



Deception Island Management Package

Introduction

Deception Island is a unique Antarctic island with important natural, scientific, historic, educational and aesthetic values.

Over the years, different parts of the island have been given legal protection under the Antarctic Treaty following piecemeal proposals, but no coherent strategy had been formulated for protecting the whole island. In 2000, an integrated strategy for the management of activities there was agreed by Argentina, Chile, Norway, Spain and the UK.

This strategy recommended an island-wide approach. Deception Island would be proposed as an Antarctic Specially Managed Area (ASMA) comprising a matrix of Antarctic Specially Protected Areas (ASPAs), Historic Sites and Monuments (HSMs), and further zones in which activities would be subject to a code of conduct.

In March 2001, the Instituto Antártico Chileno hosted a workshop in Santiago to progress the Management Plan for Deception Island. The Deception Island working group was widened to include the USA, as well as the Antarctic and Southern Ocean Coalition (ASOC) and the International Association of Antarctica Tour Operators (IAATO) as advisors to the group.

During February 2002, the Dirección Nacional del Antártico (Argentina) hosted an expedition to the island at Decepción Station. Representatives from the six National Antarctic Programmes, as well as ASOC and IAATO, participated. The overall goal of the expedition was to undertake baseline survey fieldwork to assist with the joint preparation by the six Antarctic Treaty Consultative Parties of a Management Package for Deception Island.

Following further extensive consultation, the first version of the Management Package for Deception Island was produced. Its aim was to conserve and protect the unique environment of Deception Island, whilst managing the variety of competing demands placed upon it, including science, tourism, and the conservation of its natural and historic values. It also aims to safeguard those working on, or visiting, the island. Information Papers submitted to the CEP (XII SATCM/IP8, XXIV ATCM/IP63, XXV ATCM/IP28 and XXVI ATCM/IP48) give further detail of the extensive consultation and site investigations, which have resulted in the production of the Management Package for Deception Island.

The Management Plan was updated in 2012 as a result of Measure 10 (2012). In accordance with Article 6 (3) of Annex V to the Environmental Protocol, a review process for the management plan was initiated in 2017, and on basis of discussions and new information a revised management plan was produced in 2019 and submitted to the CEP/ATCM for consideration and approval.



Management Plan

Antarctic Specially Managed Area No 4 DECEPTION ISLAND, SOUTH SHETLAND ISLANDS, ANTARCTICA

1. Values to be protected and activities to be managed

Deception Island (latitude 62°57'S, longitude 60°38'W), South Shetland Islands, is a unique Antarctic island with important natural, scientific, historic, educational and aesthetic values.

i. Natural value

- Deception Island is one of the most active volcanoes in Antarctica with eruptive activities in historical time. It was responsible for numerous ash layers dispersed across the South Shetland Islands, Bransfield Strait and the Scotia Sea. Ash from the island has even been identified in an ice core sample from the South Pole. The record of the eruptions from the 18th to the 20th centuries reveals periods of great activity with several temporally closely spaced eruptions, followed by decades of dormancy. The most recent eruptions (1967, 1969 and 1970) and episodes of unrest (1992, 1999 and 2014–2015) demonstrate that the volcanic system is still active. The occurrence of a future eruption in Deception Island is likely.
- The Area has an exceptionally important floral assemblage, including at least 18 species which have not been recorded elsewhere in the Antarctic. No other Antarctic area is comparable. Of particular importance are the very small, unique biological communities associated with the island's geothermal areas, and the most extensive known community of the flowering plant Antarctic pearlwort (*Colobanthus quitensis*).
- Nine species of seabird breed on the island, including one of the world's largest colonies of chinstrap penguins (*Pygoscelis antarctica*). The Antarctic Specially Managed Area (ASMA) contains Antarctic Important Bird Areas (IBA) Nos. 055 Baily Head and 056 Vapour Col, following the identification of IBAs across wider Antarctica (see Resolution 5 (2015)). Baily Head qualifies on the basis of the chinstrap penguin colony present, while Vapour Col qualifies on the basis of the concentration of seabirds present and in particular chinstrap penguin (see: <http://www.era.gs/resources/iba/>).
- The benthic habitat of Port Foster is of ecological interest due to the natural perturbations caused by volcanic activity. The warmer conditions of the seafloor, together with the sediment characteristics, make the benthic communities unique within the South Shetland Islands.

ii. Scientific value and activities

- The Area is of outstanding scientific interest, in particular for studies in geoscience and biological science. It offers the rare opportunity to study the effects of environmental change on an ecosystem, and the dynamics of the ecosystem as it recovers from natural disturbance.
- Long term, geothermal, geochemical, geophysical and geodetic data and biological data-sets are being collected at Decepción Station (Argentina) and Gabriel de Castilla Station (Spain)¹.

¹ Spain has been collecting seismological data since the opening of Gabriel de Castilla station in 1989; the data-sets are available in the National Polar Data Center (NPDC) of Spain. Biological data sets have been collected at irregular intervals from 2001 and are also available in the NPDC.



iii. Historic value

- The Area has had a long history of human activity since c.1820, including exploration, sealing, whaling, aviation, scientific research and tourism, and as such has played a significant role in Antarctic affairs.
- At Whalers Bay, the Norwegian Hektor whaling station, the cemetery and other artefacts, some of which pre-date the whaling station, are the most significant whaling remains in the Antarctic. The British 'Base B', which was established in the abandoned whaling station, was the first base of the secret World War II expedition 'Operation Tabarin', the forerunner to the British Antarctic Survey. As such, it was one of the earliest permanent research stations in Antarctica. The whalers' remains and 'Base B' are listed as Historic Site and Monument (HSM) No. 71. Appendix 3 contains the Conservation Strategy for HSM No. 71.
- The remains of the Chilean Presidente Pedro Aguirre Cerda Station at Pendulum Cove are listed as HSM No. 76. Meteorological and volcanological studies were undertaken at the base from 1955 until its destruction by volcanic eruptions in 1967 and 1969.

v. Aesthetic value

- Deception Island's flooded caldera, its 'horse-shoe' shape and linear glaciated eastern coastline, its barren volcanic slopes, steaming beaches and ash-layered glaciers provide a unique Antarctic landscape.

iv. Educational values

- Deception Island is one of the few places in the world where vessels can sail directly into the centre of a restless volcanic caldera, providing the opportunity for visitors to learn about volcanoes and other aspects of the natural world, as well as early Antarctic exploration, whaling and science. Deception Island is also one of the most visited touristic sites in Antarctica.

2. Aims and objectives

The main aim of this Management Package is to conserve and protect the unique and outstanding environment of Deception Island, whilst managing the variety of competing demands placed upon it, including science, tourism, and the conservation of its natural and historic values. It also aims to protect the safety of those working on, or visiting the island taking into account that it is an active volcano.

The objectives of management at Deception Island are to:

- assist in the planning and co-ordination of activities in the Area, encourage co-operation between Antarctic Treaty Parties and other stakeholders, and manage potential or actual conflicts of interest between different activities, including science, logistics and tourism;
- avoid unnecessary degradation, by human disturbance, to the unique natural values of the Area;
- safeguard in particular the scientific and wilderness values of those areas in the Area which thus far have not been significantly modified by human activity (especially the recently created volcanic surfaces);
- minimise the possibility of non-native species being introduced through human activities;
- prevent unnecessary disturbance, destruction or removal of historic buildings, structures and artefacts;
- safeguard and inform those working in or near to, or visiting, the Area from the significant volcanic risk;
- manage visitation to this unique Island, and promote an awareness, through education, of its significance and potential volcanic hazards.

3. Management activities

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

- There will be a Deception Island Management Group involving all interested Parties to:
 - oversee the co-ordination of activities in the Area;
 - facilitate communication between those working in, or visiting, the Area;
 - maintain a record of activities in the Area;
 - disseminate information and educational material on the significance of Deception Island to those visiting, or working there;
 - monitor the site to investigate cumulative impacts derived from science, permanent facilities, tourism/visitor and management activities;
 - oversee the implementation of this Management Plan, and revise it when necessary.
- a general island-wide Code of Conduct for activities in the Area is included in this ASMA Management Plan (see Section 9). Further site-specific Codes of Conduct are included in the Conservation Strategy for Whalers Bay HSM No.71 (Appendix 3), as well as the Code of Conduct for the Facilities Zone (Appendix 4), the Code of Conduct for Visitors (Appendix 5) and Site Visitor Guidelines for Telefon Bay, Whalers Bay, Pendulum Cove and Baily Head. These Codes of Conduct and Site Visitor Guidelines should be used to guide activities in the Area;
- National Antarctic Programmes operating within the Area should ensure that their personnel are briefed on, and are aware of, the requirements of this Management Plan and supporting documentation;



- tour operators visiting the Area should ensure that their staff, crew and passengers are briefed on, and are aware of, the requirements of this Management Plan and supporting documentation;
- signs and markers will be erected where necessary and appropriate to show the boundaries of ASPAs and other zones, such as the location of scientific activities. Signs and markers will be well designed to be informative and obvious, yet unobtrusive. They will also be secured and maintained in good condition, and removed when no longer necessary. Signs and marks will be analysed on a case-by-case basis and re-evaluated periodically;
- the volcanic alert scheme (as at Appendix 6) will be implemented. This alert scheme, together with the emergency evacuation plan, will be kept updated and under continuous review;
- Parties authorizing activities in the South Shetland Island area should ensure that those responsible for the activity are aware of the desirability of avoiding use of Deception Island as an emergency harbour in cases of maritime accidents/incidents due to both the ecological sensitivities and safety issues of the island. Parties should ensure that those responsible for the activity make themselves familiar with alternative emergency harbours in the area and encourage these to be used if the situation at hand deems this possible and appropriate.
- copies of this Management Plan and supporting documentation, in English and Spanish, will be made available at Decepción Station (Argentina), and Gabriel de Castilla Station (Spain). In addition, the Deception Island Management Group should encourage National Antarctic Operators, tour companies and, as far as practicable, private yacht operators visiting the Area, to have available copies of this Management Plan when they visit the Area; and
- visits should be made to the Area as necessary (no less than once every 5 years) by members of the Deception Island Management Group to ensure that the requirements of the Management Plan are being met.

4. Period of designation

Designated for an indefinite period of time.

5. Description of the Area

i. Geographical co-ordinates, boundary markers and natural features

General description

Deception Island (latitude 62°57'S, longitude 60°38'W) is situated in the Bransfield Strait at the southern end of the South Shetland Islands, off the north-west coast of the Antarctic Peninsula (Figures 1 and 2). The boundary of the ASMA is defined as the outer coastline of the island above the low tide water level. It includes the waters and seabed of Port Foster to the north of a line drawn across Neptunes Bellows between Entrance Point and Cathedral Crags (Figure 3). No boundary markers are required for the ASMA, as the coast is clearly defined and visually obvious.

Geology, geomorphology and volcanic activity

Deception Island is an active volcano with a submerged basal diameter of approximately 30 km, rising up to 1.5 km above the sea floor. The volcano has a large flooded caldera giving the island a distinctive horseshoe shape broken only on the south-eastern side by Neptunes Bellows, a narrow shallow passage about 500 m wide.

The caldera-forming eruption occurred possibly less than 10,000 years ago. It consisted of a large scale, violently explosive eruption that rapidly evacuated around 30-60 km³ of magma, leading to the collapse of the volcano summit region and the formation of Port Foster caldera. Associated ashfalls and tsunamis affected the environment of the northern Antarctic Peninsula region.

Volcanic activity in Deception Island after the formation of Port Foster caldera mostly consists of several tens of scattered eruptive vents distributed inside the caldera structure. In general, recent eruptions have been small in volume (e.g. < 0.1 km³ of erupted magma), mostly classified as VEI (Volcanic Explosivity Index) 2 or 3. In Deception Island, even small-volume eruptions can be highly explosive, in the case of shallow submarine vents or those located on waterlogged shorelines or beneath the ice caps.

The volcano was particularly active during the late 18th and 19th centuries, when numerous eruptions occurred. In contrast, 20th century eruptions were restricted to two short periods, around 1906-1910 and 1967-1970. Three processes of significant activity occurred in 1992, 2015 and especially 1999. Together with the record of historical eruptions and the presence of long-lived areas of geothermal activity, allow Deception Island to be classified as a restless caldera with a significant volcanic risk.

Approximately 57% of the island is covered by permanent glaciers, many of which are overlain with volcanic ash. Mounds and low ridges of glacially transported debris (moraines) are present around the margins of the glaciers.

An almost complete ring of hills, rising to 539 m at Mount Pond, encircles the sunken interior of Port Foster, and is the principal drainage divide on the island. Ephemeral springs flow toward the outer and inner coasts. Several lakes are located on the inner divide of the watershed.



Climate

The climate of Deception Island is polar maritime. Mean annual air temperature at sea level is -2.9°C . Extreme temperatures range from 11°C at the warmest to -28°C at the coldest. Precipitation, which falls on more than 50% of summer days, is high for the region, with a mean annual equivalent of rainfall of approximately 500 mm. Prevailing winds are from the north-east and west.

Marine ecology

The marine ecology of Port Foster has been significantly influenced by volcanic activity and sediment deposition. ASPA No. 145, comprising two sub-sites believed to be reservoirs for soft-bottom species, is located in the Area. The Management Plan for ASPA 145, contained in Appendix 2, gives further detail of the marine ecology of Port Foster.

Flora

Deception Island is a unique and exceptionally important botanical site. The flora includes at least 18 species of moss, liverwort and lichen which have not been recorded elsewhere in the Antarctic. Small communities, which include rare species and unique associations of taxa, grow at a number of geothermal areas on the island, some of which have fumaroles. Furthermore, the most extensive known concentration of Antarctic pearlwort (*Colobanthus quitensis*) is located between Baily Head and South East Point.

In many areas, ground surfaces created by the 1967–70 eruptions are being colonized rapidly, probably enhanced by the increasing summer temperatures now occurring in the Antarctic Peninsula as a result of regional climate change.

ASPA No. 140, comprising 11 sub-sites, is located in the Area. The Management Plan for ASPA No. 140 is contained in Appendix 1. This gives further details of the flora of Deception Island.

Invertebrates

Recorded terrestrial and freshwater invertebrates on Deception Island include at least 18 species of Acarina (mite) of which three are non-native, one species of Diptera (fly), three species of Tardigrada (tardigrade), 14 species of Collembola (springtail) of which six are non-native, three freshwater Crustacea (crustacean), 14 Nematoda (nematode), one Gastrotricha (gastrotrich) and five Rotifera (rotifer). Colonies of seabird ticks (*Ixodes uriae*) are frequently found beneath rocks adjacent to penguin rookeries (e.g. at the Vapour Col rookery).

In the heterogeneous intertidal zone of Port Foster, the mean and upper tidal levels of the sedimentary shores are depleted in biodiversity, harboring a low number of invertebrate species, and with only the group of Collembola linking terrestrial and marine habitats along the bay. Ice scouring during the winter period, warm soil temperatures along extensive stretches of shore line (e.g. up to 60°C at the surface) and CO_2 emissions associated with geothermal activity (up to $1000\text{ ppm m}^2\text{ s}^{-1}$), prevent the settlement of groups that conspicuously occupy similar sedimentary shores that are free of ice along the South Shetland Islands and in the Antarctic Peninsula. Biodiversity increases in the low intertidal and saturated zones, where eight species of amphipods, three species of prosobranchs and a yet unidentified assemblage of Enchytraeidae Oligochaeta have been reported to date. The surf zone and shallow water along the beaches behave as an interface between the intertidal zone that has low levels of productivity and the more highly productive sea bed; here, large supplies of organic matter from detached macroalgae decompose, underpinning a diverse and abundant community of herbivore and scavenger Amphipods. Macroalgae are frequently observed in these zones and in the intertidal, either stranded or attached to stones, with more than 90% of the deposits belonging to the Florideophyceae, including *Palmaria decipiens* and *Phaeoephyceae* and *Desmarestia* spp.

The infauna, macrofauna and megafauna at subtidal levels is very rich. The infauna has proven to be much higher than expected, both in species richness and in biomass, with a large contribution of annelid polychaetes. Macroalgae and fauna are quite diverse at the caldera, with highest abundances and levels of species richness associated with boulders and hard substrates. Important communities of suspension and filter-feeders are particularly rich in Whalers Bay and Fildes Point. The presence of vertical walls in these areas allow the growth of large invertebrates, which in turn provide a three-dimensional habitat for smaller invertebrates, generating high diversity and biomass values. These communities are composed of many different species of macroalgae, porifera, bryozoa, and soft corals, which are not found in other parts of the of the caldera further from Neptunes Bellows. As an example, more than 25 species of sponges (some of them still to be identified) have been found there. Some other new species in other phyla have been found and are currently being described.



Birds

Nine species of bird breed within the Area. The most numerous is the chinstrap penguin (*Pygoscelis antarctica*), with an estimated total population of around 70,000 breeding pairs on the island. The largest rookery is at Baily Head, with the latest estimates indicating 50,000 breeding pairs². In the last 20 years the chinstrap penguin population has declined in the Area, probably due to the effects of climate change on krill abundance, upon which the penguins feed. The most recent studies indicate a 50% decline in breeding pairs at Baily Head since the 1986/87 season census³.

Although Macaroni penguins (*Eudyptes chrysolophus*) have been observed occasionally nesting in small numbers on the island, no breeding birds have been observed over the last two decades. Brown skuas (*Catharacta antarctica lonnbergi*), south polar skuas (*Catharacta maccormicki*), kelp gulls (*Larus dominicanus*), cape petrels (*Daption capensis*), Wilson's storm-petrels (*Oceanites oceanicus*), Antarctic terns (*Sterna vittata*), Antarctic cormorant (*Phalacrocorax bransfieldensis*) and snowy sheathbills (*Chionis alba*) also breed within the Area.

Mammals

Deception Island has no breeding mammals. Antarctic fur seals (*Arctocephalus gazella*), Weddell seals (*Leptonychotes weddelli*), crabeater seals (*Lobodon carcinophagus*), southern elephant seals (*Mirounga leonina*) and leopard seals (*Hydrurga leptonyx*) haul out on the beaches of the inner and outer coast. At rare intervals whales – mostly humpback whales (*Megaptera novaeangliae*) – can be observed in Port Foster. Humpback whales are also routinely seen feeding in the island's coastal waters from late December onwards. A high number of Antarctic fur seals (around 500) normally can be observed on the beach located between Entrance Point and Collins Point.

ii. Structures within the Area

Decepción Station (Argentina) (latitude 62°58'20" S; longitude 060°41'40" W) is situated on the southern shore of Fumarole Bay. Gabriel de Castilla Station (Spain) (latitude 62°58' 40"S, longitude 060°40' 30"W) is located approximately 1 km to the south-east. Further details on both stations are contained in the Facilities Zone Code of Conduct (Appendix 4).

The remains of Hektor Whaling Station (Norway) and other remains that pre-date the whaling station, the Whalers Cemetery and the former British 'Base B', which together form Historic Site and Monument (HSM) No. 71, are located at Whalers Bay (see Appendix 3). A number of steam boilers from the whaling station can be found washed up on the southwest coast of Port Foster. The remains of the Chilean Presidente Pedro Aguirre Cerda Station (HSM No. 76) is located at Pendulum Cove. A derelict wooden refuge hut is located approximately 1 km to the south-west of HSM No.76.

A light beacon, maintained by the Chilean Navy, is located on Collins Point. A collapsed light tower, dating from the whaling era, is below it. The remains of a further light tower dating from the whaling era is located at South East Point.

The stern of the *Southern Hunter*, a whale-catcher belonging to the Christian Salvesen Company, which foundered on Ravn Rock, Neptunes Bellow's in 1956, remains on the unnamed beach to the west of Entrance Point.

A number of beacons and cairns marking sites used for topographical survey are present within the Area.

A volcanic surveillance network (seismic, geodetic, geothermal and oceanographic equipment) is deployed along Deception Island every Austral summer to record the volcanic activity of the Island. The network has permanent and seasonal instruments which is updated every season (for more information, please contact Spain⁴).

6. Protected areas and managed zones within the Area

Figure 3 shows the location of the following ASPAs, HSMs, Facility Zone and other sites with special management provisions within the Area.

- ASPA No. 140, comprising 11 terrestrial sites, including a Prohibited Zone at Site J Perchuć Cone;
- ASPA No. 145, comprising two marine sites within Port Foster;
- HSM No. 71, the remains of Hektor Whaling Station and other remains which pre-date the whaling station, the Whalers Cemetery and 'Base B'; Whalers Bay;
- HSM No. 76, the remains of Pedro Aguirre Cerda Station, Pendulum Cove;
- A Facilities Zone, located on the west side of Port Foster, which includes Decepción Station and Gabriel de Castilla Station;
- Four sites for which Site Visitor Guidelines have been adopted: Pendulum Cove, Baily Head, Whalers Bay and Telefon Bay.

² Estimates are based on surveys conducted by US in the 2011/12 season.

³ Naveen, R., H. J. Lynch, S. Forrest, T. Mueller, and M. Polito. 2012. First direct, site-wide penguin survey at Deception Island, Antarctica suggests significant declines in breeding chinstrap penguins. In review at Polar Biology. Barbosa, A., Benzal, J., De Leon, A., Moreno, J. (2012) Population decline of chinstrap penguins (*Pygoscelis antarctica*) on Deception Island, South Shetlands, Antarctica. Polar Biology 35: 1453-1457.

⁴ Please e-mail cpe@ciencia.gob.es



7. Maps

Map 1: The location of Deception Island ASMA No. 4 in relation to the Antarctic Peninsula.

Map 2: Deception Island - topography

Map 3: Deception Island Antarctic Specially Managed Area No 4

8. Supporting Documents

This Management Plan includes the following supporting documents as appendices:

- Management Plan for Antarctic Specially Protected Area No. 140 (Appendix 1)
- Management Plan for Antarctic Specially Protected Area No. 145 (Appendix 2)
- Conservation Strategy for HSM No. 71, Whalers Bay (Appendix 3)
- Code of Conduct for Facilities Zone (Appendix 4)
- Code of Conduct for visitors at Deception Island (Appendix 5)
- Alert Scheme and Escape Strategy for volcanic eruptions on Deception Island (Appendix 6)
- Site Visitor Guidelines: Telefon Bay (Appendix 7)
- Site Visitor Guidelines: Whalers Bay (Appendix 8)
- Site Visitor Guidelines: Baily Head (Appendix 9)
- Site Visitor Guidelines: Pendulum Cove (Appendix 10)

Those appendices containing management plans for ASPAs or Site Visitor Guidelines will be maintained and updated with the latest versions of these documents as they have been adopted by the ATCM.

9. General Code of Conduct

i. Volcanic risk

All activities undertaken within the Area should be planned and conducted taking into account the significant risk to human life and infrastructures posed by the threat of potential volcanic eruption (see Appendix 6).

ii. Access to and movement within the Area

Access to the Area is generally by ship or yacht, with landings usually taking place by small boat, or less frequently by helicopter.

Vessels arriving in or departing from Port Foster must announce over VHF Marine Channel 16 the intended time and direction of passage through Neptunes Bellows.

Ships may transit ASPA 145, but anchoring within either of the two sub-sites should be avoided except in extreme emergencies.

There are no restrictions on landings on any beaches outside the protected areas covered in Section 6, although recommended landing sites (including for the landing of tourists) are shown in Figure 3. Boat landings should avoid disturbing birds and seals. Extreme caution should be exercised when attempting landings on the outer coast owing to the significant swell and submerged rocks.

Recommended landing sites for helicopters are shown in Figure 3. Helicopters should avoid overflying areas with high concentrations of birds (i.e. penguin rookeries or other seabird breeding colonies). Aircraft operations over the Area should be carried out, as a minimum requirement, in compliance with ATCM Resolution 4 (2004), "Guidelines for the Operation of Aircraft near Concentrations of birds in Antarctica".

Movement within the area should generally be on foot. All-Terrain Vehicles may also be used with care exclusively for scientific support or logistical purposes along the beaches outside of ASPA 140. All movement should be undertaken carefully to minimise disturbance to animals, soil and vegetated areas, and not damage or dislodge flora.



iii. Activities that are or may be conducted within the Area, including restrictions on time or place

- Scientific research, or the logistical support of scientific research, which will not jeopardise the values of the Area;
- Management activities, including the restoration of historic buildings, clean-up of abandoned work-sites, and monitoring the implementation of this Management Plan;
- Tourist or private expedition visits consistent with the Codes of Conduct for Visitors (Appendix 5) and the provisions of this Management Plan;

Due to the presence of the most extensive known concentration of Antarctic pearlwort *Colobanthus quitensis* the walk between Baily Head and Whalers Bay should not be undertaken, unless absolutely necessary for the conduct of scientific activity.

Overwintering at Deception Island (unless for scientific purposes) is discouraged due to the unique circumstances regarding safety (including during rescue operations) with respect to any potential volcanic activity on the island and lack of year-round volcanic surveillance.

Further restrictions apply to activities within ASPA 140 and ASPA 145 (see Appendices 1 and 2).

iv. Installation, modification or removal of structures

Site selection, installation, modification or removal of temporary refuges, hides, or tents should be undertaken in a manner that does not compromise the values of the Area and follows the general safety recommendations.

Scientific equipment installed in the Area should be clearly identified by country, name of principal investigator, contact details, and date of installation. All such items should be made of materials that pose minimal risk of contamination to the area. All equipment and associated materials should be removed when no longer in use.

v. Location of field camps for scientific activities

Field camps should be located on non-vegetated sites, such as on barren ash plains, slopes or beaches, or on thick snow or ice cover when practicable, and should also avoid concentrations of mammals or breeding birds. Field camps should also avoid areas of geothermally heated ground or fumaroles. Similarly, campsites should avoid dry lake or stream beds. Previously occupied campsites should be re-used where appropriate. Due to the biological diversity of the island camping for purposes other than for scientific activity is not permitted.

The SCAR's Environmental Code of Conduct for Terrestrial Scientific Field Research in Antarctica should be used as guidance when establishing field camps (see Resolution 5 (2018); available at: <https://www.scar.org/policy/scar-codes-of-conduct/>).

Figure 3 shows the recommended sites for field camps within the Area.

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* (1998). Where taking or harmful interference with animals for scientific purposes is involved, the *SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica* should be used as a minimum standard (available at: <https://www.scar.org/policy/scar-codes-of-conduct/>).

vii. Collection or removal of anything not brought into the Area

Material should only be removed from the area for scientific, management, conservation or archaeological purposes, and should be limited to the minimum necessary to fulfil those needs.

If objects likely to stem from one of the Historic Sites and Monuments in the Area are found in other areas of the island they should be secured by the best means possible. A report describing the nature of the material and the location within the Historic Site and Monument where it has been secured and stored, should be submitted to the Chair of the Deception Island Management Group, to establish the most appropriate way to deal with the debris (i.e. conservation to preserve any historic value or appropriate disposal).

viii. Restrictions on materials and organisms which may be brought into the Area

A combination of high visitation, relatively mild climatic conditions and the presence of geothermally heated soils makes Deception Island one of the most vulnerable locations within Antarctic to non-native species introductions and establishment. Monitoring studies suggest that the island is the most highly invaded location in Antarctica, with at least nine non-native terrestrial invertebrates present. There has been success in the eradication of non-native plants, but the large number and wide distribution of non-native invertebrates present a significant problem that has yet to be resolved. Port Foster has been subject to ship visits for almost two centuries; however, the number of marine non-native species present within Port Foster is not known.

The introduction of non-native species is prohibited, except by Permit issued in accordance with Annex II to the *Protocol on Environmental Protection to the Antarctic Treaty*. To minimise the risk of accidental or unintentional introduction of non-native species the revised CEP Non-native species manual attached to ATCM Resolution 4 (2016) should be consulted (also available at: https://www.ats.aq/documents/ATCM40/att/atcm40_att056_e.pdf).

For more information on the non-native species found within Deception Island please see Hughes et al, (2015).



viii. The disposal of waste

All wastes other than human wastes and domestic liquid waste shall be removed from the Area. Human and domestic liquid wastes from stations or field camps may be disposed of into Port Foster or other coastal sites below the low water mark, and not within the boundaries of ASPA No. 145. Freshwater streams or lakes, or vegetated areas, shall not be used to dispose of human wastes.

ix. Requirement for reports

Reports of activities within the Area, which are not already covered under existing reporting requirements, or activities clearly in breach of the requirements of this plan should be made available to the Chair of the Deception Island Management Group⁵.

10. Advance exchange of information

All National Antarctic Programmes should, as far as practicable, notify the Chair of the Deception Island Management Group of the location, expected duration, and any special considerations related to the deployment of field parties, scientific instrumentation or botanical quadrats at the four sites commonly visited by tourists (Whalers Bay, Pendulum Cove, Baily Head or the eastern end of Telefon Bay). This information will be relayed to IAATO (and as far as practicable to non-IAATO members).

11. References

- Angulo-Preckler C; Tuya F; Avila C., 2016. Abundance and size patterns of echinoderms in coastal soft-bottoms at Deception Island (South Shetland Islands, Antarctica). *Continental Shelf Research* 137 : 131-141
- Angulo-Preckler C.; Leiva C.; Avila C.; Taboada S., 2017. Macroinvertebrate communities from the shallow soft-bottoms of Deception Island (Southern Ocean): a paradise for opportunists. *Marine Environmental Research* 127 :62– 74
- Baker, P.E., 1969. Investigations of the 1967 and 1969 volcanic eruptions on Deception Island, South Shetland Islands. *Polar Record* 14: 823–827. doi:10.1017/S003224740006544X
- Baker, P.E., Davies, T.G., Roobol, M.J., 1969. Volcanic activity at Deception Island in 1967 and 1969. *Nature* 224: 553–560. doi:10.1038/224553a0
- Baker, P.E., McReath, I., Harvey, M.R., Roobol, M.J., Davies, T.G., 1975. The geology of the south Shetland islands: Volcanic evolution of Deception island. *British Antarctic Survey Scientific Reports* 78: 81 pp.
- Bartolini, S., Geyer, A., Martí, J., Pedrazzi, D., Aguirre-Díaz, G., 2014. Volcanic hazard on Deception Island (South Shetland Islands, Antarctica). *Journal of Volcanology and Geothermal Research* 285: 150-168. doi: 10.1016/j.jvolgeores.2014.08.009.
- Birkenmajer, K., 1992. Volcanic succession at Deception Island, West Antarctica: a revised lithostratigraphic standard. *Studia Geologica Polonica* 101: 27–82.
- Figuerola, B.; Monleón-Getino, T.; Ballesteros, M.; Avila, C. 2012. Spatial patterns and diversity of bryozoan communities from the Southern Ocean: South Shetland Islands, Bouvet Island and Eastern Weddell Sea. *Systematics and Biodiversity* 10 (1): 109–123.
- Glover, A.G.; Wiklund, H.; Taboada, S.; Avila, C.; Cristobo, J.; Smith, C.R.; Kemp, K.M.; Jamieson, A.; Dahlgren, T.G., 2013. Bone-eating worms from the Antarctic: the contrasting fate of whale and wood remains on the Southern Ocean seafloor. *Proceedings of the Royal Society B: Biological Sciences* 280 (1768): 1–10
- Hawkes, D.D., 1961. The geology of the South Shetland Islands: II. The geology and petrology of Deception Island. *Falkland Islands Dependencies Survey Scientific Reports* 27: 43.
- Hughes, K.A.; Pertierra, L.R.; Molina-Montenegro, M.; Convey, P., 2015. Biological invasions in Antarctica: what is the current status and can we respond? *Biodiversity and Conservation* 24: 1031-1055. Available at: <https://link.springer.com/article/10.1007/s10531-015-0896-6>
- Ibáñez, J.M., Almendros, J., Carmona, E., Martí, amp, x, nez-Arévalo, C., Abril, M., 2003. The recent seismo-volcanic activity at Deception Island volcano. *Deep Sea Research Part II: Topical Studies in Oceanography* 50: 1611-1629. doi: 10.1016/S0967-0645(03)00082-1
- Martí, J., Baraldo, A., 1990. Pre-caldera pyroclastic deposits of Deception Island (South Shetland Islands). *Antarctic Science* 2: 345–352. doi: 10.1017/S0954102090000475
- Martí, J., Vila, J., Rey, J., 1996. Deception island (Bransfield Strait, Antarctica): An example of a volcanic caldera developed by extensional tectonics. In: McGuire, W.J., Jones, A.P., Neuberg, J. (Eds.), *Volcano instability on the Earth and other planets*. The geological society, Oxford: pp. 253–266.
- Martí, J., Geyer, A., Aguirre-Díaz, G., 2013. Origin and evolution of the Deception Island caldera (South Shetland Islands, Antarctica). *Bulletin of Volcanology* 75: 1–18. doi: 10.1007/s00445-013-0732-3
- Moles, J.; Avila, C.; Kim, I.H., 2015. *Anthessius antarcticus* n. sp. (Copepoda: Poecilostomatoida: Anthessiidae) from Antarctic waters living in association with *Charcotia granulosa* (Mollusca: Nudibranchia: Charcotiidae). *Journal of Crustacean Biology* 35(1): 97 –104

⁵ Contact details for the Chair of the Deception Island Management Group can be found on the <http://www.deceptionisland.aq/>



- Moles, J.; Figuerola, B.; Campanyà-Llovet, N.; Monleón-Getino, T.; Taboada, S.; Avila, C. 2015. Distribution patterns in Antarctic and Subantarctic echinoderms. *Polar Biology* 38(6): 799- 813.
- Orheim, O., 1972. A 200-year record of glacier mass balance at Deception Island, southwest Atlantic Ocean, and its bearing on models of global climate change. Institute of Polar Studies, Ohio State University, p. 118.
- Pedrazzi, D., Aguirre-Díaz, G., Bartolini, S., Martí, J., Geyer, A., 2014. The 1970 eruption on Deception Island (Antarctica): eruptive dynamics and implications for volcanic hazards. *Journal of the Geological Society* 171: 765-778. doi: 765-778. 10.1144/jgs2014-015.
- Roobol, M.J., 1980. A model for the eruptive mechanism of Deception Island from 1820 to 1970. *British Antarctic Survey Bulletin* 49: 137-156.
- Roobol, M.J., 1982. The volcanic hazard at Deception Island, South Shetland Islands. *British Antarctic Survey Bulletin* 51: 237-245.
- Taboada, S.; Riesgo, A.; Bas, M.; Arnedo, M. A.; Cristobo, J.; Rouse, G. W.; Avila, C., 2015. Bone-eating worms spread: insights into shallow-water Osedax (Annelida, Siboglinidae) from Antarctic, Subantarctic, and Mediterranean waters. *PLoS One* 10(11): e0140341
- Smellie, J.L., 1988. Recent observations on the volcanic history of Deception Island, South Shetland Islands. *British Antarctic Survey Bulletin* 81: 83-85.
- Smellie, J.L., 1989. Deception Island. In: Dalziel I, W.D. (Ed.), *Tectonics of the Scotia arc, Antarctica*. 28th International Geological Congress, Field Trip Guidebook T180. American Geophysical Union, Washington DC: pp. 146-153.
- Smellie, J.L., 2001. Lithostratigraphy and volcanic evolution of Deception Island, South Shetland Islands. *Antarctic Science* 13: 188-209. doi: 10.1017/S0954102001000281
- Smellie, J.L., 2002. The 1969 subglacial eruption on Deception Island (Antarctica): events and processes during an eruption beneath a thin glacier and implications for volcanic hazards. In: Smellie, J.L., Chapman, M.G. (Eds.), *Volcano-Ice Interactions on Earth and Mars*. Geological Society of London, London: pp. 59-79.
- Smellie, J.L.; López-Martínez, J.; Headland, R.K.; Hernández-Cifuentes, F.; Maestro, A.; Rey, J.; Serrano, E.; Somoza, L.; Thomson, J.W., 2002. Geology and geomorphology of Deception Island. *Br. Antarct. Surv.*, Natural Environmental Research Council, Cambridge.
- Taboada, S.; Doner, S.; Blake, J.A.; Avila, C., 2012. A new species of *Cirratulus* (Annelida: Polychaeta) described from a shallow-water whale bone in Antarctica. *Zootaxa* 3340: 59-68.
- Taboada, S.; Junoy, J.; Andrade, S.; Giribet, G.; Cristobo, J.; Avila, C., 2013. On the identity of two Antarctic brooding nemertean: redescription of *Antarctonemertes valida* (Bürger, 1893) and description of a new species in the genus *Antarctonemertes* Friedrich, 1955 (Nemertea, Hoplonemertea). *Polar Biology* 36: 1415-1430.
- Taboada, S.; Wiklund, H.; Glover, A.G.; Dahlgren, T.G.; Cristobo, J.; Avila, C., 2013. Two new Antarctic *Ophryotrocha* (Annelida: Dorvilleidae) described from shallow-water whale bones. *Polar Biology* 36: 1031-1045
- Taboada, S.; Bas, M.; Avila, C. 2014. A new *Parougia* (Annelida, Dorvilleidae) associated to eutrophic marine habitats in Antarctica. *Polar Biology* 38: 517-527
- Vila, M.; Costa, G.; Angulo-Preckler, C.; Sarda, R.; Avila, C. 2016. Contrasting views on Antarctic tourism, 'last chance tourism' or 'ambassadorship' in the last of the wild. *Journal of Cleaner Production* 111 (B): 451-460.

Appendix 1: ASPA 140

Currently valid plan is available at https://documents.ats.aq/recatt/Att615_e.pdf.

Appendix 2: ASPA 145

Currently valid plan is available at http://www.ats.aq/documents/recatt/Att284_e.pdf.



Appendix 3: Whalers Bay Conservation Strategy

Conservation Strategy for Historic Site and Monument No. 71 WHALERS BAY, DECEPTION ISLAND

1. Introduction

1.1 General background

Historic Site and Monument No 71, Whalers Bay (latitude 62° 59'S, longitude 60° 34'W), is located on Deception Island, South Shetland Islands, Antarctica.

The buildings, structures and other artefacts on the shore of Whalers Bay, which date from the period 1906–1931, represent the most significant whaling remains in the Antarctic. Other buildings, structures and artefacts of the British 'Base B' represent an important aspect of the scientific history of the area (1944–1969).

The remains of the Norwegian Hector whaling station at Whalers Bay were originally listed as Historic Site and Monument No. 71 in ATCM Measure 4 (1995) based on a proposal by Chile and Norway. The extent of the historic site was expanded in 2003 by means of ATCM Measure 3 (2003) (see Section 3).

1.2 Brief historical background (1906–1969)

During the 1906–07 austral summer, the Norwegian Captain Adolfus Andresen, founder of the *Sociedad Ballenera de Magallanes*, Chile, began whaling at Deception Island. Whalers Bay served as a sheltered anchorage for factory ships that processed whale blubber. In 1908 a cemetery was established here. The cemetery was partly buried and partly swept away during a volcanic eruption in 1969, at which time it comprised 35 graves and a memorial to ten men who were lost at sea (only one body was recovered). In 1912, a Norwegian company, *Aktieselskabet Hektor*, established the shore-based whaling station in Whalers Bay. Hektor whaling station operated until 1931.

During the 1943–44 austral summer, the UK established a permanent base (Base B) in part of the abandoned whaling station. Base B was operated as a British scientific station, latterly by the British Antarctic Survey, until 1969, when it was severely damaged by a mud and ash flow caused by a volcanic eruption, and was abandoned.

Attachment A contains further detail on the history of Whalers Bay, including a bibliography.



1.3 Aim and objectives of the conservation strategy

The overall aim of the conservation strategy is to protect the values of Whalers Bay Historic Site. The objectives are to:

- **Maintain and preserve the cultural heritage and the historic values of the site within the constraints of natural processes.** Minor restoration and conservation work will be considered, whilst it is recognised that natural processes will continue to cause the deterioration of buildings, structures and other artefacts over time.
- **Prevent unnecessary human disturbance to the site, its features and artifacts.** Every effort shall be made to ensure that human activity at the site does not diminish its historic values. Any damage, removal or destruction of buildings or structures is prohibited in accordance with Article 8 (4) of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty.
- **Permit ongoing clean up of debris.** Large quantities of waste are present in and around the buildings at Whalers Bay. Wind-scattered debris is present throughout the site. There is also hazardous waste present, including diesel fuel and asbestos. A major clean up of loose debris and waste, identified by conservation and environmental experts as not forming an important part of the historic remains, was undertaken in April 2004. Furthermore, a program of ongoing clean-up of debris resulting from the gradual deterioration of the structures, will be instigated. Any removal of debris must only be undertaken under the advice of a professional heritage expert, and proper documentation must be secured before such debris is removed.
- **Educate visitors to understand, respect and care for the historic values of the site.** Whalers Bay Historic Site is one of the most visited sites in Antarctica. Information on the historic significance of the site, and the need to conserve its values, will be made available to visitors.
- **Protect the natural and cultural environment of the site.** Whalers Bay is an integral part of the unique environment of Deception Island. Activities at the site should be undertaken in such a way that minimizes any impact on the natural and cultural environment.

2. Parties undertaking management

Chile, Norway and the UK shall consult within the wider Deception Island Management Group to ensure that the provisions of this conservation strategy are implemented and its aim is met.

3. Description of the site

The site comprises all pre-1970 remains on the shore of Whalers Bay, including those from the early whaling period (1906-12) initiated by Captain Adolfus Andresen of the *Sociedad Ballenera de Magallanes*, Chile; the remains of the Norwegian Hektor Whaling Station established in 1912 and all artefacts associated with its operation until 1931; the site of a cemetery with 35 burials and a memorial to ten men lost at sea; and the remains from the period of British scientific and mapping activity (1944-1969). The site also acknowledges and commemorates the historic value of other events that occurred there, from which nothing remains.

3.1 Site boundary

Figure 1 shows the boundary of the Whalers Bay Historic Site. It comprises most of the beach at Whalers Bay from Neptunes Window to the former BAS aircraft hangar. Boundary markers, which would detract from the aesthetic value of the site, have not been erected. Figure 1 also shows the major historic buildings and structures at the site.



3.2 Historic remains

Table 1 summarises the main buildings, facilities and other structures at the site. More detailed information about these historic structures is provided in Attachment B and their location is shown on Figure 1.

Table 1: Historic remains at the Whalers Bay Historic Site

# ⁶	Structure	Map ⁷
Whaling period		
WB1	Various remains from the whaling period at Deception Island (1906-1931), including: Water boats and rowing boats Wells and well head houses Storage building Wooden and metal barrels Rampart dams	14
WB2	Cemetery (1 cross and 1 empty coffin currently visible). NB The pile of stones in front of the original cross does NOT indicate a grave, but is a new addition by visitors. One memorial cross has been moved to the site.	Cross
WB3	Magistrate's residence	3
WB4	Hospital/storage building	2
WB5	Boilers	7
WB6	Cookers and associated equipment, including: cooking grills driving wheel steam winch	7
WB7	Foundation of kitchen/mess building (subsequently reused as the foundations for Priestley House) and piggery	4
WB8	Fuel storage tanks	10, 11
WB9	Half floating dock	12
WB10	Whalers Barracks (subsequently renamed Biscoe House)	5
Scientific period		
WB11	'Hunting Lodge' (UK company Hunting Aerosurveys)	9
WB12	Aircraft hangar ⁸	1
WB13	Massey Ferguson tractor	6

3.3 Natural environment

The 1967 volcanic eruption on Deception Island resulted in the deposition of a 1-5 cm layer of ash over Whalers Bay, whilst the 1969 eruption caused a lahar (mud slide) which partly buried the site. Fragile fluvial terraces are located to the north of the whaling station which were of geological importance, although have now been naturally eroded by meltwater streams.

The immediate area to the west of the Historic Site, including Kroner Lake, the Ronald Hill crater plain and the valley connecting them, is designated as part of ASPA 140 due to its exceptional botanical and limnological importance.

Further areas of botanical importance are located within the Historic Site. These include a geothermally active scoria outcrop to the east of the whaling station, around the 'Hunting Lodge', inside the two accessible whale oil tanks, around the site of the cemetery, and on the cliffs and massive boulders at Cathedral Crags and Neptunes Window. Elsewhere, timber and iron structures, bricks and mortar, are colonised by various crustose lichens, all of which are common on natural substrata on the island.

Kelp gulls (*Larus dominicanus*), Wilson's storm-petrel (*Oceanites oceanicus*) and Antarctic Terns (*Sterna vittata*) breed at Whalers Bay, and Cape petrels (*Daption capensis*) nest in Cathedral Crags, overlooking the site.

⁶ Reference number is cross-referenced with the information in Attachment B.

⁷ Reference to map location (Figure 1)

⁸ A de Havilland DHC-3 Single Otter was removed from the site in April 2004 by BAS for restoration.



4. Management of the site

4.1 Access to, and movement within, the site

All visits at the site should adhere to the adopted visitor site guidelines for Whalers Bay⁹. In addition the following should be used as guidance with respect to access to, and movement within the site:

- Motorized vehicles are only to be used within the HSM for scientific, conservation or clean-up activities (e.g. removal of waste).
- Helicopter landings, where necessary for conservation or management purposes, should only take place in the designated landing site (shown in Figure 1) to avoid dangers associated with loose debris and to prevent damaging structures or causing disturbance to wildlife.
- Field camps for scientific or management purposes should be established in the area to the east of the half floating dock as indicated in the map provided in Attachment B. The use of buildings for camping purposes is prohibited except in an emergency.

4.2 Installation, modification and removal of structures

- In accordance with Article 8 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (1998), the historic structures, facilities and artefacts at the site are not to be damaged, removed or destroyed. Graffiti considered to be of historic importance should not be removed. New graffiti should not be added.
- Conservation and/or restoration work agreed by the Parties undertaking management may be carried out. Work on the buildings and structures may be necessary to render them safe or to prevent damage to the environment.
- No new buildings or other structures (apart from interpretative material agreed by Chile, Norway and the UK, in consultation with the wider Deception Island Management Group) are to be erected at the site.
- Historic remains and artefacts found at other locations on Deception Island, or elsewhere, which originate from Whalers Bay may be returned to the site after due consideration by those Parties undertaking management.

4.3 Visitor guidelines

The Visitor Site Guidelines for Whalers Bay (adopted by ATCM) applies to all visitors, including visits by commercial tour operators (IAATO and non-IAATO affiliated), private expeditions and National Antarctic Programme staff when undertaking recreational visits¹⁰.

4.4 Information

- Information should be provided to visitors prior to landing at the site. A heritage video is available.
- Signs around the site will be assessed for removal.
- Memorial plaques (e.g. listing the names of those buried in the cemetery, or commemorating Captain Adolfus Andresen) may also be located within the site.
- Boundary markers are not considered necessary, as they would detract from the aesthetic value of the site. The boundary generally follows clearly visible natural features.
- The Parties undertaking management will disseminate further information about the significance of the historic site and the need to conserve its values.

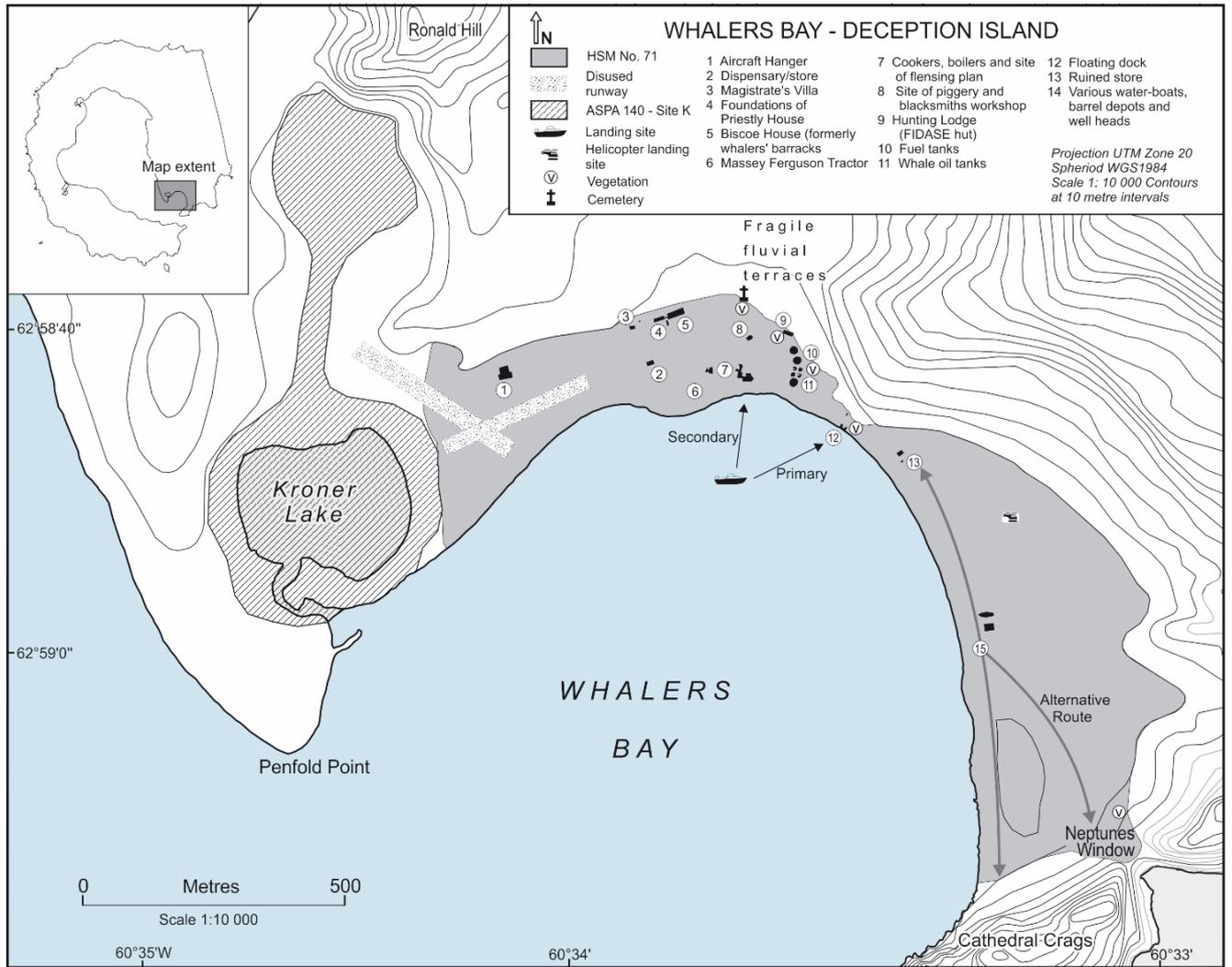
4.5 Reporting and Recording

The following records are to be maintained by the Parties undertaking management:

- number of tourists landing at the site;
- number of scientists and associated logistics personnel visiting the site for scientific and non-scientific purposes;
- conservation and clean-up work carried out; and
- site inspection reports, including reports and photographs on the condition of the historic remains.



Map 1





Appendix 4: Facilities Zone Code of Conduct

Code of Conduct for the Deception Island ASMA 4 Facilities Zone, including Decepción Station (Argentina) and Gabriel de Castilla Station (Spain)

1. Introduction

The Deception Island ASMA includes a Facilities Zone (Figure 1) within which is located 'Decepción' Station (Argentina, Figure 2) and 'Gabriel de Castilla' Station (Spain, Figure 3). Figure 1 shows the extent of the Facilities Zone, which includes the two stations, the surrounding beach area, and a small unnamed lake, to the west of Crater Lake from which freshwater is extracted. Activities within this zone are to be undertaken in line with this Code of Conduct, the aims of which are to:

- encourage the pursuit of scientific investigation on Deception Island, including the establishment and maintenance of appropriate supporting infrastructure;
- preserve the natural, scientific and cultural values of the Facilities Zone;
- safeguard the health and safety of station personnel.
- Develop all activities following the Madrid Protocol

This Code of Conduct summarises existing station procedures, a copy of which is available at Decepción and Gabriel de Castilla stations.

Staff and visitors will be made aware of the contents of this Code of Conduct during pre-deployment training programmes and briefing sessions on board ship prior to arrival at the station.

A copy of the complete Deception Island ASMA Management Package will be kept at Decepción Station and Gabriel de Castilla Station, where relevant maps and information posters about the ASMA will also be displayed.

2. Buildings and services

2.1 Buildings

- In addition to the general EIA requirements, in relation to the facilities, an EIA must be undertaken for the quarrying of rock to maintain existing buildings, in line with Annex I to the Environmental Protocol, as well as with the prior approval of the national authorities of Argentina (Decepción Station) or Spain (Gabriel de Castilla Station).
- Consideration will be given to reusing existing sites when practicable, in order to minimise disturbance.
- Buildings are to be maintained in good condition. Buildings not currently in use are to be routinely checked, and assessed for likely removal.
- Work-sites are to be kept as neat as possible.

2.2 Power Generation

- Maintain generators in good condition, and undertake routine inspections, so as to minimise emissions and possible fuel leaks.
- Ensure economy in power consumption and hence fuel usage and emissions.
- The use of renewable energy sources will be encouraged, where appropriate.



2.3 Water Supply

- Handling or disposing of wastes, fuel or other chemicals within the stations' water catchment area is prohibited.
- Use of vehicles within the water catchment area will only be for essential purposes.
- Ensure that regular tests of water quality, as well as routine cleaning of water holding tanks, are conducted.
- Regulate water consumption, so as to avoid unnecessary extraction.

3. Fuel handling

- The integrity of bulk fuel storage facilities, supply lines, pumps, reels and other fuel handling equipment will be regularly inspected.
- At both stations, fuel storage includes secondary containment. Drummed fuel should be stored inside. Storage areas should, as far as practicable, be properly ventilated, and sited away from electrical services. Storage facilities should also be sited away from accommodation facilities for safety reasons.
- All practicable measures will be undertaken to avoid fuel spills, in particular during fuel transfer (e.g. ship to shore transfer by pipeline or zodiac, refuelling day tanks).
- Any fuel, oil or lubricant spills will be reported immediately to the Station Leader, and subsequently to the National Authority.
- Ensure that adequate and sufficient spill response equipment (e.g. absorbents) is kept in a known location and available to deal with any spills.
- Station personnel will be trained in how to use spill response equipment. Training exercises will be undertaken at the beginning of each season.
- In case of fuel spills, response actions will be undertaken in line with the Oil Spill Contingency Plan held at each station.
- Oily wastes will be packaged in appropriate containers and disposed of according to station procedures.

4. Fire prevention and fire-fighting

- Signs indicating no-smoking areas, and flammable substances, will be displayed as appropriate.
- Firefighting equipment will be available at fuel storage sites and elsewhere. Such equipment will be clearly marked.

5. Waste Management

- Waste management, including waste reduction and the provision of equipment and appropriate packaging material, will be considered in the planning and conducting of all activities at Decepción and Gabriel de Castilla stations.
- All station personnel will be instructed on the provisions of Annex III to the Environmental Protocol.
- A waste management co-ordinator will be appointed at each station.
- Wastes will be segregated at source and stored safely on site prior to removal. After each summer season, wastes generated at Decepción and Gabriel de Castilla stations will be removed from the Antarctic Treaty Area.
- Rests of uncooked poultry products should be incinerated as soon as possible or stored in tight recipients in a closed room until safe evacuation to avoid their dispersion
- Regular tests of water effluents discharged into Port Foster will be undertaken.
- Any substances that may adversely affect the working of effluent treatment plants will not be disposed of through the drainage system (including toilets and wash basins).
- Cleaning up past waste disposal sites on land and abandoned work sites will be considered a priority, except where removal would result in more adverse environmental impacts than leaving the structure or waste material *in situ*.
- Personnel from both stations should periodically participate in clean-up activities within the facilities area, so as to minimise any scattered wastes around the stations.
- At the end of each summer season, activities connected to clean-up and removal of wastes will be reported to the appropriate national authority.



6. Other Operational Issues

6.1 Communications

- The installation of permanent or temporary aerials is to be carefully considered through the environmental evaluation procedures in place.
- VHF Marine Channel 16 will be monitored.
- All station personnel leaving the Facilities Zone must be equipped with a VHF radio.

6.2 Use of vehicles and small boats

- Vehicles should only be used around and between the stations when necessary.
- Keep to established tracks within the station area where practicable.
- Refuelling and servicing of vehicles will be carried out at the facilities provided for these purposes. Every effort should be made to avoid spills during refuelling and servicing.
- Do not use vehicles close to sensitive scientific equipment, across flora or near concentrations of fauna, or unnecessarily within the water-catchment area.
- Small boats operating out of Decepción or Gabriel de Castilla Station are only to be used within Port Foster, when weather conditions allow, and principally for scientific and logistic reasons. No small boats will be used outside Port Foster. Avoid the use of small boats close to cliffs and/or glaciers, to avoid rock or ice falls.
- When operating one boat, a second boat will be on stand-by, at the Station, for immediate support in an emergency.
- Small boats will be operated by at least two people. Essential equipment will include boating immersion suits, life jackets and appropriate radio links (for example, VHF radios).

6.3 Aircraft Operations

Helicopters will generally take off from and land at the helipad at Decepción Station. Occasionally, operational reasons may require them to take off from, or land at, other appropriate locations within the Facilities Zone.

Helicopters should avoid overflying areas with high concentrations of birds (i.e. penguin rookeries or other seabird breeding colonies) or seals.

Aircraft operations over the area should be carried out, as a minimum requirement, in compliance with the "Guidelines for the Operation of Aircraft near Concentrations of birds in Antarctica" contained in Resolution 2 (2004).

The use of UAV (Unmanned Aerial Vehicles) and RPAS (Remotely Piloted Aircraft Systems) around the stations should follow Resolution 4 (2018) "Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS)1 in Antarctica", the COMNAP "Antarctic Unmanned Aerial Systems (UAS) Operator's Handbook" and the existing domestic legislation ,

6.4 Field travel

All wastes from field camps, that depend on the stations Decepción and Gabriel de Castilla including human wastes (faeces, urine and grey water) will be returned to the stations or ships for safe disposal. The human and domestic liquid wastes are to be disposed in Port Foster or other coastal areas below the low water mark.

The Station Leader and/or the Station Environment Officer will brief field parties on environmental management in the field, the location of protected areas, and the provisions of the ASMA Management Plan.

No uncooked poultry products will be used by field parties.

All field parties will be equipped with VHF radios.

All movements into the area shall consider, when appropriate and taking into account the particularities and level of impact already existing on Deception Island, the *SCAR Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica*.

7. Protected Areas

Three terrestrial sub-sites of ASPA No. 140 (Site B - Crater Lake, Site C - Caliente Hill, southern end of Fumarole Bay, and Site D - Fumarole Bay), are located close to the Facilities Zone. Station personnel will be made aware of the location of, and restrictions on access to, all protected areas on Deception Island. Information about these protected areas, including a map showing their location, will be prominently displayed at both stations.



8. Flora and fauna

Any activity involving the taking of, or harmful interference with, native flora or fauna (as defined in Annex II to the Protocol) is prohibited unless authorised by a permit issued by the appropriate authority.

To minimise the risk of accidental or unintentional introduction of non-native species, the 'Non-native species manual' attached to Resolution 4 (2016) should be consulted.

An appropriate precautionary approach distance, no closer than 10 meters, is to be maintained from birds or seals present in the Facility Zone.

Staff and visitors are to walk slowly and carefully when near wildlife, in particular avoiding birds which are nesting, moulting, crèching or returning from foraging trips. Give 'right of way' to wildlife at all times.

Birds are not to be fed on waste food scraps from the stations. Food wastes will be secured to prevent scavenging by birds. Special attention should be paid to uncooked remains of poultry products which could transmit disease to native birds.

The introduction of herbicides, pesticides or other harmful substances is prohibited.

At the end of each summer season, a report on activities involving the taking of, or harmful interference with, native flora and fauna will be forwarded to the appropriate national authorities.

9. Tourist visits to the Facilities Zone

Any visits to Decepción Station (Argentina) or Gabriel de Castilla Station (Spain) may only be undertaken at the discretion of the respective Station Leader and according to the policy of reception of visitors in stations, of each of these two countries. Contact can be made via VHF Marine Channel 16. Visits will only be allowed if they do not interfere with scientific or logistical work.

Visits are to be undertaken in line with Recommendation XVIII-1 "Guidelines for tourism", Resolution 3 (2004) "Tourism and Non-Governmental activities", Resolution 4 (2007) "Ship-based Tourism, Resolution 7 (2009) "General Principles of Antarctic Tourism", Resolution 3 (2011) "General Guidelines for Visitors to Antarctica" and Measure 15 (2009) "Landing of Persons from Passenger vessels".¹¹

Station Leaders will co-ordinate visits to stations with Expedition Leaders.

Visitors will be informed about the principles of this Code of Conduct, as well as the ASMA Management Plan.

The station leader will appoint a guide (English speaking, when appropriate and possible), to escort visitors around the station, in order to ensure compliance with the measures included in this Code of Conduct.

The national authorities operating Decepción or Gabriel de Castilla Stations will inform Antarctic Treaty Secretariat, COMNAP and IAATO in case of a significant change in the volcanic situation. The stations shall notify any ships in the area of any immediate danger. See appendix 6.

10. Co-operation and sharing of resources

Both stations will co-ordinate and periodically conduct joint emergency evacuation, oil spill response and fire-fighting exercises.

¹¹ Measure 15 (2009) is not in force (as of July 2019).



Figure 1. Facilities Zone

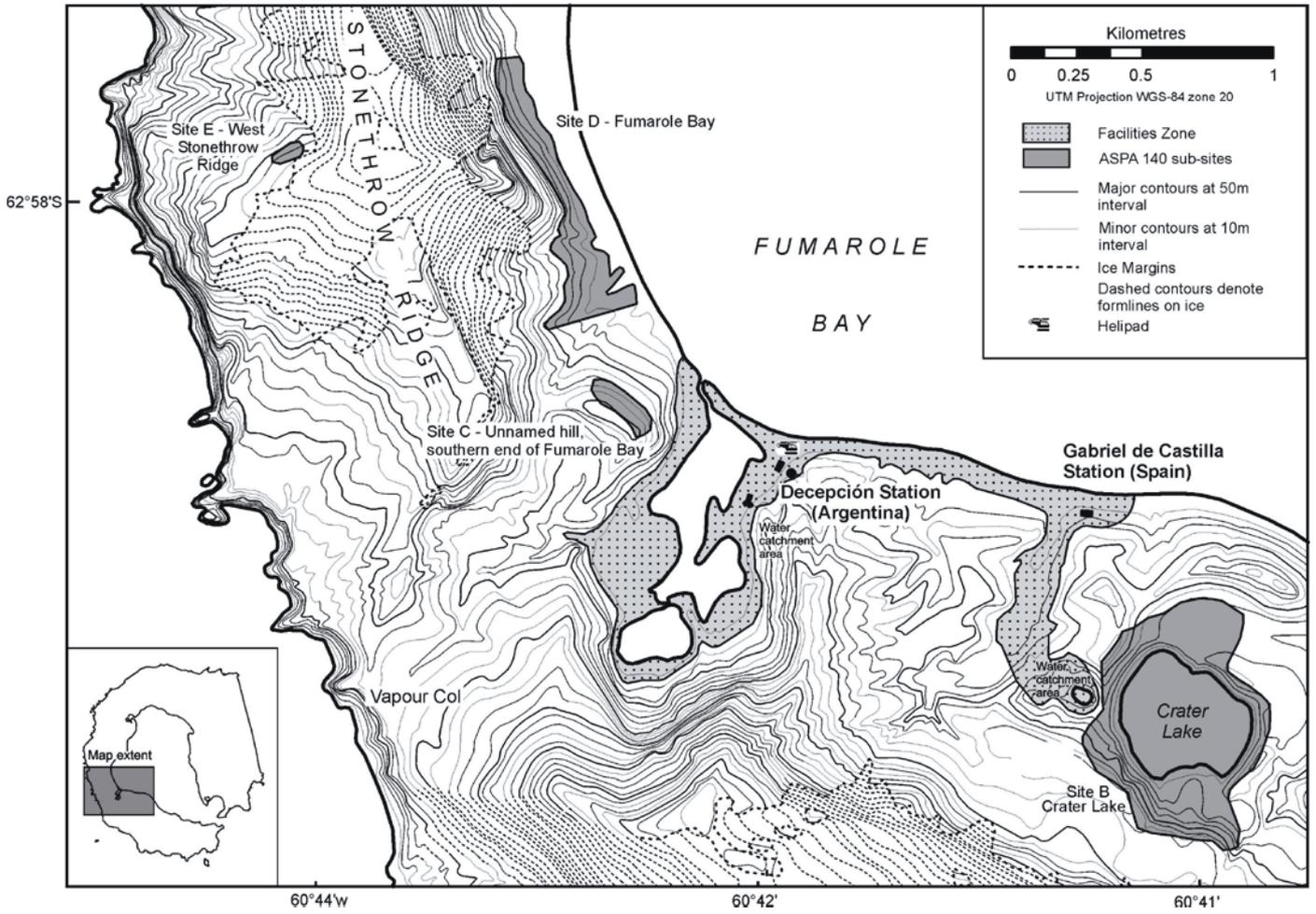


Figure 2. Argentinian Antarctic Station Decepción



Figure 3. Spanish Antarctic Base Gabriel de Castilla





Appendix 5: Visitor Sites Code of Conduct

Code of Conduct for Visitors to Deception Island

1. Introduction

This code of conduct has been produced for commercial tour operators (IAATO and non-IAATO affiliated), private expeditions and National Antarctic Programme staff when undertaking recreational visits to Deception Island.

There are four sites on Deception Island which may generally be visited: Whalers Bay, Baily Head, Pendulum Cove, and Telefon Bay (east). Stancomb Cove, in Telefon Bay, is also used as an anchorage for yachts. Visits to Decepción Station (Argentina) and Gabriel de Castilla Station (Spain) are only permitted by prior agreement with the respective Station Leaders. Tourist or recreational visits to other sites on the island are discouraged.

2. General Guidelines

The following general guidelines apply to all the above sites visited on Deception Island:

- Visits are to be undertaken in line with the Management Plan for Deception Island ASMA 4, the general guidelines for visitors to the Antarctic Resolution 3 (2011) and with Recommendation XVIII-1 "Guidelines for tourism."
- All visits must be planned and conducted taking into account the significant risk to human life and infrastructures posed by the threat of volcanic potential volcanic eruptions.
- Expedition Leaders of cruise ships and Masters of national programme support vessels are encouraged to exchange itineraries in order to avoid two ships unintentionally converging on a site simultaneously.
- Vessels and yachts approaching or departing from Port Foster must necessarily announce over VHF Marine Channel 16 the intended time and direction of passage through Neptune's Bellows.
- For commercial cruise operators, no more than 100 passengers may be ashore at a site at any time, accompanied by a minimum of one member of the expedition staff for every 20 passengers except for Baily Head where additional restrictions apply. See Appendix 9
- Clearly marked walking paths should be used instead of free walking (i.e. walking path to Vapour Col Do not walk on vegetation such as moss or lichen that sometimes can be unnoticed. The flora of Deception Island is of exceptional scientific importance. Walking on the alga *Prasiola crispa* (associated with penguin colonies) is permissible as it will not cause it any adverse disturbance.
- Maintain an appropriate distance from birds or seals which is safe and does not cause them disturbance. As a general rule, maintain a distance of 10 metres. Where practicable, keep at least 15 metres away from fur seals.
- Avoid walking along the path used by penguins between colonies and sea even when no penguins are present.
- In order to prevent biological introductions, carefully wash boots and clean clothes, bags, tripods and walking sticks before landing.
- Do not leave any litter.
- Do not take biological or geological souvenirs or disturb artefacts.
- It is strictly prohibited to write or draw graffiti on any man-made structure or natural surface or any interference on the natural landscape.
- Scientific equipment is routinely deployed during the austral summer by National Antarctic Programmes at a number of locations on Deception Island. The Spanish Antarctic Programme deploys equipment for important and necessary volcanic monitoring. Such, equipment, as well as other, is highly sensitive to disturbance. At least 20 metres must be maintained from the equipment, which will be marked with a red flag.
- Do not touch or disturb other types of scientific instruments or markers (e.g. wooden stakes marking botanical plots).
- Do not touch or disturb field depots or other equipment stored by National Antarctic Programmes.
- It is recommended not to enter in Port Foster if the state of the alert system is orange.



3. Site Specific Guidelines

3.1 Whalers Bay (latitude 62°59'S, longitude 60°34'W)

Whalers Bay is the most visited site on Deception Island, and one of the most visited sites in the Antarctic. It is a small bay immediately to the east after passing into Port Foster through Neptune's Bellows. It was named by the French explorer Jean-Baptiste Charcot because of the whaling activity that took place there. The site includes the remains of the Norwegian Hektor Whaling Station, the site of the cemetery and the abandoned British 'Base B', as well as the whaling remains along the length of the beach, some of which pre-date the whaling station. Appendix 3, Conservation Strategy for Whalers Bay Historic Site and Monument No. 71, contains further information about Whalers Bay.

Visits to Whalers Bay must be undertaken in line with Visitor Site Guide for Whalers Bay (Appendix 8).

3.2 Pendulum Cove (latitude 62°56'S, longitude 60°36'W)

Pendulum Cove (see figure 1) is a small cove on the north east side of Port Foster. It was named by Henry Foster of the British Royal Naval vessel HMS *Chanticleer* who, in 1828, undertook magnetic observations there using pendulums. The gently sloping ash and cinder beach leads to the remains of the abandoned Presidente Pedro Aguirre Cerda Station (Chile), Historic Site and Monument No. 76, which was destroyed by a volcanic eruption in 1967.

Visits to Pendulum Cove must be undertaken in line with Visitor Site Guide for Pendulum Cove (Appendix 10).

3.3 Baily Head (latitude 62°58'S, longitude 60°30'W)

Baily Head (see figure 2) is a rocky headland exposed to the Bransfield Strait on the southeast coast of Deception Island. It was named after Francis Baily, the English astronomer who reported on Foster's magnetic observations at Pendulum Cove. The site comprises the southern end of a long linear beach which runs along most of the eastern side of Deception Island, and a narrow valley that rises steeply inland to a semi-circular ridgeline, giving the impression of a natural 'amphitheatre'. It is bounded to the north by a large glacier and to the south by the cliffs of Baily Head. A substantial melt-stream runs through the centre of the valley during the austral summer.

Within this unnamed valley, and to the south of it, is one of the largest colonies of chinstrap penguins (*Pygoscelis antarctica*) in Antarctica - although recent studies indicate a significant reduction of around a 50% in the population here. Brown skuas (*Catharacta antarctica lonnbergi*), cape petrels (*Daption capensis*) and snowy sheathbills (*Chionis alba*) also nest at Baily Head. Antarctic fur seals (*Arctocephalus gazella*) haul out along the beach in large numbers during the austral summer.

Visits to Baily Head must be undertaken in line with Visitor Site Guide for Baily Head (Appendix 9).

3.4 Telefon Bay (east) (latitude 62°56'S, longitude 60°40'W)

Telefon Bay (see figure 3) was named after the whaling vessel *Telefon* which was moored in the bay for repairs in 1909 by Adolfus Amandus Andresen, founder of the company Sociedad Ballenera de Magallanes. At the easternmost end of Telefon Bay a gently sloping beach leads to a shallow valley which rises sharply to the rim of an unnamed volcanic crater.

Visits to Telefon Bay must be undertaken in line with Visitor Site Guide for Telefon Bay (Appendix 7).

3.5 Decepción Station (Argentina) and Gabriel de Castilla Station (Spain)

Visits to Decepción Station (Argentina) and Gabriel de Castilla Station (Spain) may only be undertaken with the prior agreement of the appropriate Station Leader. Visits to the stations must be undertaken in line with the Code of Conduct for the Deception Island Facilities Zone (Appendix 4).



Appendix 6: Volcanic Alert and Escape

Alert Scheme and Escape Strategy for volcanic eruptions on Deception Island

Historical Context and Volcanic Activity

Volcanic activity in Deception Island after the formation of Port Foster caldera mostly consists of several tens of scattered eruptive vents distributed inside the caldera structure. The composition of the extruded magma mainly ranges from basaltic andesite to andesite, with some post-caldera eruptions involving also more evolved dacitic-rhyolitic magmas. Historical eruptions have been small in volume (e.g. 0.1 km^3 of erupted magma) but the presence of Deception Island tephra in marine sediments and ice cores in the Scotia Sea and the South Pole, suggests that some recent eruptions may have been much more violent. Indeed, Deception Island's eruptions can show important degree of explosivity due to the interaction of the rising or erupting magma with water of diverse provenance (i.e., from Port Foster Bay; from the underground aquifer; melt water from the glaciers). The record of the eruptions from the 18th to the 20th centuries reveals periods of great activity with several temporally closely spaced eruptions, followed by decades of dormancy. The most recent eruptions (1967, 1969 and 1970) and unrest episodes (1992, 1999 and 2014–2015) demonstrate that the volcanic system is still active and the occurrence of a future eruption in Deception Island should be taken into account.

Between 1967 and 1970, the intense volcanic activity in Deception Island caused the destruction of the scientific stations of Chile, in Pendulum Cove, and the United Kingdom, in Whalers Bay. The intense volcanic activity changed the island's morphology; a small island was created in Port Foster which, with time, was joined to the rest of Deception Island in the Telefon Bay area. The great amount of ejected volcanic ash, rock and debris covered some of the surrounding islands, which can still be observed at Johnson Glacier on Livingston Island. An immediate consequence of the volcanic activity in 1967–1970, was the temporary end of scientific activity on the island, with only a limited number of studies looking at the post eruptive period taking place.

At present, evidences of volcanic activity on Deception Island include deformation of the volcanic edifice, thermal anomalies, and the presence of significant local seismic activity.

Deception Island has horizontal NE geodynamic deformation measured in 2 cm per year and 6 mm/year of subsidence. The deformation due to the volcanic activity has alternative expansion-elevation and compression-subsidence phases. The periods of higher volcanic activity match with expansion-elevation phases. The geothermal station at Caliente Hill shows temperatures up to 80–100° Celsius during the austral summer at 10–40 cm in depth.

Shallow seismicity at Deception Island can be related to the tectonic expansion of the Bransfield rift as well as to the local volcano dynamics. Background seismicity averages several hundred low-energy volcanic earthquakes per month. However, higher magnitude volcano-tectonic earthquakes were recorded during three particularly active surveys: 1991–1992; 1998–1999 and 2014–2015. During these periods, some earthquakes were felt by the personnel working on Gabriel de Castilla Station.

Between 31 December 1991 and 25 January 1992, the island experienced an important increase in seismic activity with up to 900 earthquakes recorded, four of which were directly felt by personnel on the island. These activities were interpreted as a reactivation process, probably due to a small intrusion located in Fumarole Bay. These periods match with expansive and subsidence periods recorded during 1991–1992 and 1995–1996 austral summer.

On 3 January 1999, a further important period of seismic-volcanic activity commenced with two earthquakes of magnitude 2.9 (January 11) and 3.4 (January 20). These seismic-volcanic activities were located between Fumarole Bay and Whalers Bay. They included volcano-tectonic quakes that liberated a significant amount of energy, the like of which had never been recorded previously. Between the austral summers of 1995–1996 and 1999–2000 the major expansion-elevation process never registered was measured from Port Foster.

Following this period of more intense seismic activity, the multi-disciplinary geophysical and geodetic studies were increased within the island. Activities included: resurveying of the geodetic net, establishing a new seismometer display, sampling of gases in the fumaroles and maintaining geomagnetic, gravimetric and bathymetric data records. An important geophysical study was performed that produced a tomography model of speed and attenuation in wave propagation, including a model to explain the relationship between the seismic activity recorded and the dynamics of the volcano. In 2012, by means of submarine and terrestrial thermometric, a new process of high volcanic activity was recorded that lasted till 2014–2015 austral summer. Between 2012 and 2015 an expansion-elevation process occurred.



During the 2014–2015 austral summer, there was an increase in the number of earthquakes recorded at Deception Island volcano. This activity followed an intense seismic swarm that occurred at SE of Livingston Island, comprising ~10,000 earthquakes with estimated magnitudes up to 4.6 between September 2014 and April 2015. The local seismic activity at Deception Island was initially located SW of the island, but during February 2015 epicentres migrated towards the caldera, increasing both in number and magnitude. This observation led to a temporal change in the volcanic alert level that was set to yellow (i.e., enhanced monitoring to corroborate the observed anomalies) on February 17th. After February 20th, the seismicity rate temporarily decreased and the alert level was set back to green. The Gabriel de Castilla Base was closed on February 24th. However, permanent seismic stations operating in the area indicate that the seismic activity continued at Deception Island at least until May 2015, with intense swarms in March and April 2015.

Alert System

Every year, for approximately four months in the austral summer, Spanish and Argentinian scientists record continuously the volcanic activity on the island (typically between the end of November and the beginning of March). These periods are also coincident with the maximum human presence on the island.

The instruments deployed on Deception Island include a local network of seismometers and seismic array, telemetric seismographs, thermometric stations, geodetic network, geothermal station at Caliente Hill and a tide station at Colatinas, maintained and recorded at Gabriel de Castilla Station. Since 2008, a permanent broadband seismic station is also operating at Deception Island.

Captains of ships entering Port Foster, and pilots of aircraft or helicopters, overflying the island, must request information about the volcanic activity recorded in the island from Gabriel de Castilla (Spain) and Decepción (Argentina) Stations on VHF Channel 16 Marine.

To communicate this information, it is considered useful to use a traffic light system that describes in a simple and accessible way, the present volcanic risk of the Deception Island volcano (Table 1).

Table 1

Alert system for volcanic eruptions in Deception Island as recommended by IAVCEI (*International Association of Volcanology and Chemistry of the Earth's Interior*)

Colour Code	Alert State	Description	Operative Actions
GREEN	No eruption expected	Normal volcanic parameters recorded. This is the normal island status	Control
YELLOW	Some anomalies in the volcanic system. A volcanic crisis could arise at some point in the future	There are small but significant anomalies in the volcanic parameters recorded	Control. Increase volcanic parameters recordings. Verify the parameters
ORANGE	Increased probability of a volcanic eruption in the near future	Significant increase in volcanic parameters anomalies recorded. New changes in volcanic parameters appears	Increase readiness to respond. Start preparing the evacuation plan. Recommend restricting access to the island. Recommend temporary evacuation of the island including ships and helicopters
RED	High probability of an imminent volcanic eruption or ongoing volcanic event	High probability of volcanic eruption confirmed with a significant change in the number of volcanic parameters anomalies	Personnel on the island to move to emergency camps or evacuate the island entirely depending on the location of the eruption. Prohibit ships and helicopters from entering the island, unless for rescue purposes.

Note: The recording and evaluation of the volcanic risk should be on-going, at least during the time the bases are operating. Volcanologists must update the state of the traffic lights system, according to the variability of the recorded volcanic parameters.

Escape strategy in case of a volcanic eruption on Deception Island

The present evacuation strategy is based in the assumption that future eruptions will be similar to those in 1967–1970 and that the volcanic activity will have a geographically limited impact in the island.

A sudden slump of the whole caldera could result in a most serious event with lethal effects for all personnel on the island. An effective evacuation under this scenario is unlikely. However, the likelihood of such event is probably low and would likely be preceded by many warning events such as an increase of ground deformation, temperature and increase in earthquake frequency and intensity for several days or weeks before the event. Nevertheless, an event could arise suddenly, without any warning signs.

If an orange state of alert is declared:

- Ships should be advised not to access Port Foster in order to reduce future evacuation problems. These measures would be temporary meanwhile orange state
- All ships should leave Port Foster immediately after taking on board all crew and passengers that are ashore
- It is recommended to take some other precautionary actions by every ship (i.e. breathing masks, abandon the main deck).



Captains and Masters of ships must take extreme caution when crossing Neptune Bellows taking into account the possibility of strong currents, Ravn rock in the middle of the narrow strait and any material that may have fallen from the steep cliffs on either side of the channel.

Although the island is small, it may be large enough to have areas where small groups may be relatively safe during a volcanic event. When considering recent eruptions on Deception Island, locations at distances from 7 to 10 kilometres from the centre of volcanic activity could be relatively safe. However, some ash fall out may be experienced over the whole island depending on the wind's direction and intensity.

It should be noted that evacuating all personnel from existing research stations could be more problematic, and have more serious consequences, than moving personnel to selected emergency camps during a volcanic event. Timely use of previously assessed emergency camp locations could reduce the risk associated with a fast and full evacuation of personnel from the island during a volcanic event.

Consequently, it is important to have selected locations *a priori* for emergency camps, taking into consideration the different possible locations of volcanic eruptions and other processes. As a general rule, different options should therefore be considered before initiating an evacuation.

General volcanic emergency kit

It is highly recommended to have in both stations volcanic emergency kits (including glasses, protective masks, helmet, and torch, etc.) for the personnel at the station and the personnel working on the island.

Evacuation routes

During a volcanic event, all interior coastal areas may be considered dangerous, because of the fall of pyroclasts, rocks and other materials and the possibility of high, fast and irregular waves produced by seiches in Port Foster, that could put in danger ships sailing or anchoring in the island's lagoon.

Before evacuation it should be understood, that evacuation routes may be over difficult terrain and that the descent to the beaches on the outer coastline of the island may be steep and difficult to follow.

In addition, because of the substantial difficulties associated with crossing glaciers (broken and slippery surfaces, sudden lahars possible), it is advisable to avoid these areas, unless the support of specialists guides and adequate equipment is provided. However, it is recognised that such support may not always be available under emergency conditions.

Although the evacuation in helicopters might be possible before the onset eruption, it should be taken into account that external beaches are steep and narrow, with large boulders and are adjacent to deep waters with large waves that are often present even under good weather conditions. Some beaches (for example near Punta de la Descubierta) have submerged rocks which may be dangerous for small boats.

If the eruption has not started and the weather is good, it could be possible to try helicopter evacuation from some locations around Port Foster, although helicopters working in any evacuation must avoid flying through volcanic clouds, because the fall of pyroclasts and ash could damage their engines. These factors increase the danger of evacuation from Port Foster beaches, and it should be considered likely that evacuations may only be possible from external beaches or from some specific areas that could allow safe helicopters operation

To estimate the likely difficulties that could be encountered by evacuating personnel, the recommended evacuation routes should be regularly checked by station personnel to assess their availability. Previous inspections indicate that only three of the island's external beaches are available during bad weather: north side of Kendall Terrace, Macaroni Point and Baily Head, depending on the location and type of the eruption. All of the other beaches identified were rocky and with access available only with helicopters. The route toward Punta de la Descubierta could be used, but only when the tide is very low.

As a result of these studies the main available evacuation routes are:

- From the facilities zone (Gabriel de Castilla, Decepcion Stations) toward De la Descubierta Point (1)
- From the facilities zone towards Entrance Point (the proposed route would entail evacuation from the beach) (2)
- From the facilities zone towards Entrance Point (helicopter extraction) (2)
- From Whalers Bay towards Baily Head (3)
- From the facilities zone towards Kendall Terrace (through the Pass at 168 m altitude above Telefon Bay) (4)
- From the facilities zone towards Kendall Terrace (through the Pass at 158 m altitude near Obsidians) (5)
- From the facilities zone towards Extremadura Cove beach to Kendall Terrace (6)

Table 2 includes details of the evacuation routes, including distance, height gain and estimated journey time.

**Table 2. Evacuation routes**

Evacuation route	Total distances	Maximum altitude ¹²	Estimated time
Facilities zone to Punta de la Descubierta (Figure 2)	3920 m	130 m in Espolon	1 hours 11 minutes
Facilities zone to Entrance Point (beach extraction area);	6800m	180 in Espolon	2 hours 9 minutes
Facilities zone to Entrance Point (helicopter extraction area)	7237 m	172 m	2 hours
Whalers Bay to Baily Head	3954 m	295 m in Collado crossing	1 hour 37 minutes
Facilities zone to Kendall Terrace (by Collado crossing 168 of Telefon Bay)	9400 m	168 m in Collado	2 hours 31 minutes
Facilities zone to Kendall Terrace (by Collado crossing 158 in Obsidianas)	6400 m	169 m in Collado	1 hour 46 minutes
Extremadura Cove to Kendall Terrace	5980 m	180 m Vaguada crossing	1 hour 30 minutes

Appendix 7: Visitor Site Guide: Telefon Bay

Current guidelines at https://guidelines.ats.aq/GuideLinePDF/37dd76bd-0441-4276-aed0-39223d6caf87/20_Telefon_2019_e.pdf

Appendix 8: Visitor Site Guide: Whalers Bay

Current guidelines at https://guidelines.ats.aq/GuideLinePDF/30c44ada-60be-404c-9665-331b79c81ecf/17_Whalers_2018_e.pdf

Appendix 9: Visitor Site Guide: Baily Head

Current guidelines at https://guidelines.ats.aq/GuideLinePDF/b509e543-a156-4ac7-a824-c2503b2a3d85/19_Baily_2018_e.pdf

Appendix 10: Visitor Site Guide: Pendulum Cove

Current guidelines at https://guidelines.ats.aq/GuideLinePDF/1f36044a-88e6-4ac3-a10b-c764d1981949/35_Pendulum_2018_e.pdf

¹² The given altitudes refer to the highest point of the route.



Figure 1. Suggested escape routes on Deception Island during a volcanic crisis corresponding to no more than a code orange alert state.

