush area.

A plastic greenhouse was erected within the Area close to the flush from 1979 to 1983 for research and experimental growth of garden vegetables. The structure was removed at the end of each season. In 1983 it was destroyed by a winter storm. Remains of the greenhouse found in the Area have since been removed.

Near the flush area, the first site of the New Zealand hut at Canada Glacier consisted of paths marked by lines of rocks, areas cleared for use as campsites, an old helicopter pad, and several low rock structures. A series of at least four shallow pits (~1 m in depth) were also dug close to the site. This site was relocated to a second site in 1989 and the first hut site was remediated. The second hut site comprised two small buildings, several new campsites, and a helicopter pad. The buildings were removed completely in the 1995–96 season. However, the helicopter pad remains and is the only helicopter landing site in the Area. This camp site area is still the preferred camping site in the Area (Map B).

A weir is present on Canada Stream (see Section 6(iii)). A path from the Lake Fryxell Camp Facilities Zone is located between the lake shore and the weir on Canada Stream (Map B). Another path exists between the designated camp site and the Canada Glacier edge, crossing a moist area of plant growth, but is not indicated on the map. An access route is also located between Lake Hoare Camp Facilities Zone and Lake Fryxell Camp Facilities Zone running just above the northern boundary (Maps A and B).

6(ii) Special zones within the Area
None.

6(iii) Location of structures within and adjacent to the Area
A rock weir was constructed in the constricted part of Canada Stream in the 1981/1982 season and was fully removed at the end of the season. In 1990 a more substantial weir and 9-inch Parshall flume were installed nearby (Maps B). The flume is made of black fibreglass. The weir consists of polyester sandbags filled with alluvium from near the stream channel. Areas disturbed during construction were restored and after one season were not evident. The upstream side of the weir is lined with vinyl-coated nylon. A notch has been built into the weir for relief in case of high flow. Clearance of seasonal snow from the channel has been necessary to prevent water from backing up at the weir. Data logging instrumentation and batteries are stored in a plywood crate located nearby on the north side of the stream. The weir is maintained by the McMurdo Dry Valleys Long Term Ecological Research project.

Three cairns mark the Area boundaries.

The Lake Fryxell Camp Facilities Zone (USA) is located 1.5 km to the east of the Area (20 m asl) midway along Lake Fryxell on the north side of the lake. The F6 Camp Facilities Zone is located approximately 10 km to the east of the Area on the south side of Lake Fryxell. The Lake Hoare Camp Facilities Zone (USA) is located 3 km to the west of the Area (65 m asl) on the western side of Canada Glacier at the base of the glacier on the north side of Lake

Hoare. The Taylor Valley Visitor Zone is located to the south of the Area at the terminus of Canada Glacier (Map A).

6(iv) Location of other protected areas in the vicinity
The nearest protected areas to Canada Glacier are:

- Linnaeus Terrace, Asgard Range (ASPA No. 138) 47 km west in the Wright Valley; and
- Barwick and Balham Valleys, Southern Victoria Land (ASPA No. 123) 50 km to the northwest (Map A, Inset).

7. Terms and conditions for entry Permits

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 for compelling scientific reasons that cannot be served elsewhere, or for reasons essential to the management of the Area;
- the actions permitted will not jeopardise the ecological or scientific values of the Area;
- access to any zone marked as possessing medium or higher vegetation density (Map B) should be carefully considered and special conditions to access such areas should be attached to the Permit;
- any management activities are in support of the aims of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the Permit, or an authorized copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the Permit; and
- the Permit shall be issued for a stated period.

7(i) Access to and movement within or over the Area
Access to the Area shall be by foot or by helicopter. Vehicles are prohibited within the Area and all movement within the Area should be on foot.

Pedestrians travelling up or down the valley shall not enter the Area without a Permit. Permitted visitors entering the Area are encouraged to keep to established paths where possible. Visitors should avoid walking on visible vegetation or through stream beds. Care should be exercised when walking in areas of moist ground, where foot traffic can easily damage sensitive soils, plant, algal and bacteria communities, and degrade water quality: walk around such areas, on ice or rocky ground, and step on larger stones when stream crossing is unavoidable. Care should also be taken around salt-encrusted vegetation in drier areas, which can be inconspicuous. Pedestrian traffic should be kept to the minimum necessary consistent with the objectives of any permitted activities and every reasonable effort should be made to minimise effects.

Where possible, helicopters should land at existing landing sites in nearby Facilities Zones and the Visitor Zone. Helicopter access to the Area should be approached from south of the line marked on Map B. Helicopters shall land only at the designated landing site (163° 02.88' E, 77° 36.97' S: Map B). Over flight of the Area should generally be avoided. Within the Area overflights less than 100 m Above Ground Level (AGL) north of the line indicated on

Map B are prohibited. Exceptions to these flight restrictions will only be granted for an exceptional scientific or management purpose and must be specifically authorised by Permit. Use of helicopter smoke grenades within the Area is prohibited unless absolutely necessary for safety, and then these should be retrieved. Visitors, pilots, air crew, or passengers en route elsewhere on helicopters, are prohibited from moving on foot beyond the immediate vicinity of the designated landing and camping site unless specifically authorised by a Permit.

7(ii) Activities which may be conducted in the Area

- Scientific research that will not jeopardise the ecosystem of the Area;
- Essential management activities, including monitoring and inspection.

In view of the importance of the water regime to the ecosystem, activities should be conducted so that disturbance to water courses and water quality is minimised. Activities occurring outside of the Area (e.g. on the Canada Glacier) which may have the potential to affect water quantity and quality should be planned and conducted taking possible downstream effects into account. Those conducting activities within the Area should also be mindful of any downstream effects within the Area and on endorheic Lake Fryxell.

7(iii) Installation, modification or removal of structures

No structures are to be erected within the Area, or scientific equipment installed, except for compelling scientific or management reasons as specified in a permit. All markers, structures or scientific equipment installed in the Area must be authorised by a Permit and clearly identified by country, name of the principal investigator, year of installation and date of expected removal. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that 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(iv) Location of field camps

Nearby Facilities Zones outside of the Area should be used as a base for work in the Area (Map A). Camping at the designated campsite (Map B) may be permitted to meet specific essential scientific or management needs.

7(v) 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 and precautions listed in paragraph 7(ix) below shall be taken against accidental introductions. 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 or other chemicals shall not be stored in the Area, unless required for essential purposes connected with the activity for which the Permit has been granted, and must be contained within an emergency cache authorized by an appropriate authority. All materials introduced shall be for a stated period only, be removed at or before the conclusion of that stated period, and be stored and handled so that risk of their introduction into the environment is minimised.

7(vi) Taking or harmful interference with native flora or fauna

Taking of, or harmful interference with, native flora and fauna is prohibited, except in accordance with a separate 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 this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

7(vii) The collection or removal of materials not imported by the Permit holder
Material 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. Similarly, sampling is to be carried out using techniques which minimise disturbance to the Area as well as duplication. Material of human origin likely to compromise the values of the Area, and 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 the impact of removal is likely to be greater than leaving the material in situ the appropriate authority should be notified and approval obtained.

7(viii) Disposal of waste
All wastes, including all human wastes, shall be removed from the Area.

7(ix) Measures that may be necessary to continue to meet the aims and objectives of the Management Plan
Permits may be granted to enter the Area to:

- carry out biological monitoring and Area inspection activities, which may involve the collection of a small number of samples or data for analysis or review;
- erect or maintain signposts, structures or scientific equipment;
- carry out protective measures;

Any specific sites of long-term monitoring shall be appropriately marked on site and on maps of the Area. A GPS position should be obtained for sites of long-term monitoring and scientific sampling for lodgement with the Antarctic Master Directory system through the appropriate national authority. If appropriate, metadata should also be provided for the Antarctic Master Directory system through the appropriate national authority.

To help maintain the ecological and scientific values of the plant communities found at the Area visitors shall take special precautions against introductions. Of particular concern are microbial or vegetation introductions sourced from soils at other Antarctic sites, including stations, or from regions outside Antarctica. To minimise the risk of introductions, visitors shall thoroughly clean footwear and any equipment to be used in the area particularly camping and sampling equipment and markers before entering the Area.

7(x) 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 in Appendix 4 of the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas appended to Resolution 2 (1998)] [available from the website of the Secretariat of the Antarctic Treaty 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. Parties should maintain a record of such activities and report them in the Annual Exchange of Information. Parties should, wherever possible, deposit originals or copies of such 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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