Management Plan

for Antarctic Specially Protected Area (ASPA) No. 121 CAPE ROYDS, ROSS ISLAND

Introduction

Cape Royds lies at the western extremity of Ross Island, McMurdo Sound, at 77° 33′ 20″ S 166° 09′ 56″E. Approximate area of the ASPA: 0.66 km2. The primary reasons for designation are that the Area supports the current most southerly established Adélie penguin (*Pygoscelis adeliae*) colony, for which there exists the longest time series of population size in the Antarctic, data that are of unique and outstanding scientific value. In addition, the Area has important terrestrial and freshwater ecological values, including the most southerly observation of snow algae, the type locality for original descriptions of a number of species of algae, and the unusual presence of a form of Dissolved Organic Matter that is almost entirely microbially-derived.

The Area was originally designated as Site of Special Scientific Interest (SSSI) No. 1 in Recommendation VIII-4 (1975) after a proposal by the United States of America.

The SSSI designation was extended through Recommendation X-6 (1979), Recommendation XII-5 (1983), Resolution 7 (1995) and Measure 2 (2000). A revision was adopted through Recommendation XIII-9 (1985). The site was renamed and renumbered as Antarctic Specially Protected Area (ASPA) No 121 by Decision 1 (2002). A revised management plan was adopted through Measure 1 (2002), then through Measure 5 (2009) when the size of the marine component was reduced, and through Measure 2 (2014).

The Area is situated within Environment P – Ross and Ronne-Filchner ice shelves based on the Environmental Domains Analysis for Antarctica (Resolution 3 (2008)) and within Region 9 - South Victoria Land based on the Antarctic Conservation Biogeographic Regions (Resolution 3 (2017)).

1. Description of values to be protected

An area of about 300 m^2 at Cape Royds was originally designated in Recommendation VIII-4 (1975, SSSI No.1) after a proposal by the United States of America on the grounds that it currently supports the most southerly established and consistently occupied Adélie penguin (*Pygoscelis adeliae*) colony known. The most southerly intermittently occupied colony occurs at Cape Barne across Backdoor Bay ~1.4 km from Cape Royds, e.g. 1988-2001; likely a demographic extension of the Royds colony. The Adélie penguin population at Cape Royds decreased from 1956 to the early 1960s as a consequence of human interference during a period when heavy sea ice cover made the colony particularly susceptible to reduced recruitment. In 1963 United States and New Zealand authorities agreed to restrict activities and develop a management plan for the Area in order to protect the scientific values related to penguin research. The site was specially protected to allow the population to recover and protect on-going science programs. The population began to grow reaching almost 4,000 pairs by 1999, primarily due to natural variation in local sea ice cover. More recently the colony has been impacted (including the loss of the Cape Barne component) by severe sea ice conditions, especially in 2001-2005. Since 2005 the penguin colony at Cape Royds has been recovering.

The long time series of population data on the penguin colony at Cape Royds is of unique and outstanding scientific value, for it enables investigations into long-term biological interactions with and responses to environmental forcing factors. The colony remains of high scientific and ecological value and as such merits continued long-term special protection, especially in view of ongoing visits to Cape Royds from nearby stations and tourist groups.

The original Area was enlarged in 1985 as a result of a proposal by New Zealand (Recommendation XIII-9) to include a 500 m–wide coastal strip to protect the seaward access and nearshore feeding ground of the Adélie penguins, as well as projected research on the Cape Royds inshore marine ecosystem. This coastal area of Cape Royds was a site of studies on Nototheniid fish population structure and dynamics. More recently, research on foraging patterns of Adélie penguins from Cape Royds, conducted since this marine component of the Area was adopted, has shown that the marine area as it had been designated is not significant as a penguin feeding ground and that the birds forage more widely than had previously been known. In addition, projected research on the Cape Royds inshore marine ecosystem has not occurred to the extent that had been anticipated, and currently few studies are being carried out on the Nototheniid fish population at Cape Royds. In view of these factors, and because specific values

related to the marine environment adjacent to Cape Royds remain undescribed, the marine boundary was redefined through Measure 5 (2009) to focus more particularly on the area immediately surrounding the Adélie penguin colony. The marine component immediately adjacent to the Cape Royds penguin colony has been retained because it includes the primary access route of the penguins to the colony, which could otherwise be subjected to unnecessary disturbance by both visitors and local helicopter activity in the vicinity.

Research carried out over the last several decades has also noted that the Area has important values related to freshwater and terrestrial ecology. Pony Lake is a type locality for original descriptions of a number of species of algae collected during Shackleton's British Antarctic Expedition of 1907-09. The most southerly observation of snow algae, dominated by *Chlamydomonas*, has been made within the Area. In addition, recent studies have shown fulvic acid Dissolved Organic Matter (DOM) present in Pony Lake is almost entirely microbially-derived, which is considered unusual. Because these substances are poorly understood, isolated reference samples are needed for research purposes: a sample collected from Pony Lake has made a valuable contribution as a reference for the International Humic Substances Society. Finally, it has been noted that the very low diversity of soil organisms at the site makes it valuable for comparisons with other, more favorable, habitats.

Shackleton's hut (Historic Monument No. 15), located in ASPA No. 157 (Backdoor Bay), lies 170 meters to the northeast of the Adélie colony and, together with the colony, are attractions of high aesthetic and educational value to visitors. Regular and frequent visits to Cape Royds mean that the Area could easily be damaged by human impact if not provided with adequate protection. The scientific and ecological values of the Area require long-term protection from possible adverse impacts associated with these activities. However, in recognition of the value of the Adélie colony as the most accessible of any penguin species to visitors and national program participants in the southern Ross Sea, provision has been made for controlled access to two viewing areas outside, but near, the ASPA boundaries in order to allow visitors to Cape Royds the opportunity to observe the penguin colony without causing significant impact. Such visits are subject to Site Guidelines agreed through Resolution 4 (2009).

Relics from the time of Shackleton's voyages are present at the site of a small depot in an embayment on the west side of the penguin nesting area (77° 33′ 14.3″ S 166° 09′ 35.2″ E: Map 2). The depot has historic value and should not be disturbed except by permit for conservation or management purposes.

The boundaries encompass the entire Adélie penguin colony, the southern part of Pony Lake, and the marine environment up to 500 meters from the shoreline surrounding Flagstaff Point, comprising a terrestrial component of 0.05 km^2 and a marine component of 0.61 km^2, giving a total area of 0.66 km^2.

2. Aims and objectives

Management at Cape Royds aims to:

- Avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance and sampling in the Area;
- Allow scientific research on the ecosystem of the Area, in particular on the avifauna and terrestrial and freshwater ecology, provided it will not compromise the values for which the Area is protected;
- Allow other scientific research and visits for educational and outreach purposes (such as documentary reporting (visual, audio or written) or the production of educational resources or services) provided such activities are for compelling reasons that cannot be served elsewhere and will not compromise the values for which the Area is protected;
- Minimize the possibility of introduction of non-native species (e.g. plants, animals and microbes) to the Area;
- Minimise the possibility of the introduction of pathogens that may cause disease in faunal populations within the Area;
- Take into account the potential historic and heritage values of any artifacts before their removal and/or disposal, while allowing for appropriate clean-up and remediation if required;
- Allow visits for management purposes in support of the aims of the management plan.

3. Management activities

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

- Brightly colored markers, which should be clearly visible from the air and pose no significant threat to the environment, should be placed to mark the helicopter landing sites adjacent to the protected area (Maps 1 and 2);
- Signs illustrating the location and boundaries with clear statements of entry restrictions shall be placed at appropriate locations at the boundaries of the Area to help avoid inadvertent entry. In addition, on the first visit each season flags should be placed to mark the vehicle access route over sea-ice and the parking area in Backdoor Bay so those travelling over sea ice to Cape Royds can avoid the marine boundary of the Area. Flags placed shall be removed immediately prior to closure of sea-ice travel each season;
- Notices showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently, and a copy of this management plan shall be kept available, in all research hut facilities located at Cape Royds;
- Copies of this management plan shall be made available to all vessels and aircraft visiting and/or operating in the vicinity of Cape Royds, and all personnel (national program staff, field expeditions, tourist expedition leaders, pilots and ship captains) operating in the vicinity of, accessing or flying near the Area, shall be informed by their national program, tour operator or appropriate national authority of the location, boundaries and restrictions applying to entry and overflight within the Area;

- National programs shall take steps to ensure the boundaries of the Area and the restrictions that apply within are marked on relevant maps and nautical / aeronautical charts;
- Markers, signs or structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition, and removed when no longer necessary;
- National Antarctic programs operating in the Area should maintain a record of all new markers, signs and structures erected within the Area;
- The Area shall be visited as necessary (no less than once every five years) to assess whether it continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate;
- National Antarctic Programs operating in the region shall consult together with a view to ensuring these steps are carried out.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No. 121 Cape Royds - location.

Projection: Lambert Conformal Conic; Standard parallels: 1st 77° 33′ 10″ S; 2nd 77° 33′ 30″S; Central Meridian: 166° 10′ 00″ E; Latitude of Origin: 78° 00′ 00″ S; Spheroid: WGS84.

Data sources:

The base map and contours are derived from an orthophotograph using aerial imagery acquired by USGS/ DoSLI (SN7847) 16 November 1993 prepared at 1:2500 with a positional accuracy of ±1.25 m (horizontal) and ±2.5 m (vertical) and an on-ground pixel resolution of 0.4 m. Signposts: UNAVCO (Jan 2014). ASPA boundary: ERA (Jan 2014). Survey markers: LINZ (2011). Viewing areas and AWS (approx.): ERA (Jan 2014). Paths and anchorages from ASPA No. 157 Management Plan; approximate penguin nesting area digitized from georeferenced aerial image acquired 19 Jan 2005 (P. Lyver, pers. comm. 2014), updated by D. Ainley pers. comm. 2019. Contours (interval 10 m) and other infrastructure supplied by Gateway Antarctica (2009).

Inset 1: Ross Sea region, showing location of Inset 2.

Inset 2: Ross Island region, showing location of Map 1 and McMurdo Station (US) and Scott Base (NZ).

Map 2: ASPA No. 121 Cape Royds – air access. Map specifications as per Map 1.

Map 3: ASPA No. 121 – topography, access, facilities and wildlife. Map specifications as per Map 1, except the contour interval is 2 m.

6. Description of the Area

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

Overview

Cape Royds (77° 33′ 20″ S 166° 09′ 56″ E) is situated at the western extremity of Ross Island, McMurdo Sound, and occupies a coastal strip of ice-free land approximately 8 km wide on the lower western slopes of Mount Erebus (Map 1, Insets). The Area comprises a small part of Cape Royds, and includes both terrestrial and marine components.

The terrestrial component of the Area consists of ice-free land within approximately 350 m of Flagstaff Point (77° 33′ 21″ S 166° 09′ 55″ E) that is seasonally occupied by a breeding Adélie penguin (Pygoscelis adeliae) colony. The boundary includes all of the area occupied by breeding penguins and the two main routes used by the penguins to access the sea: Arrival and Backdoor bays. The marine component comprises an area of sea within 500 m of the Cape Royds coastline, which includes the main penguin access routes to the colony.

Boundaries and coordinates

The northern boundary of the terrestrial component of the Area extends from a small embayment at the northwestern corner of the Area for 53 m in a straight line northeast to a survey mark identified on earlier New Zealand maps as IT2 (77° 33′ 11.1″ S 166° 09′ 33.8″ E), which is an iron tube embedded in the ground. The boundary thence extends 9 m east from IT2 to a signpost (77° 33′ 11.2″ S 166° 09′ 35.2″ E), thence a further 30 m east-northeast to a signpost (77° 33′ 10.9″ S 166° 09′ 39.4″ E) half way down the slope of a small hill. From this signpost the boundary extends in a southeast direction for 133 m to a signpost (77° 33′ 11.8″ S 166° 09′ 59.0″ E) east of Pony Lake. The boundary thence extends 42 m in a south-southeast direction to a signpost (77° 33′ 12.9″ S 166° 10′ 01.9″ E), thence a further 74 m to a signpost (77° 33′ 15.2″ S 166° 10′ 05.7″ E) at the southern end of the penguin viewing area. The boundary thence extends 18 m to the coast at Arrival Bay (77° 33′ 15.8″ S 166° 10′ 06.6″ E). The northeastern boundary thence follows the coastline from Arrival Bay to Derrick Point. The boundary from Pony Lake (signpost at 77° 33′ 11.8″ S 166° 09′ 59.0″ E) to Derrick Point is coincident with the southern boundary of ASPA No. 157 Backdoor Bay, which has been designated to protect Shackleton's historic hut and associated artefacts (Historic Site and Monument No. 15).

The marine component of the Area encompasses the area within 500 m of the mean high water coastline of Flagstaff Point, with the boundary extending 500 m southwest from Derrick Point in the east (77° 33′ 14.1″ S 166° 10′ 22″ E), thence westward maintaining a distance of 500 m from the shore to 77° 33′ 11.8″ S 166° 08′ 10″ E, thence due east 500 m to coast at the northwestern corner of the Area (77° 33′ 11.8″ S 166° 09′ 25″ E).

Climate

An Automatic Weather Station (AWS) installed 1.75 km northeast of the Area has recorded data since 2004. Data are archived and available at the University of Wisconsin-Madison Antarctic Meteorological Research Center at *ftp://amrc.ssec.wisc.edu/pub/aws/spawar/* (accessed 30 March 2020). Air temperature data collected at Cape Royds and nearby McMurdo Station, located approximately 35 km southeast of Cape Royds indicate that, in general, December is the warmest month and July is the coolest month. The wind at Cape Royds is predominantly from the southeast and deposits sea spray across the Area (Broady 1989a). Data from McMurdo Station over the period 1973–2004 showed average wind speeds of around 10 knots, whilst the maximum recorded reached 112.3 knots (Antarctic Meteorological Research Centre 2009).

Long term climate records indicate that during the 1960's air temperatures and wind speeds recorded at Scott Base were relatively low, which was followed by a period of warming in the early 1970's (LaRue *et al*. 2013). From the early 1980's a marked warming trend was observed across the McMurdo Sound area (Blackburn *et al*. 1991) and records from McMurdo Station suggest that air temperatures peaked in the late 1980's. While warm temperatures peaked then, minimum temperatures continued to rise (LaRue ***et al***. 2013).

Geology and soils

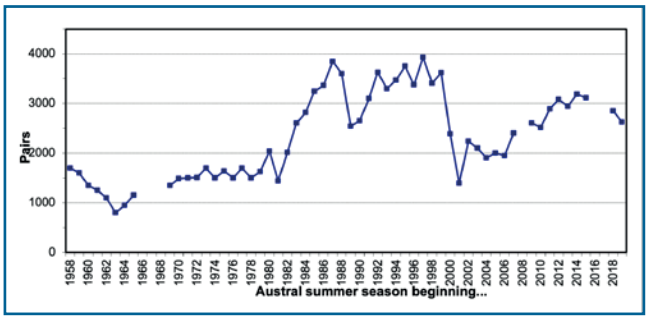
The terrestrial component of the Area is composed of rocky terrain of irregular lava flows, volcanic gravels and dark reddish scoria, bounded on the seaward side by a low cliff of approximately 10-20 m in height. Mineral soils and sand are present together with encrusted salts and compacted ornithogenic soils associated with the Adélie penguin colony (Cowan and Casanueva 2007).

Breeding birds

The Area contains the world's current most southerly established Adélie penguin (*Pygoscelis adeliae*) colony, with annual population numbers that in recent years have ranged 2,500 to 4,000 breeding pairs during the approximate mid-October to mid-February occupation (Figure 1). The population size in 1959 was deemed to be equivalent to that in 1909 with no evidence that it had been larger in historical times (Ainley 2002), then decreased to fewer than 1000 breeding pairs in 1963, a result of severe ice conditions sensitizing the population to disturbance by visitation and helicopter movements (Thompson 1977). Following visitor restrictions and, in 1996, relocation of the helicopter pad away from the colony, penguin numbers increased, eventually quadrupling the population (Ainley *et al*. 2005; Taylor and Wilson 1990). Following a peak in 1987, Adélie numbers at Cape Royds decreased sharply in 1988 and 1989, before recovering once more to reach a population comparable to levels recorded during the late 1980's. By 1998, the Adélie population at Cape Royds had reached 4,000 breeding pairs, with numbers subsequently decreasing to 2,400 pairs by 2000 (Ainley *et al*. 2004).

Fluctuations in Adélie penguin populations at Cape Royds have been linked to changes in a range of climatic and environmental variables. The sharp population increase during the 1980s has been linked to the take of minke whales from the Ross Sea sector, which continued for a time as 'scientific whaling'; the penguin population increase ceased upon the cessation of whaling and recovery of the minke whale population (Ainley *et al*. 2007). Rather than decreasing as the whale numbers recovered, increasing winds made persistence of the McMurdo Sound and Ross Sea polynyas more consistent to the benefit of the Cape Royds (and other Ross Sea) colonies (Ainley *et al*. 2005, 2010). Overall, on a shorter-time scale perspective, Wilson *et al*. (2001) found a significant inverse correlation between annual variation in Adélie numbers and winter sea ice extent, with more extensive (i.e. more northerly) sea ice coverage reducing sub-adult survival rates by restricting access to productive feeding areas. Consequently, total Adélie numbers at Cape Royds showed a 5-year lagged response to sea ice concentration variation. The influence of sea ice coverage on Adélie numbers within the Area was further highlighted following the grounding of large icebergs (including the iceberg designated B-15A) on the northern shore of Ross Island prior to the 2001 nesting season (Arrigo *et al*. 2002; Ainley *et al*. 2003). The obstruction caused by the icebergs resulted in unusually extensive sea ice coverage during 2001-05, with the exception of 2003. The number of breeding pairs and the number of chicks fledged decreased dramatically, with a significant portion moving to Cape Bird (Dugger *et al*. 2014). Upon disappearance of the icebergs in 2005, the sea ice regime returned to a 'normal' state, with the number of breeding pairs showing a gradual recovery and as of 2019 had achieved a level similar to that which existed prior to the icebergs event (Figure 1).

Figure 1. Number of breeding pairs of Adélie penguins at Cape Royds 1958-59 – 2012-13. (Sources: Stonehouse 1965; Taylor *et al*. 1990; Woehler 1993; Woehler pers. comm. 1999; Ainley *et al*. 2004; Lyver *et al*. 2014; Ainley 2014, Ainley pers. comm. 2019).



The Area has been monitored regularly since 1957 and has been photographed from the air during the incubation phase of breeding annually since 1981, i.e. around 1 December each year, the date when only single incubating birds are present. The annual assessment of Adélie penguin population size at colonies on Ross Island, Ross Sea, from 1959 to 2019 is the longest-running marine biological time series in the Antarctic (Taylor and Wilson 1990; Taylor *et al*. 1990; Wilson *et al*. 2001). The long history of scientific observations at Cape Royds thus provides rare opportunities to assess population trends over long periods.

Studies of Adélie foraging patterns during austral summers 1997/98 to 2014/15 indicate that the mean foraging

distance from Cape Royds ranges between 9.70 km and 12.09 km (Ainley *et al*. 2004; Ford *et al*. 2015; Saenz *et al*. in press), and observations suggest that little foraging occurs within 200 m of the coast (Ainley pers. comm. 2008). The foraging range of penguins belonging to the Cape Royds colony overlaps extensively (30–75%) with the ranges of birds originating from both Cape Bird and Beaufort Island (Ainley *et al*. 2004). Banded penguins from Cape Royds, Cape Bird and Beaufort Island are often seen within the other colonies (LaRue *et al*. 2013, Dugger *et al*. 2014).

In addition to the Cape Royds Adélie penguin colony, a significant breeding population of south polar skuas (Catharacta maccormicki) is located within the ASPA, with a number of nests near to the boundary. Numbers totalled 76 breeding pairs in 1981 (Ainley *et al*. 1986). While many of those skuas nesting at Cape Royds then were likely sustained by refuse from McMurdo Station, some were observed to forage for food within the Adélie penguin colony (Young 1962a). It was noted, however, that preying of skuas on young penguins was limited and that only a portion of the skuas breeding at Cape Royds obtained food from within the colony (Young 1962b). Following the cessation of human refuse disposal at McMurdo Station in the 1980s and improved waste management procedures, the Cape Royds (and Cape Evans) skua populations decreased. Now the skuas number fewer than 30 pairs including the entire Cape (Wilson *et al*. 2016). Currently, 9-11 pairs nest within or in close proximity to the ASPA.

Marine biology and oceanography

The marine ecosystem within and near the boundaries of the Area was investigated in 2012-2014 (Saenz *et al*. in press). The prime penguin prey, silverfish and crystal krill, abound along the McMurdo Sound fast ice edge, which usually extends west from Cape Royds across the Sound. Upon intensive foraging by the penguins and minke whales, krill become less available at shallow depths and the penguins turn increasing to silverfish (Ainley *et al*. 2006; Saenz *et al*. in press). In regard to the sea floor, samples collected several kilometers north of Cape Royds consisted of coarse volcanic gravels and small to large boulders. Research on the Nototheniid fish population and structure in this vicinity indicated that fish were abundant, with the most common species at that time being Trematomus bernacchii. The surveys also recorded the presence of Trematomus hansoni, T. centronotus, T. nicolai and Gymnodraco acuticeps. The surveys identified the presence of invertebrates such as echinoids, asteroids (e.g. Odontaster validus), ophiuroids, pycnogonids (e.g. Pentanymphon antarcticum, Colossendeis robusta), pteropods, copepods, amphipods, isopods, hirudinea, bryozoa, polycheates, ctenophores, mollusca, and medusae. Several kilometers to the south, in Erebus Bay, the fish fauna shifted during the heavy sea ice event associated with large icebergs grounding, when air breathing predators (especially seals) were precluded from the area. During 2005 only T. bernacchi was observed but with return of more 'normal state' sea ice conditions, several additional species were observed (Buckley 2013). The benthic invertebrate community is dominated by what was termed a 'basin' faunal group (Barry *et al*. 2003).Local ocean currents originate from the eastern Ross Sea continental shelf and flow westward along the Ross Ice Shelf past Cape Crozier, and then turns northward along the Victoria Land coast. The current divides at Beaufort Island, where a minor arm veers southward past Capes Bird and Royds (Jacobs *et al*. 1970; Barry 1988). The warmer, south flowing current along the western shore of Ross Island brings an injection of phytoplankton from the Ross Sea (Barry & Dayton 1988, Saenz *et al*. in press).

Terrestrial and freshwater ecology

Ponds within the Area, including Pony Lake, are nutrient-enriched and contain an abundant and diverse algal community adapted to high nutrients and salinity, dominated by phytoplankton, diatoms and oscillatorian benthic felts (Broady 1987). Some species of algae were first formally described from Pony Lake (West and West 1911), making the site a 'type locality'. Snow algae are present on small patches of snow on the coastal ice-foot adjacent to the penguin colony, dominated by species of Chlamydomonas, which is the most southerly record of snow algae (Broady 1989a).

Pony Lake has been identified as an important source of microbially derived Dissolved Organic Material (DOM) (Brown *et al*.2004). One type of DOM, fulvic acid, is derived from decaying plant matter and microbial activity. The fulvic acid present in Pony Lake has been identified as an important end-member as it is almostly entirely microbially-derived. Fulvic acids affect the chemistry, cycling and bioavailability of chemical elements in terrestrial and aquatic environments. Because these substances are poorly understood, isolated reference samples are needed for research purposes. A reference sample of Pony Lake fulvic acid was collected and made available to serve as a microbial end-member for distribution through the International Humic Substances Society. The lake's abundant levels of DOM and convenient location from McMurdo Station make it an ideal place to conduct such fieldwork.

Studies of terrestrial invertebrate (nematode) populations from the ornithogenic soils at Cape Royds have been carried out since 1990. In contrast to the greater invertebrate diversity in the Dry Valleys, only one species of nematode was observed at Cape Royds (Panagrolaimus davidi) (Porazinska *et al*. 2002). The very high-nutrient soils at Cape Royds lead to low biodiversity of soil organisms, making the Area susceptible to local and global human disturbance. Additionally, Cape Royds serves as a comparison for habitats under investigation in the McMurdo Dry Valleys.

There is little lichen growth within the Area, although different lichen growth forms (crustose, foliose and fruticose) are found in other parts of Cape Royds, distributed in three distinct zones believed to result from marine aerosol and snow accumulation patterns (Broady 1989a, 1989b).

Human activities and impact

Changes to the population of Adélie penguins at Cape Royds attributed at least in part to human visitation and helicopter movements is discussed in the section above on breeding birds.

National program personnel from nearby McMurdo Station (US), Scott Base (NZ) and tourist groups regularly visit Cape Royds to view Shackleton's hut and the Adélie penguin colony. Visits to Cape Royds are carefully controlled by national authorities, and entry to protected areas is strictly by permit and permits for entry into ASPA 121 are issued only under the conditions in Section 7(i) below. Numbers of visitors may fluctuate depending on a range of factors, including sea ice and weather conditions, available logistics, and the number of tour operators in any given year.

Penguin viewing areas are located outside of the Area immediately to the north and east of the existing boundary (Map 3). Visitors are briefed and visits are supervised, and the boundaries of the Area are generally respected.

6(ii) Access to the Area

The Area may be accessed by traversing over land or sea ice, by sea or to nearby helicopter landing sites outside of the Area by air. Particular routes are recommended for access to the Area, and overflight and aircraft landing restrictions apply, the specific conditions for which are set out in Section 7(ii) below.

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

Shackleton's Hut (ASPA No. 157 and Historic Site and Monument No. 15) (77° 33′ 10.7″ S 166° 10′ 06.4″ E) is situated approximately 70 m from the NE boundary sign of the terrestrial component of the Area, 100 m northeast of which is a small research shelter (New Zealand) (77° 33′ 07.5″ S 166° 10′ 10.6″ E) (Map 2). An AWS and remote camera installation is located 10 m inside the eastern boundary of the Area (Map 2), 80 m from Shackleton's hut (present in April 2020). Two survey markers are present within the Area – marker IT2 is on the northern boundary of the terrestrial part of the Area and is described above, while marker IT3 (77° 33′ 19.7″ S 166° 09′ 52.7″ E) (also an iron tube embedded in the ground) is 45 m NW of Flagstaff Point. Relics at the site of a small depot from the time of Shackleton's voyages are present in a small embayment on the west side of the penguin nesting area (77° 33′ 14.3″ S 166° 09′ 35.2″ E: Map 2). The depot should not be disturbed except by permit for conservation or management purposes.

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

The nearest protected areas to Cape Royds are Backdoor Bay (ASPA No.157 and HSM No.15) which is adjacent to and shares part of the boundary of the Area, Cape Evans (ASPA No.155) 10 km to the south, Tramway Ridge (ASPA No.130) close to the summit of Mount Erebus situated 20 km east, New College Valley (ASPA No.116) 35 km to the north at Cape Bird, and Arrival Heights (ASPA No.122) which is adjacent to McMurdo Station 35 km to the south. Cape Crozier (ASPA No.124) is 75 km to the east on Ross Island.

6(v) Special zones within the Area

There are no zones designated within the Area.

7. Terms and conditions for entry permits

7(i) General permit conditions

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

- It is issued for scientific research, and in particular for research on the avifauna in the Area, or for compelling scientific, educational or outreach reasons that cannot be served elsewhere, or for reasons essential to the management of the Area;
- The actions permitted are in accordance with this Management Plan;
- The activities permitted will give due consideration via the environmental impact assessment process to the continued protection of the environmental and scientific values of the Area;
- Approach distances to fauna must be respected, except when scientific needs may require otherwise and this is specified in the relevant permits;
- the permit shall be issued for a finite period;
- the permit, or a copy, shall be carried within the Area.

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

Within the terrestrial part of the Area access shall be on foot and vehicles are prohibited. Within the marine part of the Area, access should be by foot or vehicle when sea-ice is present, or by ship or small boat during open water periods. Foot access into the Area should be from the direction of the Primary helicopter landing site, and if arriving over the sea ice or by boat, then access should first be to Backdoor Bay and thence on foot following the paths shown on Maps 1 and 3.

Foot access and movement within the Area

Movement on land within the Area shall be on foot. Pedestrians should maintain a minimum approach distance of 5 m from wildlife, unless it is necessary to approach closer for purposes allowed for by the permit. Visitors should move carefully so as to minimize disturbance to flora, fauna, soils, and water bodies. Pedestrians should walk around the penguin colonies and should not enter sub-groups of nesting penguins unless required for research or management purposes. Care should be taken to avoid trampling nests when moving through skua territories. Pedestrian traffic should be kept to the minimum consistent with the objectives of any permitted activities and every reasonable effort should be made to minimize effects.

Ship and small boat access

Ships and small boats are prohibited from entering the marine component of the Area except by permit. Ships embarking passengers should remain at least 300 m from shore and visitor access either by small boat or over sea ice should be to the landing site on the northwestern shore of Backdoor Bay (Maps 1 and 3).

Aircraft access and overflight

Aircraft shall operate within and near the Area according to strict observance of the following conditions (refer Map 2):

1) Helicopter landings within the Area are prohibited.

2) Overflight of the Area by piloted aircraft below 2000 ft (~610 m) Above Ground Level is prohibited, except in accordance with a permit issued by an appropriate national authority.

3) Overflight / landings of all aircraft within ½ nautical mile (~930 m) of ASPA No. 121 are strongly discouraged, except for scientific or management purposes (Map 2).

4) Helicopters should land at the Primary landing site (77° 33.06′ S 166° 10.38′ E) (Maps 1-3), 250 m northeast of Shackleton's hut, and ~125 m north of the New Zealand refuge hut.

5) A secondary landing site is located at 77° 33.11′ S 166° 10.24′ E, ~100 m southwest of the Primary landing site (Maps 2 and 3), which should be avoided when the penguin colony is occupied (01 November through 01 March). Another secondary landing site, which may be used year-round, is located adjacent to the seasonal field camp (US) ~200 m north of the Primary landing site.

6) Overflight below 2000 ft (610 m) and landings within the Area by Remotely Piloted Aircraft Systems (RPAS) are prohibited except in accordance with a permit issued by an appropriate national authority. RPAS use within the Area should follow the Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (Resolution 4 (2018)).

7(iii) Activities that may be conducted within the Area

- Scientific research that will not jeopardize the ecosystem or scientific values of the Area;
- Activities with educational and / or outreach purposes (such as documentary reporting (e.g. visual, audio or written) or the production of educational resources or services) that are for compelling reasons that cannot be served elsewhere. Activities for educational and / or outreach purposes do not include tourism;
- Activities with the aim of preserving or protecting historic resources within the Area;
- Essential management activities, including monitoring and inspection.

7(iv) Installation, modification or removal of structures / equipment

- No structures are to be erected within the Area except as specified in a permit and, with the exception of permanent survey markers and signs, permanent structures or installations are prohibited;
- All structures, scientific equipment or markers installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator, year of installation and date of expected removal. All such items should be free of organisms, propagules (e.g. seeds, eggs) and non-sterile soil, and be made of materials that can withstand the environmental conditions and pose minimal risk of contamination or damage to the values of the Area;
- Installation (including site selection), maintenance, modification or removal of structures or equipment shall be undertaken in a manner that minimizes disturbance to flora and fauna, preferably avoiding the main breeding season (01 Oct – 31 Mar);
- Removal of specific structures / equipment for which the permit has expired shall be the responsibility of the authority which granted the original permit, and shall be a condition of the permit.

7(v) Location of field camps

Camping within the terrestrial part of the Area is prohibited. Camping within the marine part of the Area when sea ice is present is allowed by permit. Such camps should avoid the penguin approach routes within 200 m of the breeding colony, but are otherwise not restricted to a particular location. Outside of the Area, a New Zealand campsite is located adjacent to the shelter (NZ) 175 m northeast of the Area, and a United States campsite is located ~350 m north of and above the shelter (Maps 1 and 3).

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

In addition to the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, restrictions on materials and organisms that may be brought into the Area are:

- Deliberate introduction of animals, plant material, micro-organisms and non-sterile soil into the Area is prohibited. Precautions shall be taken to prevent the accidental introduction of animals, plant material, micro-organisms and non-sterile soil from other biologically distinct regions (within or beyond the Antarctic Treaty area).
- Visitors shall ensure that sampling equipment and markers brought into the Area are clean. To the maximum extent practicable, clothing, footwear and other equipment used or brought into the Area (including backpacks, carry-bags, walking poles and other equipment) shall be thoroughly cleaned before entering the Area. Visitors should also consult and follow as appropriate recommendations contained in the Committee for Environmental Protection Non-native Species Manual (Resolution 4 (2016); CEP 2019), and in the Environmental Code of Conduct for terrestrial scientific field research in Antarctica (Resolution 5 (2018));
- All poultry and poultry products, including products containing uncooked dried eggs, are prohibited from the Area. All poultry brought to and not consumed or used at nearby huts, facilities and / or camping sites, including all parts, products and / or wastes of poultry, should be removed or disposed of by incineration or equivalent means that eliminates risks to native flora and fauna;
- Herbicides or pesticides are prohibited from the Area;
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the permit was granted;
- Fuel, food, chemicals, and other materials shall not be stored in the Area, unless specifically authorized by permit and shall be stored and handled in a way that minimises the risk of their accidental introduction into the environment;

- All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period;
- All materials shall be stored and handled so that risk of their introduction into the environment is minimized;
- If release occurs which is likely to compromise the values of the Area, removal is encouraged only where the impact of removal is not likely to be greater than that of leaving the material *in situ*.

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

Taking or harmful interference with native flora and fauna is prohibited, except in accordance with a permit issued under Article 3 of Annex II of the Protocol on Environmental Protection to the Antarctic Treaty. Where animal taking or harmful interference is involved, this should, as a minimum standard, be in accordance with the SCAR Code of Conduct for the Use of Animals for Scientific Purposes in Antarctica.

7(viii) Collection or removal of materials not brought into the Area by the permit holder

- Material may be collected or removed from the Area only in accordance with a permit and should be limited to the minimum necessary to meet scientific or management needs. This includes biological samples, rock specimens, soil and historical items.
- Material of human origin likely to compromise the values of the Area, and which was not brought into the Area by the permit holder or otherwise authorized, may be removed from any part of the Area, unless the impact of removal is likely to be greater than leaving the material *in situ*. If this is the case the appropriate authority should be notified and approval obtained.
- Unless specifically authorized by permit, visitors are prohibited from interfering with or from handling, taking or damaging any historic artifacts found within the Area. Any new artifacts observed should be notified to the appropriate national authority. Relocation or removal of artifacts for the purposes of preservation, protection or to re-establish historical accuracy is allowable by permit.

7(ix) Disposal of waste

All wastes, including human wastes, shall be removed from the Area.

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

Permits may be granted to enter the Area to:

1) Carry out biological monitoring and Area inspection activities, which may involve the collection of a small number of samples or data for analysis or review;

2) Install or maintain signposts, markers, structures or scientific or essential logistic equipment;

3) Carry out protective measures;

4) Carry out research or management in a manner that avoids interference with long-term research and monitoring activities or possible duplication of effort. Persons planning new projects within the Area should consult with established programs working within the Area, such as those of the United States and New Zealand, before initiating the work.

7(xi) Requirements for reports

- The principal permit holder for each visit to the Area shall submit a report to the appropriate national authority after the visit has been completed in accordance with national procedures and permit conditions.
- Such reports should include, as appropriate, the information identified in the visit report form contained in the Guide to the Preparation of Management Plans for Antarctic Specially Protected Areas (Resolution 2 (2011)). If appropriate, the national authority should also forward a copy of the visit report to the Parties that proposed the Management Plan, to assist in managing the Area and reviewing the Management Plan.
- Parties should, wherever possible, deposit originals or copies of such original visit reports in a publicly accessible archive to maintain a record of usage, for the purpose of any review of the Management Plan and in organising the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures that might have exceptionally been undertaken, and / or of any materials released and not removed, that were not included in the authorized permit.

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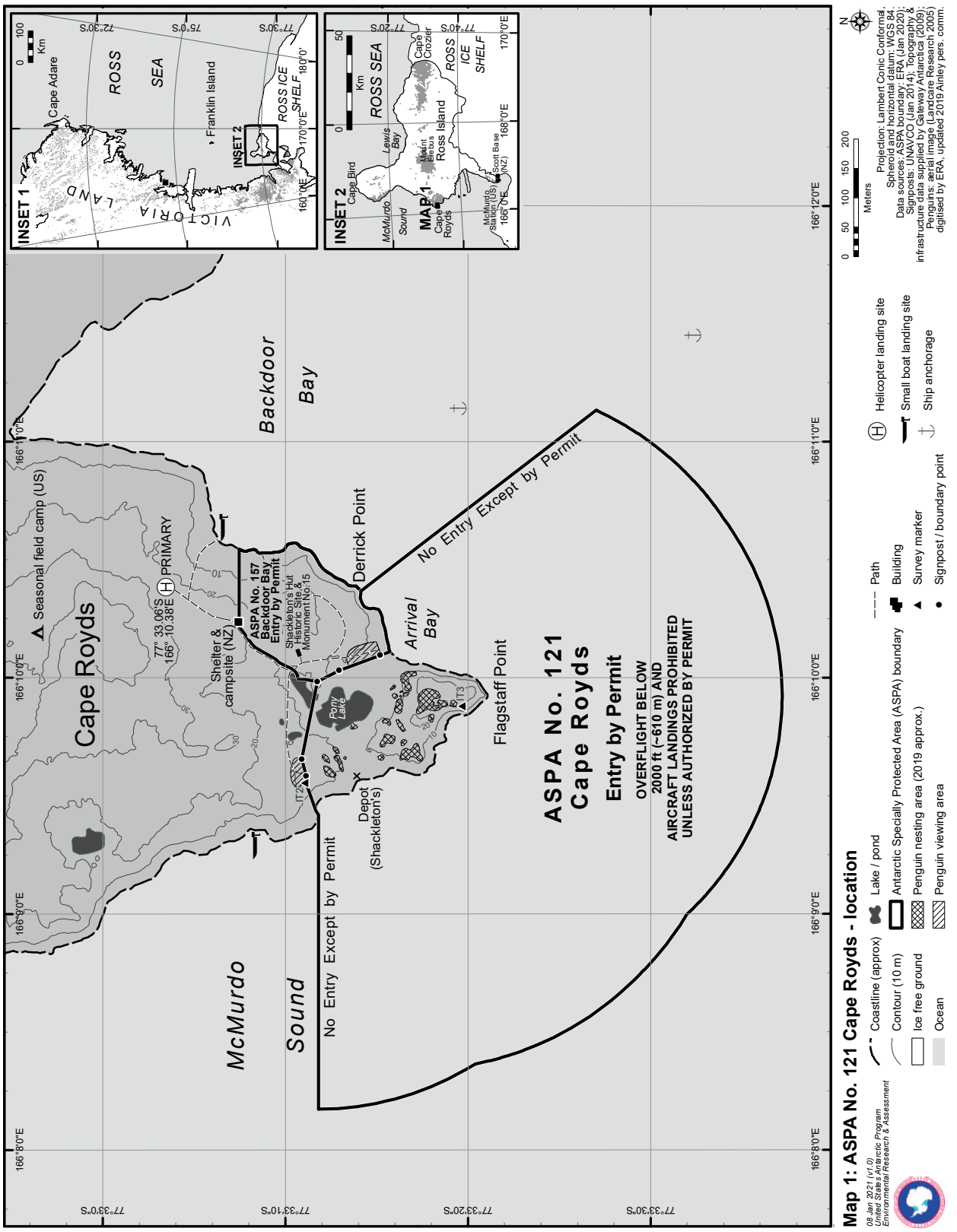
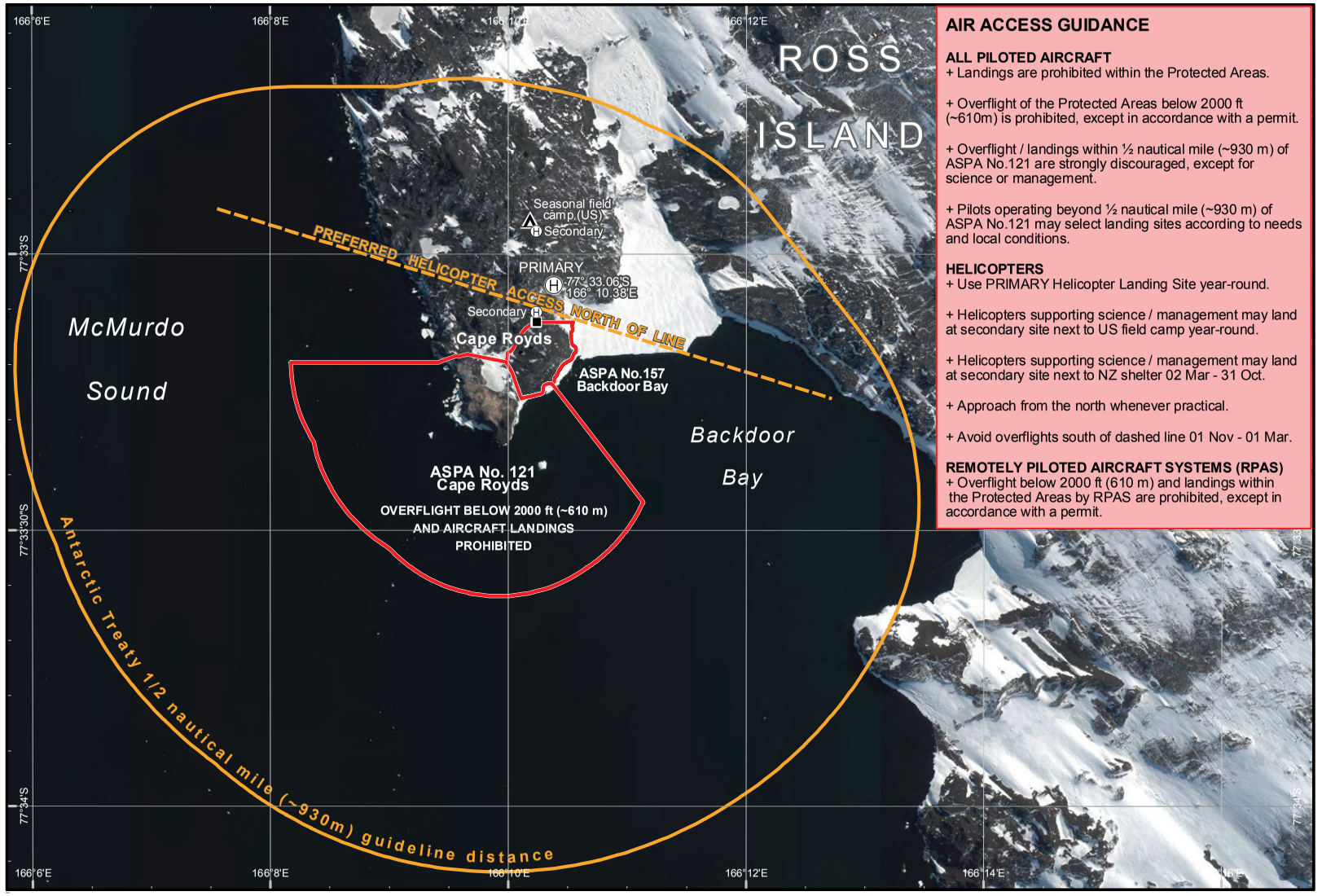


Map 1: ASPA No. 121 Cape Royds - location

08 Jan 2021 (v1.0)
United States Antarctic Program
Environmental Research & Assessment

Coastline (approx)
Contour (10 m)
Ice free ground
Ocean
Lake / pond
Antarctic Specially Protected Area (ASPA) boundary
Penguin nesting area (2019 approx.)
Penguin viewing area

Projection: Lambert Conic Conformal.
Spheroid and horizontal datum: WGS 84.
Data sources: ASPA boundary: ERA (Jan 2020);
Signposts: UNAVCO (Jan 2014); Topography &
infrastructure data supplied by Gateway Antarctica (2009);
Penguins: aerial image (Landcare Research 2005)
digitised by ERA, updated 2019 Ainley pers. comm.



AIR ACCESS GUIDANCE

ALL PILOTED AIRCRAFT
+ Landings are prohibited within the Protected Areas.

+ Overflight of the Protected Areas below 2000 ft (~610m) is prohibited, except in accordance with a permit.

+ Overflight / landings within ½ nautical mile (~930 m) of ASPA No.121 are strongly discouraged, except for science or management.

+ Pilots operating beyond ½ nautical mile (~930 m) of ASPA No.121 may select landing sites according to needs and local conditions.

HELICOPTERS
+ Use PRIMARY Helicopter Landing Site year-round.

+ Helicopters supporting science / management may land at secondary site next to US field camp year-round.

+ Helicopters supporting science / management may land at secondary site next to NZ shelter 02 Mar - 31 Oct.

+ Approach from the north whenever practical.

+ Avoid overflights south of dashed line 01 Nov - 01 Mar.

REMOTELY PILOTED AIRCRAFT SYSTEMS (RPAS)
+ Overflight below 2000 ft (610 m) and landings within the Protected Areas by RPAS are prohibited, except in accordance with a permit.

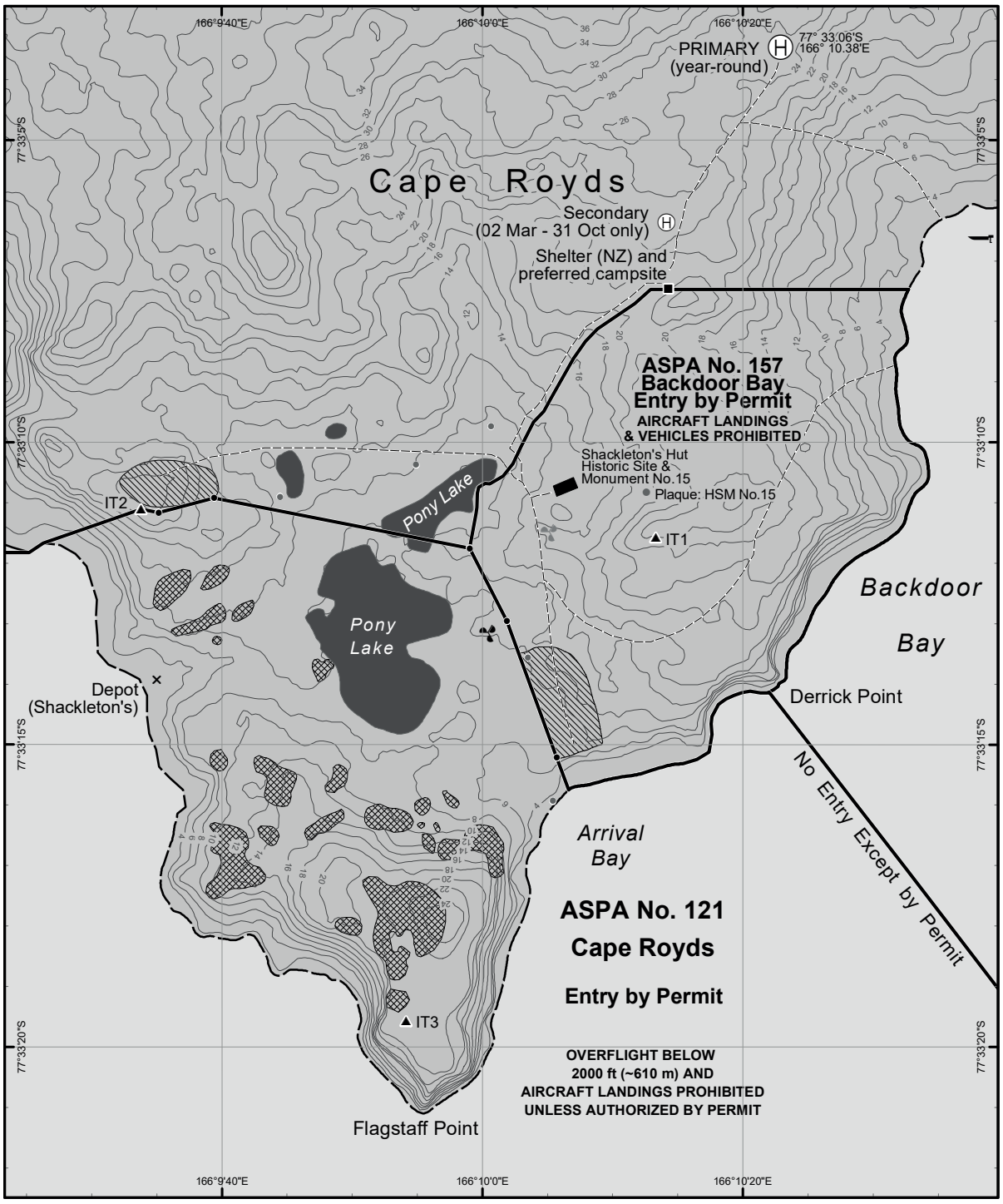
Map 2: ASPA No. 121 Cape Royds - air access

08 Jan 2021 (v1.0)
United States Antarctic Program
Environmental Research & Assessment

- Antarctic Specially Protected Area (ASPA) boundary
- Recommended aircraft separation distance
- Shelter (NZ)
- Primary HLS
- Secondary HLS
- Seasonal camp (US)

Nautical Miles: 0, 0.5, 1
Kilometers: 0, 0.5, 1

Projection: Lambert Conformal Conic
Spheroid and horizontal datum: WGS84.
Data sources: ASPA boundaries: ERA (2020);
WorldView 3 image 19 Feb 2017 © Digital Globe.



Map 3: ASPA No. 121 Cape Royds - topography, access, facilities and wildlife

08 Jan 2021 (v1.0)
United States Antarctic Program
Environmental Research & Assessment

Coastline (approx)
Contour (2 m)
Ice free ground
Ocean
Lake / pond
ASPA boundary
Penguin nesting area (2019 approx.)
Penguin viewing area
Path
Building
Survey marker
Signpost / boundary point
Signpost
Helicopter landing site
Small boat landing site
Automatic Weather Station
Historic weather station

0 50 100 Meters

N

Projection: Lambert Conformal Conic
Spheroid and horizontal datum: WGS 84.
Data sources: ASPA boundary: ERA (Jan 2020);
Signposts: UNAVCO (Jan 2014);
Topography & infrastructure data supplied
by Gateway Antarctica (2009);
Penguins: aerial image (Landcare Research 2005)
digitised by ERA, updated 2019 Ainley pers. comm.